The Dissertation Committee for Danny Lee Davis certifies that this is the approved version of the following dissertation:

Commercial Navigation in the Greek and Roman World

Committee:

____
Joseph C. Carter, Supervisor

____
Gwyn M. Morgan

____
Rabun Taylor

____
Robert Hohlfelder

____
John Hale

Commercial Navigation in the Greek and Roman World

by

Danny Lee Davis, B.A.; M.A.

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To Madeleine and Kie,

for the time we shall never recover

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Commercial Navigation in the Greek and Roman World

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Supervisor: Joseph C. Carter

The economic development of Greece and Rome hinged directly on the ability of commercial vessels to transport large volumes of goods across the Mediterranean and Black Sea. Archaeology has revealed the sizes, construction methods and cargos of these ships, but the navigational techniques that were employed to direct them from port to port remain unclear and elusive. In ancient literature, the oft-repeated themes of storm, shipwreck and death at sea led to the popular assumption among scholars that seafarers developed habits to minimize their exposure to this hostile element—hugging the shore to avoid the open sea, putting in at night, sailing only in summer, and using 'seafaring manuals' to help guide their way. While several recent studies have made some strides in overturning this overly simplistic view by highlighting aspects of navigation in certain areas and in certain periods, the 'standard model' lingers in both scholarly and popular imagination.

This study offers a comprehensive review of the scattered textual and archaeological evidence pertaining to ancient seafaring and navigation, and a major reinterpretation of ancient commercial navigation in both periods. Chapters 2–3 explore the parameters of the maritime environment (coasts, winds, currents and visibility) and the human responses to them in the form of ships, seasonal rhythms and maritime corridors. Chapters 4 and 5

discuss the ways in which Greek and Roman sailing masters accounted for the fundamental requirements of navigation—the determination of direction, position, speed and distance—using wind roses as a 'compass' and various stars and star groups at night. Chapter 6 treats the question of whether seafarers used written guides or experience, or both, to help determine their position. Chapter 7 explores the historical figure of the sailing master himself and integrates a wide range of evidence to reconstruct the navigational routines of the crews of Alexandrian grain ships during the Roman imperial era.

My research concludes that both coastal and open-sea sailing were matters of routine in the commercial sector, that commercial seafarers did indeed sail at night and employ the stars to deduce navigational information, that winter sailing was a widespread practice, and that crews employed navigational strategies to weather storms, usually successfully.

Table of Contents

List of Tables

List of Figures

Chapter 1: ***Introduction***

> On the sea it is never easy to find a man with grey hair.
>
> —Phalaecus[1]

> Audacity, you inventor of ships (for you discovered the paths of the sea, and excited the minds of men with hope of gain), what deceitful timbers you fashioned; what lust for gain brought to them by death have you tested men! Verily the race of mortals had been golden, if the sea, like Hades, were viewed from the land in the far distance.
>
> —Antiphilus of Byzantium[2]

The subject of this dissertation is the *technē* or *ars*[3] of navigation as practiced by Greek and Roman seafarers.[4] More specifically, it is about how those crew members responsible for the navigation of the ship (generally *kybernētai* in the Greek tradition, *gubernatores* in the Roman) made use of winds, stars, nautical manuals (arguably) and experience to make voyages safely and repetitively. The focus of inquiry is toward the commercial sphere of shipping; the navigational modes of warships and naval fleets are deserving of their own separate study.[5] The historical period covered here stretches from the eighth century B.C. to the fifth century A.D., well over a millennium during which the Mediterranean and Black Sea were crisscrossed by countless merchant ships, each making way to markets near and far. Through a careful and critical reading of ancient sources, this study aims to show, firstly, that the persistent conception of ancient seafarers as fearful travelers who kept the shore in sight at all times and rarely if ever sailed at night or in winter is more a product of ancient literary

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[1] *Gr. Anth.* 7.650: *εἰν ἁλὶ δ' οὔ πως | εὐμαρὲς εἰς πολιὴν ἀνδρὸς ἰδεῖν κεφαλήν.*

[2] *Gr. Anth.* 9.29: *Τόλμα, νεῶν ἀρχηγέ (σὺ γὰρ δρόμον ηὕραο πόντου | καὶ ψυχὰς ἀνδρῶν κέρδεσιν ἠρέθισας), | οἷον ἐτεκτήνω δόλιον ξύλον, οἷον ἕνεικας | ἀνθρώποις θανάτῳ κέρδος ἐλεγχόμενον. | ἦν ὄντως μερόπων χρύσεον γένος, εἴ γ' ἀπὸ χέρσου | τηλόθεν ὡς Ἀίδης πόντος ἀπεβλέπετο.*

[3] Both terms are untranslatable, "unless in a periphrasis which fuses the modern senses of technology and art into a single notion" (Havelock 1982, 269).

[4] "Navigation" has acquired numerous definitions in modern languages but may be defined simply as the process of *directing* the movement of a ship from one place to another (Maloney 1978, 1). The modern term is derived from Latin *navigatio*, which is in turn a compound word consisting of *navis*, ship, and *ago*, to direct or manage. In Roman usage, *navigatio* denoted the action of journeying by ship (voyaging) or simply the sea voyage itself, a passage on a particular route. *Gubernatio*, that is, pilotage or the direction or control of a ship, is perhaps closer to the modern usage of the term navigation. The occupation of *navigator*, as one who sails a ship, is rarer than the more common *gubernator*, a helmsman, pilot or sailing master (see *OLD*, s.v. and below, page 218 n. 76 for examples).

conventions and faulty comparisons with pre-modern and modern navigation modes than reality; and secondly, that Greek and Roman seafarers, employing no instruments whatsoever, practiced both coastal and open-sea navigation as matters of routine.

In historical terms, those who were tasked with navigating merchant ships from port to port are an elusive group. Historically invisible and, like the practitioners of many contemporary seafaring professions, socially marginalized, they are known mostly through a distorted epic lens—Theseus' pilot Nausithoos, Jason's Tiphys, Menelaus' Phrontis and Aeneas' Palinurus, to name just a few. And yet on their shoulders rested the fortunes of innumerable merchants who trafficked in seaborne commerce, as well as the fates of hundreds and even thousands of passengers who braved the elements and the threat of piracy each year. Who were these technicians of maritime movement? How much do we know about their craft? By what means did they maintain courses without a compass on the open sea day and night? How aware were they of their true position at any one moment? How did they conceptualize the maritime space in which they operated? Did they rely on written directions to find their way? These are questions this study will attempt to answer in the following chapters. In doing so, I shall rely in the main on Greek and Roman literary texts, but also on epigraphy, iconography and archaeology. The three main voyage narratives from Roman times receive special emphasis for the detail they bring to bear; the reader will find the original texts with English translations by the author in Appendices A–C.

I. ATTITUDES ANCIENT AND MODERN

It might be thought that such an interesting subject, so fundamental to any study on maritime communication and seaborne trade, and with a wealth of material to work with, must have been thoroughly investigated long ago. But this is far from the case. The few early studies on the subject set a strong precedent by portraying Greeks and Romans as generally fearful, ignorant and coast-bound seafarers. And here the image has remained a fixture for several decades in many if not most branches of scholarship. The notion is perhaps best expressed of late in J. Romm's critically acclaimed *Edges of the Earth in Ancient Thought* (1992):

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[5] Below, notes 34–6.

> Just as a mouse placed in the center of an empty room will immediately dash toward one of the walls, so Greek sailors...were accustomed, even when sailing the comparatively placid Aegean, to hug the coasts and stay within sight of land at all times.[6]

When, specifically, and with whom did this conception of timid, unskilled Greek and Roman seafarers originate?

We may trace two general lines of influence. The first is a group of ancient literary conventions or archetypal themes known as *topoi* that expressed a highly negative attitude toward the sea and seafaring; Antiphilus' epigram above is one of a great many examples from ancient literature. Students of the classics are quite familiar with the vivid storm scenes of Greek and Roman epics, particularly Books 5 and 12 of Homer's *Odyssey*, the wellspring of the Greek storm tradition, and its Latin counterpart in Book 1 of Virgil's *Aeneid*.[7] Both works inspired a number of stock elements that recur time and again in literary imitations and spin-offs throughout antiquity: the voyage begins in fair weather; soon, however, the winds wage war with each other; thunder and lightning ensue; and the crew attempts to furl the sails or stow the oars; the cargo is jettisoned; the pilot abandons control of the ship, leaving it to the mercy of the winds and waves.[8] While we may be sure that actual seafarers caught in real storms had the same or similar responses (see below, pages 224–30), the literary conventions are signaled by context, diction and the epic style. Indeed, the dramatic actions just described had become so standardized in literary writing by the first century that

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[6] Romm 1992, 16 (cf. below, notes 25–8); reviewed favorably by Dilke (1993). Romm (idem, n. 22) curiously adds that "one factor influencing the tendency toward "coasting" voyages…was the Greek seaman's dread of having to sleep or take his meals while still on shipboard." I have found no evidence for either aversion.

[7] On storms in epics and their influences on later literature, see Friedrich 1956; Morford 1967, 20–58 (esp. 32–6); Burck 1978; Cristóbal 1988.

[8] Beginnings in fair weather: Hom. *Od.* 5.268–9, 12.400–2; Ap. Rhod. *Argon.* 2.1100–1, 4.1223–5; Chion of Heraclea, *Ep.* 4.1–2, "Herpyllis" 17 (= Zimmerman 1936, 71); Ennius, *Annales*, fr. 430–2 (quoted by Macr., *Sat.* 6.2.28); Pacuvius, *Teucer*, fr. 350–65 (quoted in Cicero, *De orat.* 3.157; *Div.* 1.24); Sen. *Ag.* 431–55; Lucian, *Ver. hist.* 1.5; Achilles Tatius 2.32; Quint. Smyrn. 14.403–18; winds warring with each other: Hom. *Od.* 5.291–7; Verg. *Aen.* 1.50–86; Ov. *Tr.* 1.2.27–30; Luc. 5.597–620; Sen. *Ag.* 474–87, *Controv.* 8.6; Petron. *Sat.* 114; Valerius Flaccus, *Argon.* 1.574–615; Lucian, *Ver. hist.* 1.6; Achilles Tatius 3.1–2; Quint. Smyrn. 14.466–91; thunder and lightning: Verg. *Aen.* 1.90; Achilles Tatius, 3.2.2; "Herpyllis" 19.45–9 (= Zimmerman 1936, 68–78); Luc. 5.630–3; Ov. *Met.* 11.522–3; Sen. *Ag.* 494–95; Sil. *Pun.* 17.251–52; Valerius Flaccus, *Argon.* 1.616–17, 621–4; furling the sails and running in the oars: Ov. *Fast.* 587–90; Petron. *Sat.* 114; Quint. Smyrn. 14.497–501; jettisoning the cargo: Juv. 12.30–53; Achilles Tatius 3.2; abandoning control and letting the ship run free: Hom. *Od.* 5.297–312; Ov. *Met.* 11.492–4, *Fast.* 593–4, *Tr.* 1.2.31–3; Luc. 5.638–53; Petron. *Sat.* 114; Achilles Tatius 3.3; cf. the similar sequence in *Acts of the Apostles* 27 (Appendix A).

Dionysius of Halicarnassus could speak of "writing the storm" (*to cheimōna graphein*) as a rhetorical exercise, and the Elder Seneca complained that the common declamations on storms in the rhetorical schools of his day lacked in both length and detail.[9] It is not without reason that every epic had its storms, serving as they did as episodes of intense dramatic tension. It should come as no surprise that no fewer than three Greek plays (now lost) included the word *nauagos* ("shipwreck"), and some Roman theaters and amphitheaters were fitted with mechanical devices that simulated ships in the act of wrecking.[10]

A somewhat more intricate convention appearing in the works of numerous Greek and Roman poets from Hesiod to Claudian was the moralizing *topos* classified broadly as the "folly of navigation," which cast the sea and seafaring in an exceedingly negative light.[11] The *topos* appears only in its constituent parts, but begins with an ideal era in the remote past, a Golden Age when the land provided all sustenance and seafaring was unnecessary. Man's flawed nature, however, caused him to turn his back on the life-giving soil (the natural element) and to turn to ships and the sea (the unnatural element) in order to gain riches from abroad.[12] The Argonauts were considered the pioneers. The *Argo* and its crew, as the first ship and the first seafarers (at least in literature), and with their avowed intent to steal the golden fleece, served as icons of man's daring and avarice. This was the kind of "lust for

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[9] Dion. Hal. *Rhet.* 10.17; Sen. *Suas.* 1.15. Juvenal (12.22–4) described a storm that he encountered at sea as happening "in the same way and as frightfully as when a storm arises in a poem" (*si quando poetica surgit tempestas*). Cf. Cestius' imperative in Sen. *Suas.* 3.2, "Now describe the storm" (*Describe nunc tempestatem*). Cf. the storm scene in Syn. *Ep.* 4.44 (Appendix C). On storm-scene composition in the rhetorical schools, see Morford 1967, 32–6.

[10] Ar. *CAF* F 266 = Kassel-Austin, *PCG* F 277 (*Dionysos Nauagos*); Ephippus *CAF* F 14 = Kassel-Austin, *PCG* F 14 (*Nauagos*); Paramonus *CAF* (*Nauagos Choregon*) = Kassel-Austin, *PCG* (*Nauagos*). On shipwreck scenes staged in Greek and Roman theater, see Panayotakis 1995, 137–40.

[11] Outlined by Smith 1913, 244–5 and briefly discussed in Nisbet and Hubbard 1970, 49–50 and Rougé 1974, 275–6. More extended discussions on the role of the sea in ancient literature may be found in de Saint Denis 1935a (Latin poetry) and Lesky 1947 (Greek literature).

[12] The *topos* of a Golden Age before the invention of seafaring is first found in Hesiod (*Op.* 236–7), after which it appears in several authors, including Sophocles (*Ant.* 332–8), Plato (*Crit.* 113e) and Aratus (*Phaen.* 109–13). Numerous Roman poets beginning with Virgil echo the sentiment: Verg. *G.* 1.130, *Ecl.* 4.31–9; Hor. *Carm.* 1.3.21, *Epod.* 16.57–64; Tib. 1.3.35–6; Ov. *Met.* 1.97–100, *Am.* 3.8.35–44; Sen. *Med.* 330–8; *Phaed.* 526–31, *Hipp.* 530; *Suas.* 1.15; Manilius, *Astronomica* 1.73–90; Stat. *Silv.* 3.2.61–77; Claudian, *In Ruf.* 1.215–19; *Anth. Pal.* 9.29; Alciphron 1.3.1–3.

gain" that so outraged Antiphilus in the epigram heading this chapter.[13] Poseidon punished them accordingly by sending storms.[14] More audaciousness and avarice ensued and with them more consequences.[15] The sea would be viewed as an horrific place to die, causing grieving parents to lament empty graves,[16] leaving bodies to litter the shores in the wake of vicious storms and violent shipwrecks, and creating an environment filled with danger and uncertainty.[17] The *Greek Anthology* contains an abundance of related *topoi* including the folly of sailing in winter, of sailing in certain difficult areas, and of using timbers twice cursed to build ships—unfortunate to be selected for cutting, unfortunate to be forced to go to sea.[18] We might also add the frequent mention of one thin plank staving off death.[19] Most of these *topoi* persisted for well over a millennium, thus attesting both to their popularity and to a remarkable conservatism of formulaic literary themes.

By the first century B.C. the folly *topos* had become so commonplace in literary circles that Roman philosophers and prose writers drew on it as well. Lucretius in his *De Rerum*

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[13] See also Eur. *IT* 408–37, *Med.* 1–8; Ov. *Am.* 2.11.1–6; Luc. 3.193–8, 6.401–3; Sen. *Med.* 301–9, 607–68; Valerius Flaccus, *Argon.* 1.597–9; Sil. *Pun.* 11.469–72; Stat. *Achil.* 1.62–5, *Silv.* 3.2.61–77. Cf. Pease 1955–1958, 2:28.

[14] Punishment: Prop. 3.7.14–15; Hor. *Carm.* 1.28.18; Valerius Flaccus, *Argon.* 1.644–5; Stat. *Silv.* 3.2.61–77.

[15] Inventions: Theognis 1.17.1–28; Eur. *Med.* 1–8; Prop. 1.17.13–14; Ov. *Am.* 3.8.45–46; *Tr.* 1.2.76–76; Sen. *Med.* 301, 607–68; Valerius Flaccus, *Argon.* 1.597–665; Stat. *Silv.* 3.2.61–77; Claudian, *De Raptu Proserpinae* 1.32.1–12. Audaciousness: *audacia* was Horace's theme in *Od.* 1.3.17–26; see Antiphilus' epigram heading this chapter; Avarice: Hes. *Op.* 676–92; Pind. *Nem.* 7.17–19; Eur. *IT* 408–19; Prop. 3.7.1–9, 37–8; Hor. *Carm.* 3.29.57–64; Tib. 1.3.37–40, 2.3.35–40; Sen. *Med.* 361–4, 607–68; Manilius, *Astronomica* 1.87, 4.165–72; Juv. 12.37–49, 14.275–83; *Anth. Pal.* 7.286, 7.534, 7.586, 9.29. Cf. Cic. *Fam.* 16.9.4; Sen. *Q Nat.* 5.18.4–16 and Plin. *NH* 2.47.125.

[16] Empty graves: Hom. *Od.* 5.311–12; Hes. *Op.* 687; Tib. 1.3.50; Ov. *Tr.* 1.2.53–6; Prop. 3.7.9–10; Petron. *Sat.* 12.81; *Anth. Pal.* 7.271–3, 275, 282–3, 285–6, 374, 395, 397, 495–7, 500, 539, 591, 624, 652–3, 9.228, 9.271. Cf. Sen. *Q Nat.* 5.18.6. Cf. Achill. Tat. 5.16, where those who die at sea are described as being prevented from entering Hades and compelled to hover around the area where they drowned.

[17] Dangerous and uncertain environment: Hom. *Od.* 5.171–9; Hes. *Op.* 614–25; Plaut. *Rud.* 485; Hor. *Carm.* 1.3.26, 1.28.6, 18; Prop. 3.7.30–1; Columella, *Rust.* 1.7–9; Lucan 3.193–8, 6.401–3; Juv. 14.275–83; *Anth. Pal.* 6.69–70, 7.264, 266, 650, 665, 668, 9.23, 29, 82, 133. Cf. Pittacus of Mytilene (quoted in Diog. Laert. 1.77.6); Sen. *Q Nat.* 5.18.4–16. The New Testament book of *Revelation* looks to a future (one might say a return to the Golden Age) in which "there was no sea" (21.1).

[18] Winter sailing: *Anth. Pal.* 7.263, 272–3, 292, 295, 392, 395, 495, 498, 500, 502–3, 534, 539, 640, 653, 9.36, 271, 11.31, 227; sailing in trouble areas: 6.245, 251, 7.275, 497, 499, 532, 584, 624, 699, 739, 9.90, 289, 429; cf. the trouble spot known as Syrtis mentioned in Ap. Rhod. *Argon.* 4.1235–6; Ov. *Am.* 2.11.17–20; Sen. *Ag.* 479–80; Sil. *Pun.* 17.246–7; Verg. *Aen* 1.111; see also pages 19–20, 29, 143, 147, 225, 293; using twice cursed timbers: *Anth. Pal.* 9.30, 31, 33–6, 376, 11.248.

[19] Thin plank staving off death: Aratus, *Phaen.* 298; Sen. *Med.* 305–8; Juv. 7.57–9; Achilles Tatius 3.2; Alciphron 1.3.2. The medieval equivalent as we read in the eleventh-century Cairo Geniza was "a little worm on a splinter" (Goitein 1999, 320).

Natura, for example, reflected on a sea enticing men to their doom and a former age that had not yet seen seafaring.[20] Strabo wrote bitterly of how the Scythians, the most sincere and least deceitful of any people, became depraved, piratical, murderous, extravagant and dishonest only after they had learned the art of navigation.[21] The Elder Pliny extolled the virtues of flax and how it enabled men to produce sails with which to range widely over the sea, bringing "Egypt in close proximity to Italy" and "Gades within six days of Ostia." But in the next section he felt moved to call the production and adaptation of flax a bold (*audax*) and criminal (*scelus*) act, and to blame the inventor, Jason, for creating a form of death lacking in burial rites (*insepultus*).[22] Seneca, too, resorted to these commonplace motifs, not only in his tragedies, but also in his philosophical treatises.[23]

Even Roman voyage narratives, few as they are, were colored with these rhetorical elements. The voyage of Paul described in *Acts of the Apostles* 27–8, while providing an abundance of crucial information on Roman-era navigation, nevertheless was ostensibly modeled on the shipwreck scenes in the *Odyssey*.[24] Lucian in his satirical piece *Navigium* describes the tumultuous voyage of an enormous Roman grain ship, the *Isis*, but could not avoid inserting an epic vignette on the pall of darkness and the appearance of one of the Dioskouroi (Castor and Pollux) to lead the ship out of harm's way.[25] Synesius' starkly

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[20] Lucr. 2.560.

[21] Strab. 7.3.7; cf. 7.4.6.

[22] Plin. *NH* 19.1.3–6; cf., however, Pliny the Elder's overall positive conceptualization of the sea and navigation as discussed in Beagon 1992, 159–201.

[23] See for example Sen. *Q Nat.* 5.18.4–6, where he debated whether the winds were evil or good à propos of seafaring and ultimately concluded that seafaring itself was not evil, although men perverted it in making war. On how these literary motifs influenced prose narrations, cf. Tacitus, *Ann.* 2.23 (on Germanicus' northern adventure) in which many of the standard literary storm-scene conventions appear: beginnings in fair weather, winds warring with each other, abandoning control of the helm, ending in shipwreck.

[24] See Appendix A. Dibelius (1956, 205) was among the first to suggest that Paul's sea voyage was modeled on literary wrecks; Praeder (1984) compares Paul's tumultuous voyage with ancient literary models; and MacDonald (1999) makes a strong case that the narrative was modeled not just on the ancient storm *topos*, but specifically on Homer's *Odyssey* Books 5 and 12. In addition to examining the deliberately classicizing nautical diction used in the passage, he draws attention to the shared shipwreck elements of both works: the appearance of a goddess or angel assuring safety, riding debris after the shipwreck, the arrival on an island full of hospitable natives, their mistaking of each protagonist as a god, and their friendly send off to continue the voyage.

[25] Lucian, *Navigium* 7–9 (Appendix B). The pall of darkness may allude to a motif found in numerous authors, e.g. Hom. *Od.* 5.293–5, 12.405, Ap. Rhod. *Argon.* 2.1103–4, 4.1692–8, Verg. *Aen.* 3.203–4, 5.8–11; Luc. 5.625–31; Petron. *Sat.* 114. The Dioskouroi were considered deliverers of seafarers from stormy seas, as we read in the *Homeric Hymns to the Dioskouroi* (3.4) and in Theocritus, *Hymn to the Dioskouroi* 22.14–22. The ship on which Paul embarked out of Malta was named *Dioskouroi* (*Acts of the Apostles* 28.11; see Appendix A).

realistic description of his own voyage between Alexandria and Ptolemais (Cyrene) in the opening years of the fifth century is deeply textured with seafaring clichés and literary allusions, including the notorious greed of sailors, the ill-omened rising of Arcturus (the brightest star in the constellation Boötes), and that mythical arch-enemy of navigation, Nauplius—all harmonizing with the numerous classicizing motifs from which Neoplatonists and Christian intellectuals drew in his time.[26] And Rutilius Namatianus employed traditional poetic imagery in his elegiac poem *De Reditu Suo* which lightly narrates his very real voyage from Ostia to Gaul in A.D. 416.[27] In these passages one may well wonder where the lines between cliché, allusion and reality were drawn.

These attitudes toward the sea and the condemnations voiced by the moralizers are belied by the prodigious and universal seafaring activity in the whole period of this study. The Archaic period saw Greeks engaged in trade in the Levant, Egypt, Cyrene and western Mediterranean, and a colonization movement that also took in every shore of the Mediterranean and Black Sea. The Classical and Hellenistic period saw trade and trading voyages extending even farther abroad, and by the Augustan Age voyages outside the Pillars of Hercules, down the Red Sea corridor and across the Indian Ocean to India and beyond had become commonplaces. Even so, the ubiquity and persistence of these literary *topoi*, read by scholars largely unaware of their programmatic structures and idiom, has had a strongly negative effect on modern conceptions of ancient navigation.

The second influence on modern notions of ancient navigation began to appear in the mid-nineteenth century. It was at this time that scholars steeped in the classics (and all too familiar with the associated ancient *topoi*) considered ancient navigation too primitive to have been effectively and safely practiced. They offered two explanations to justify this view. According to the first, ancient seafarers were unable to sail the open seas simply because they lacked the proper equipment (compass, chart, log and celestial navigation instruments) to do so. Without those instruments deemed crucial to the safe navigation of the world's

[26] Syn. *Ep.* 4 (Appendix C). On Synesius' classicizing allusions, see Pando 1940, 20–2; Rougé 1963, 264; and Long 1992, 352–7. Nauplius, it will be recalled, served as an Argonaut, but to avenge the death of his son Palamedes was responsible for lighting false beacons on the heights of Euboea, thereby wrecking the Greek ships voyaging home from Troy (see, e.g., Eur. *Hel.* 767, 1126–9).

oceans during the Age of Exploration, the ancients simply had no means to guide their ships, and thus they kept the shore in sight at all times. M. Navarette in his *Historia de la nautica* of 1846, one of the first widely published studies on the history of early navigation, touched on this sentiment:

> In truth the invention [of the wind rose] was in itself sterile and of little utility for the seafarer without the help of the magnet, whose property of attracting iron they knew. Ignorant of its north-pointing property, they could not apply it to serve as a guide for navigators. [28]

As the history of the compass and nautical astronomy became clearer, the notion of ancient navigational ineptitude took on the mantle of wisdom. G. Lewis, for example, in his comprehensive *Historical Survey of the Astronomy of the Ancients* (1862), treated the topic of the "…the helplessness, timidity, and unskilfulness of the ancient navigation" as a matter of course.[29]

J. De Perott was more specific with regard to ancient shortcomings. In his 1895 review of Navarette's book, he agreed that

> The Ancients had no means to determine the latitude and still less the longitude at sea, so they navigated wholly by dead reckoning. The instruments at their command were the sounding lead, and at a later time the plane chart. The absence of an instrument to measure the speed of a vessel was not very material—a good estimate of the velocity can be easily obtained without it—but the want of an instrument like our compass, to guide the pilot when thick weather prevailed, was sadly felt. Consequently winter was not considered as a season proper for navigation, and even in summer they generally ranged the coast, seldom venturing into the open sea…[30]

Several other works on antiquity since De Perott's have taken similar views and made similar comparisons between the navigation practiced since Late Middle Ages and that

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[27] Rutilius Namatianus, *De Reditu Suo*; see especially 1.42 (uncertain sea), 185–8 (setting of the Pleiades), 633–8 (watery Hyades and the Dog star).

[28] Navarrete 1846, 20: "…a la verdad la invencion era por si misma esteril y de corta utiladad para la marina sin el auxilio del iman, cuya propiedad atractiva del hierro conocian; pero ignorando la de dirijirse hacia el norte no pudieron aplicarlo para servir de guia a los navegantes."

[29] Lewis 1862, 462. See also p. 509, where "the general system of navigation in antiquity, whether the vessel was impelled by sails or by oars, was to keep close to the shore, and never to venture into the open sea… Navigation was moreover suspended during the winter months."

[30] De Perott 1895, 64. It is ironic that De Perott includes longitude as a point of comparison between ancient and modern navigational systems: the problem of determining longitude at sea was not solved until the mid-eighteenth century, some two and a half centuries after Columbus (see Sobel 1995).

practiced in antiquity. They typically cite the dearth of instruments, a lack of cartographic knowledge and primitive ship design.[31] Romm, whose statement on the timidity of ancient seafarers opened this section, was simply drawing from received wisdom.

The other explanation for the poverty of ancient navigational skills is that it was practiced predominantly by line of sight, and therefore lacked a need for instruments to aid in navigation in the first place. According to this notion, the Mediterranean is sufficiently small and its coastal margins suitably elevated to complete most if not all passages with the coastline in view. The idea began effectively with Cary and Warmington's *Ancient Explorers* in 1929 (rev. ed. 1963), was adopted by Semple in her lauded *Geography of the Mediterranean Region* in 1931, and since then has gained a significant following.[32] But this opinion stands in stark contrast to that of the famed French historian Ferdinand Braudel, who described the empty areas of the Mediterranean as maritime "Saharas." This debate is more fully discussed in the following chapter, but for the moment let it be stated that there are in fact large areas of the western, central and Eastern Mediterranean from which any coast cannot be seen and across which it required several days to transit. This is made abundantly clear in ancient and medieval sources and is a function of simple geography and meteorology. The upshot is that methods had to be developed to help guide ships, without landmarks, between landfalls.

Many of these parochial notions began to change, slowly at first, in the latter half of the nineteenth and in the opening decades of the twentieth century. Several scholars who chose to address the topic in more detail found themselves unable to square the received

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[31] Lefebvre des Noëttes (1935, 6), for example, argued that the steering oars of ancient ships were of such primitive and ineffective design that ships so equipped made quite poor performers, and thus could carry out only coastal navigation ("Leur gouvernail n'était…d'une efficacité très médiocre, sauf pour les embarkations légères, et c'est pourquoi le navire antique ne fut jamais, en somme, qu'une barque de cabotage"). His view was easily refuted by Rougé (1981, 13) and Pomey (1981, 99–100). For sentiments similar to Lefebvre des Noëttes', see Nordenskiöld 1898, 4; Kroll 1923, 408; Cary and Warmington 1963, 6; Thomazi 1947, 22; Havelock 1947, 10–11; Hyde 1947, 317; Thomson 1948, 46; Collinder 1954, 52–53; Neuburger 1969, 499–502; Isager and Hansen 1975, 57–58; Kemp 1976, 577–578; Severin 1987, 13–17; Starr 1989, 21; Meijer and van Nijf 1992, 176.

[32] Cary and Warmington 1963, 10 ("Unaided by compass or sextant, a seaman may sail the whole length of the Mediterranean without losing his bearings"); Semple 1971, 589 ("Hence it was possible for the ancient navigators to cross the western Mediterranean Basin from north to south at its widest part without losing sight of land"); Aubet 1993, 144 ("A ship leaving Tyre for Gadir could do the voyage in a more or less straight line *on the open sea* without losing sight of land by making one slight detour northwards between the Ionian isles and Sicily" [my emphasis]); Bartoloni 1988, 72 ("ships would take routes farther away from the coastline, usually *on the open seas, but probably always in sight of land* [my emphasis]"); Horden & Purcell 2000, 126 ("There are only relatively restricted zones where, in the clearest weather, sailors will find themselves out of sight of land").

wisdom with the textual evidence that described long, multi-day passages on the open sea. We may identify the enlightenment in Smith's essential *Voyage and Shipwreck of St. Paul* (1848) and Breusing's *Die Nautik der Alten* (1886). Both argued against the minimalist view and asserted the existence of open-sea navigation in antiquity on practical grounds.[33] But it is not until August Köster's *Das Antike Seewesen* (1923) that the contradiction between ancient sources and modern notions was fully identified and then addressed in any detail. Köster demonstrated that there were actually two systems of navigation in antiquity, a mandatory coastal mode for war galleys and a mode for merchant ships that entailed both coastal and open-sea navigation.[34] War galleys, he argued, were constrained to remain near coasts for practical and logistical reasons; built for speed and not for heavy seas, galleys (i.e. triremes) could not endure the heavier seas of the open main, and packing large crews of rowers they had to put in to shore at night for food and rest. Merchant ships, on the other hand, were entirely different. "Sie waren fest gebaut, mit einem durchgehenden Deck versehen, in jeder Weise seetüchtig, und sie brauchten weitere Reisen über die offene See nicht zu scheuen, ja der direkte Weg war für sie die Regel."[35] A decade later, A.W. Gomme concurred with Köster's explanation and added numerous examples of both modes from the pages of Demosthenes and Thucydides.[36] This remains the standard conception of ancient galley navigation.[37]

Köster's views on strongly built merchant vessels began to crystallize with the advent of the new field of nautical archaeology, a discipline that came of age in the 1950s and 1960s a short time after the invention of scuba. It was at this time that the French Riviera began to yield numerous Roman vessels of great length, large tonnage, and strong, double-planked hulls with decks that ran from stem to stern. Soon more ancient wrecks were discovered near the coasts of nearly all Mediterranean countries. By 1992, Parker could tally over fifteen

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33 Breusing 1886, 5–12 (Breusing's study was adapted into French by Vars in 1887; see esp. pages 6–15.); Smith 1848, 180–1.

34 Köster 1923, 186–7. The dichotomy between coastal navigation (pilotage) and open-sea (oceanic) navigation characterizes nearly all historic western navigation systems; see, e.g., Waters 1958, 5.

35 Köster 1923, 187. Cf., however, Caesar's crossing from Rhodes to Alexandria in a trireme (page 79 n. 113, pages 89–90).

36 Gomme 1933.

37 On more up-to-date studies on the nature and limitations of galley navigation, see Pryor 1995 and Hirschfeld 1996, 610–11.

hundred-plus known wrecks throughout the Roman world.[38] As the numbers of known and excavated wrecks began to climb each year, however, the uniform themes behind the *topoi* began to contribute in some measure to the notion of ancient navigational ineptitude: virtually none of these wrecks have produced a single navigational instrument aside from the humble sounding-lead,[39] and the vast majority have been found in scuba-diving depths within sight of the coast, in harbors or in inland waterways—all find spots highly suggestive of an avoidance of the open sea. While some have argued that it is precisely because so many ships sank near shore that the open sea would have been deemed a safer area to operate,[40] it is the growing number of ancient shipwrecks found in deep water, far from shorelines, that serve as poignant reminders of what ancient sources actually relate. To date, deepwater explorers and archaeologists have discovered several dozen ancient wrecks in the open sea, and more are brought to light each year.[41]

In 1957, the year when Cousteau was wrapping up some of the first scientific underwater excavations ever carried out on the two superimposed ancient wrecks (one Greek, the other Roman) off Grand Congloué in southern France, E.G.R. Taylor published her landmark book on the history of navigation, *The Haven-Finding Art* (2nd ed. 1971). This study was the first serious attempt to explain ancient navigation *techniques*.[42] Taylor, a geographer by training, is to be credited with conclusively demonstrating, from a limited body of textual evidence, that ancient Mediterranean seafarers practiced both coastal and open-sea navigation. In addition, she identified in the literature the three main spheres of navigational knowledge that pertain to movement in maritime space. Winds, she argued, were employed by ancient seafarers as a kind of "compass" that provided a means of orientation at sea; the height of the circumpolar constellations above the horizon provided position information; and *periploi*, or sailing manuals, which listed details of the coasts and

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[38] Parker 1992 is a catalog of all reported and/or documented ancient wrecks in the Mediterranean Roman provinces to the year of publication. Since then hundreds of wrecks have been discovered: Parker's catalogue is in dire need of an update.
[39] The most recent and comprehensive study of sounding leads is Oleson 2008.
[40] Wachsmann and Davis 2002, 499; Davis 2003, 2007.
[41] A comprehensive catalogue of deepwater wrecks has yet to be written. For a list of deepwater wrecks in French waters, see Long 1998, 353–5.
[42] Taylor 1971, 35–64; see S.E. Morrison's review (1958).

the distances between them helped seafarers determine their position. While this study takes issue with some of Taylor's conclusions in the following chapters, she did advance the field of navigational studies significantly. If she is to be faulted, it is in her naivety in adducing *topos*-laden literature to buttress her main points, her lack of more detailed discussion and a narrow selection of the evidence (she was not a Classicist). As shallow as the pool of evidence is on the topic, she was just skimming the surface.

While there have appeared several studies on various aspects of navigation since Taylor's work, they generally lack the foundation of inquiry that incorporates discussion of how ancient seafarers accounted for such fundamental factors as direction, position, distance and speed—the core ingredient of navigation. Or they treat one of these aspects in just one of the periods.[43] To my knowledge, no holistic approaches that incorporate all aspects of navigation in both Greek and Roman periods has appeared in print. Taylor's study is woefully in need of expansion and updating.

II. APPROACH AND ORGANIZATION

The approach of this study is to examine afresh and in depth how Greek and Roman seafarers practiced day-to-day navigation and solved (or attempted to solve) the most pressing navigational problems. As navigation is a word that summarizes a multifaceted and distinct group of techniques, this study treats each chapter thematically and diachronically. Chapters 2 and 3 are devoted to establishing some very basic facts, supported by citation of both modern studies and ancient texts, before going on to the more interesting task of drawing out their implications, suggesting solutions and putting them in context, the main role of Chapters 4–7. Chapter 2 is devoted to delineating the maritime environment of the Mediterranean and Black Sea. The configuration and character of the coasts, the arrangement of the islands, the speed and direction of currents, the dynamics of the seasons

[43] See, e.g., Morton 2001; on Dardanelles navigation, see Carpenter 1948; Labaree 1957; Severin 1985; Korfmann 1986; Neumann 1986, 1991; Rutishauser 2001; on Gibraltar see Ponsich 1974; Pomey 1996. On night-time navigation, see Lane 1963; Fresa 1964, 1969; Adam 1966; Basch 1974; Malkin and Fichman 1987; Rostropowicz 1990; McGrail 1996; Pomey 1981, 1996, 1997; Janni 1998; Medas 1998; Hannah 1997; Davis 2002, 2007. On religious aspects of seafaring see Recio 2000; Neilson 2003, 2006; and Vella 2005; on sea routes and travel itineraries, see Arnaud 1992; 1993; 1995; 1996; 2004; and 2005.

and the weather, and the shifting boundaries of visibility at sea—all of these parameters offer the reader a sense of scale and reveal the navigational complexity of these waterways. They also dictated the patterning of the main maritime corridors and consequently defined the parameters of ship construction and navigation.

Chapter 3 treats the three critical responses to the maritime environment made by Greek and Roman seafarers. The first part deals with the classes and sizes of the merchant ships themselves, about which there is still much uncertainty due to the paucity of unambiguous literary evidence. The ancient sailing season(s) is the subject of part two; here the reader will find some surprising evidence that argues against the prevailing notion that all or even most shipping halted in winter. Part three draws on both literary and archaeological evidence to model the more heavily-trafficked sea lanes that were structured by a combination of geography, sail technology and seasonal winds.

Much of the rest of the literary evidence on navigation falls into those three categories which Taylor herself recognized half a century ago: winds, stars and written guides. Chapter 4 investigates the manifestations and evolution of the ancient wind rose from Homer to Vegetius. This circular model of the horizon, divided into four, eight or twelve winds, could take either mental or material form. As several of the Mediterranean's wind regimes can be characterized as trade winds, that is winds that blow strong, steady and consistently from a single direction, the wind rose became the equivalent of the medieval compass—hence its utility to seafarers in their attempt to maintain orientation and heading on the open sea.

Chapter 5 is devoted to an extended discussion of the astronomical dimensions of night-time sailing. The evidence cited is, for the most part, derived from *topos*-laden literary sources, mostly from epic or court poetry, a circumstance which makes interpretation difficult. Nevertheless, several writers refer to techniques that can ostensibly be found in the later European traditions of navigation, particularly with regard to the circumpolar stars of the northern sky.

The question of whether seafarers employed *periploi* and *limenai* as written aids to navigation is the subject of Chapter 6. Scholars have long assumed that these sub-literary texts replete with distances and paratactic lists of coastal locations were written by seafarers for navigational purposes. My findings dispute the assumption. The general lack of relevant and detailed navigational information argues instead that these texts were written by learned writers of geographic genres for the large populations of seaborne travelers, as several independent sources strongly suggest.

Chapter 7 rounds out our knowledge of Greek and Roman commercial navigation by examining the general social background and organization of the seafarers and sailing masters themselves, and by offering a reconstruction of a hypothetical long-distance voyage of one of the hundreds of Alexandrian grain ship that sailed back and forth between Egypt and Italy during the Roman imperial era of the first-fourth centuries A.D. These were among the longest voyages that commercial vessels undertook in antiquity. The hypothetical voyage presents an opportunity to demonstrate to readers the scope of the practical navigational knowledge required of sailing masters—the long-distance experts of their day—to make voyages repetitively and safely each season.

Chapter 8 concludes the work with an overview of the study and suggestions for further lines of research.

III. Terminology and Transliteration

For the uninitiated, ships, seafaring and navigation are highly specialized topics with a correspondingly specialized vocabulary. The reader will find starting on page 308 a convenient glossary of terms in English related to navigation and seamanship. The kilometer (km) is used for distances on land, while the nautical mile (abbreviated hereafter as nm: 1,852 m, 6,076.11 feet) and the knot (kt) are used according to international standards to represent distances and speed, respectively, at sea.

For ship and navigation terms in Greek and Latin I refer the reader to the helpful glossary provided by L. Casson in his *Ships and Seamanship in the Ancient World*.[44] The transliteration of Greek and Roman personal names and works follows the standard of the

[44] Casson 1995, 389–402.

Oxford Classical Dictionary (3rd ed.). The place-names and map text in this study are derived from R. Talbert's *Barrington Atlas of the Greek and Roman World* (2000). Here the reader will encounter numerous exceptions for the sake of clarity and prevalent usage; these include well-known cities and sea names, such as Athens for Athenae, Rome for Roma, Tyrrhenian Sea for Tyrrhenum Mare, among others.

All translations of Greek and Latin texts are my own.

Chapter 2: *The Maritime Environment*

> Hope of the sea drew me, Eteokles, from my farm and made a merchant abroad. I was treading the back of the Tyrrhenian Sea, but with my ship I was capsized and sunk beneath the waves in a sudden violent squall. It is not the same wind that blows on the threshing-floor and billows the sails.
>
> —Isidorus of Aegae[1]

The physical setting of the greater Mediterranean region must always receive attention in any discussion of ancient navigation, for it has an important bearing on the nature of the wayfinding system or systems that arise in response to its challenges.[2] The configuration of the coasts, the nature of currents, the patterns of winds and seasons, and the dynamic nature of visibility at sea—all of these factors contributed to the great range of variables that were encountered and defined the limited range of solutions that could be found to navigate safely and effectively. The ways in which these two seas have been traditionally characterized, however, as we shall see below, may be described as subjective at best, and often inaccurate at worst. In general terms, the Mediterranean and Black Sea may be considered variously benign and hazardous for navigation—benign in the sense that both seas are limited in size, are nearly tideless, have elevated shores, exhibit weak currents (except in certain straits), and boast clear skies and moderate winds throughout numerous months of the year. The physical configuration of both seas may be considered to have facilitated navigation when compared with other historic areas of seafaring, such as the North Atlantic, Indian Ocean or South Pacific. Generally absent are the weather conditions and geography that produce the great tides and monstrous storms and rollers of the global oceans. And yet they are also hazardous, their complex geography and climate presenting their own challenges and leaving an indelible imprint on how Greek and Roman seafarers solved the

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[1] *Gr. Anth.* 7.532: *Ἔκ με γεωμορίης Ἐτεοκλέα πόντιος ἐλπὶς | εἵλκυσεν, ὀθνείης ἔμπορον ἐργασίης. | νῶτα δὲ Τυρσηνῆς ἐπάτευν ἁλός· ἀλλ᾽ ἅμα νηὶ | πρηνιχθεὶς κείνης ὕδασιν ἐγκατέδυν | ἀθρόον ἐμβρίσαντος ἀήματος. οὐκ ἄρ᾽ ἀλωὰς | αὑτὸς ἐπιπνείει κεἰς ὀθόνας ἄνεμος.*

[2] There have appeared several excellent studies that have approached the topic of ancient and medieval navigation by first delineating the physical parameters of the Mediterranean or its relevant micro-regions. See, e.g., Agouridis 1997 (Early Bronze Age Aegean); Morton 2001 (ancient Greek seafaring); Pryor 1988, 1995 (the medieval Mediterranean); Rougé 1966, 31–45 (the Roman period).

universal problems associated with intended movement within maritime space. Defining and contextualizing this space in concrete and navigational terms is the purpose of this chapter.

I. THE ORA MARITIMA

The first parameter to explore is the dramatic and complex configuration of the *ora maritima*, the littoral zone of the Mediterranean and Black Sea. Around the rim of both basins mountains of various heights, ages and compositions thrust out of the sea while long, lofty peninsulas, large islands and island chains severely fragment the liquid plain. The intricate coastal rim served as the focus of navigation conceptualizations from an early date, functioning as the primary frame of reference in the ancient geographical tradition and reaching its most pragmatic expression as early as the sixth century B.C. in the subliterary genre known as the *periplus*, or coasting voyage (see Chapter 5). To geographers and seafarers alike, the shoreline at its most basic level was conceived as a linear continuum, a long, sinuous march of coastal elements registered by the sequence of harbor, rivers, headlands and other natural features that interrupted or characterized the regular coastal silhouette. Such real and perceived benchmarks, in combination with the dynamics of winds, currents and visibility, directly shaped the patterning and consistency of maritime corridors in antiquity. Before we can explore these and other aspects of navigation in subsequent chapters, it is necessary to examine this zone in more detail.

1. The Mediterranean Littoral

In geographical terms the Mediterranean is the world's largest inland sea (figs. 2.1, 2.2 and 2.3). Its waters span some 3,800 km west to east and nearly 1,100 km north to south. A coastline of some 22,000 km—a distance equivalent to more than half the circumference of the earth—encloses an area approaching 3,000,000 km^2. Only the Caribbean (2,718,200 km^2) and South China Sea (2,319,000 km^2) are comparable.

The long corridor separating Europe from Africa is naturally split into two major basins of unequal size by a broad and relatively shallow sill beneath the Sicilian Strait. Coastal ranges of various heights and depths rim nearly the entire northern shore of both basins. In the west these include the Baetic Cordillera, the eastern Pyrenees, the Maritime Alps and the Apennines of Italy and Sicily. In the east they comprise the Dinaric Alps, the lofty Balkan peninsula with its volcanically-active island arcs, the Rhodope Mountains of Thrace and the steep scarps of the Taurus mountains of southern Asia Minor. Most of these ranges rise to between 500 and 2,000 m behind thin coastal plains or directly adjacent to the coast. Where these ranges meet the sea we find elongated peninsulas, heavily indented coastlines teeming with headlands, deep and shallow gulfs, cul-de-sac seas, tiny embayments and an occasional high coastal plain. Most of these coastlines boast natural harbors and quiet anchorages, but there are exceptions: the western Adriatic coast, for example, is comparably bereft of harbors and natural landmarks; it is a lee shore for much of the year and its bottom shoals unexpectedly in many areas.

Massive and violent tectonics appear especially magnified in the Aegean, where thin, mountainous peninsulas thrust far out into the sea and create a relentlessly fragmented seascape. Their trajectories are often continued by myriad islands and island chains, the tops of submerged mountains. These sweep off the mainland in several clearly defined arcs. The outer arc of high mountain ranges and karst landscapes extends from Albania to the Peloponnese, then curves eastward to take in Kythera, Crete, Rhodes and southern Anatolia. A second, inner arc is delineated by both active and dormant volcanoes, including the islands of Melos, Thera (Santorini) and Nisyros. Further northward, inner arcs include the lofty islands of the Cyclades and Sporades, which served as convenient stepping stones between the Greek mainland and Asia Minor. In the Aegean the coastline amounts to 11,000 linear km distributed among mainland and island shores—nearly half the coastline of the entire Mediterranean.

The western half of the southern Mediterranean shore, known in Arabic as the Maghreb ('west') and in French as *l'Atlas Maritime*, consists of a nearly unbroken wall of lofty coastal ranges extending roughly west to east from the promontory of Mount Abila on the Strait (opposite Gibraltar) to the uplands of Tunisia 1,500 km to the east (fig. 2.2). The coastal barrier actually comprises several systems.[3] In the west are the Rif Mountains of modern Morocco (geologically associated with the Baetic Cordillera) which lie between the Strait and Cape Tres Forcas (Ras Tleta Madari). Tall peaks of 2,000 m and more (e.g., Jabal Tidiquin, 2,448 m) lie just a few kilometers from shore. To the east of these stretch the coastal extensions of the Atlas Mountains, including the Dahra and the Grand and Little Kabylia. These range from 500 to 1,500 m in elevation near the coast before descending gently in the Aurès and Zeugitane Mountains to form Capes Bon and Blanco near ancient Carthage. Along this shore seafarers found a seemingly endless series of craggy headlands (Arabic *ra's*), sandy coves, occasional shallows and numerous treacherous islets. In contrast to the island-strewn northern shore, the southern shore includes just a few small offshore islands, such as Galite, the Kerkennah islands and Djerba.

The eastern half of the North African littoral presents a striking contrast to the western half and the northern shore (fig. 2.3). The coast between Cap Bon and the Nile Delta (modern Tunisia, Libya and Egypt) is characterized by long and straight sandy beaches, with broad and relatively featureless maritime plains fronting a low-lying and semi-arid hinterland. It is comparably bereft of natural harbors for over 2,500 km. The coast here, averaging between 3 and 10 m above sea level, is difficult to spot even from a short distance at sea, thus making coasting voyages along this stretch extremely dangerous. The treacherous conditions of the two Syrtides (Syrtis Maior and Syrtis Minor, modern Sidra and Gabes), whose tides and currents were well-known in antiquity among geographers and seafarers (see below), fueled a literary *topos*.[4] Diodorus Siculus, however, provides a more technical description of this stretch of coast. He focuses on Egypt, but his observations may be applied to nearly the entire eastern coast of North Africa:

> A sandbank stretches along the whole length of Egypt, not noticeable to the inexperienced approaching by sea. As a result, those who consider that they have escaped the danger of the sea, and on account of their ignorance gladly turn toward the land, suddenly run their ship ashore and are hopelessly shipwrecked; and some, unable to see land beforehand on account

[3] Walker 1965, 280–2, fig. 34.

[4] See Chapter 1, n. 12, and Ap. Rhod. *Argon.* 4.1240–78. The geographical problems of the two gulfs are discussed by Janni 1984, 141–2.

> of very low-lying ground, are unaware that they are being driven ashore, some of them in marshy areas and stagnant pools, other in desert areas.[5]

Such conditions eventually gave rise to the construction of numerous reference towers along this coast as early as the fifth century B.C., culminating in the famous lighthouse of Alexandria, built in the early third century B.C. (see below, page 213). These and other shore structures enabled passing and port-bound seafarers to acquire their orientation along a virtually featureless horizon.

The single yet major exception to the low elevations along this coast is the plateau of Cyrenaica, situated on a broad bump in the North African coast opposite Crete's western extremity. The high, terraced plateau of the Gebel Akhdar begins its rise to 800 m only 1 km from the coast. Its uplands stretch for some 400 km east to west and are visible from far out to sea on clear days. The Archaic and Classical city of Cyrene situated atop the forested tableland looked out over the sea and its seaport of Apollonia (modern Marsa-Susa).

The coastlands of the Levant mix elements of the Mediterranean's northern and southern shore. Its shores extend for approximately 850 km from the Gulf of Iskenderun in the north to the Nile Delta in the south. The Levantine coast and coastal ranges parallel the Jordan Rift Valley, which is part of the larger Afro-Arabian fault line originating far to the south in Mozambique. The Amanus Mountains in the north descend to the sea in the Gulf of Iskenderun and stretch as far south as the mouth of the Orontes. Between here and the Carmel Ridge, a distance of some 300 km, the snow-capped mountains of Lebanon hem in a thin coastal strip. These mountains, some of which attain 2,500 m and more (e.g., Mt. Hermon, 2,814 m), stretch southward to the Jezreel valley and form an imposing backdrop to the historic cities of the Phoenician seaboard—Ugarit, Arados, Byblos, Beirut, Sidon and Tyre. On the southern side of the valley lies the Carmel Ridge, which descends into the sea at modern day Haifa. Its parent range to the southeast contains lofty peaks, but the heights are set farther away from the shore and are visible from seaward only on the clearest of days.

[5] Diod. Sic. 1.31.3–5: *ταινία παρ' ὅλην σχεδὸν τὴν Αἴγυπτον παρήκει τοῖς ἀπείροις τῶν προσπλεόντων ἀθεώρητος· διόπερ οἱ τὸν ἐκ πελάγους κίνδυνον ἐκπεφευγέναι νομίζοντες, καὶ διὰ τὴν ἄγνοιαν ἄσμενοι πρὸς τὴν γῆν καταπλέοντες, ἐξαίφνης ἐποκελλόντων τῶν σκαφῶν ἀνελπίστως ναυαγοῦσιν· ἔνιοι δὲ διὰ τὴν ταπεινότητα τῆς χώρας οὐ δυνάμενοι προϊδέσθαι τὴν γῆν λανθάνουσιν ἑαυτοὺς ἐκπίπτοντες οἱ μὲν εἰς ἑλώδεις καὶ λιμνάζοντας τόπους, οἱ δ' εἰς χώραν ἔρημον*. Cf. Mela 1.35.

The coastal strip from Gaza to the Nile Delta, as Diodorus described, becomes flat, featureless and arid.

Aside from the two sea inlets at Gibraltar and the Dardanelles, gaps in the mountainous rim of the Mediterranean are few, and nearly all are associated with rivers that offered penetration into the hinterland. Notable by their width are the Rhône and Po Valleys. The Rhône (Rhodanus) with its tributaries Saône and Doubs (Arar and Dubis) was navigable deep into Gaul to the northern flank of the Alps. The Po (Padus/Eridanus) maintained a consistent volume year round and was navigable for nearly 370 km upstream to Augusta Taurinorum (Turin). Rivers and streams of lesser scale form much smaller gaps and offer limited access into interiors: in the west these included the Guadalquivir (Baetis), the Guadalhorce (Malaga), the Ebro (Hebrus), the Aude (Atax) of the Carcassonne gap and the Tiber of Rome and central Italy; in the eastern basin, the Achelous (Greece's greatest river), the Alpheios of the western Peloponnese and the Thracian rivers Ludias, Struma and Maritza; gaps in the Taurus range include those carved by the Aksu (Cestrus) and the Köprüçay (Eurymedon); and Syria's main river, the Orontes, separated the Amanus from the Lebanon mountains and permitted smaller boats a difficult, upstream journey of some 25 km to Antioch. Of all the Mediterranean rivers, the Nile is unique in its volume and length: the first 1,200 of its 6,700 km are navigable by deep-draft vessels to the first cataract at Elephantine.

2. Mediterranean Islands

The Mediterranean abounds in islands. The figure would well surpass two thousand if every islet, isle and island proper were counted. For those traveling by sea, their ubiquity made them extremely valuable. From acting as convenient stepping stones to other islands and mainland areas, to dividing maritime space into convenient, cognitive units, to serving as natural navigation aids (route markers, safe havens and wind screens), every island in the Mediterranean, large or small, was exploited by ancient seafarers. Of islands proper (i.e. those large enough to sustain human habitability), the Mediterranean boasts some 115, most of which comprise less than 250 km^2.[6] These can be grouped conveniently into regional clusters (fig. 2.4).

The vast majority of islands are visible from the peaks and elevated shorelines of adjacent mainland areas or form links, or "stepping stones," in a chain of islands tied to the mainland by their mutual, island-to-island visibility. The coastlines of the large island of Corsica (highest elevation, 2,700 m), for instance, are tied to mainland Italy by the Tuscan archipelago (Elba, Gorgona, Capraia, Pianosa, Montecristo and Giglio), while Sardinia (1,834 m) lies about seven nautical miles from Corsica across the islet-strewn Strait of Bonifacio, the ancient Gallicum Fretum. At its closest point, Sicily's northeastern shoreline lies just 3 km (or 1.6 nm) from Italy's toe across the Strait of Messina (*Siculum Fretum*), but serves as a link to the Aegadian Islands to the west.

Along the Adriatic's eastern shore, the hundred or so Dalmatian Islands are strung out, as Braudel described, "like a convoy of ships," from the Cres-Losinj Islands (*Apsyrtides*) in the north to Mjlet (*Melite*) in the south.[7] These form a complex web of channels and protected waterways along the Illyrian coast for several hundred kilometers. To the south, just offshore of the Balkan seaboard, lie the Ionian Islands, another "flotilla," dominated by Corcyra (Corfu), Leucas, Cephallania and Zacynthus.

In the island-rich Aegean nearly all of the islands can be sighted from some adjacent island or mainland area on the clearest of days. Crete, with its White Mountains in the west (2,453 m), the central Ida massif (Mt. Psiloriti 2,456 m), and the Lasithi Mountains in the east (2,148 m) commands all Mediterranean approaches into and departures from the Aegean; its high elevation and lengthy southern coast also served as a wind screen for west-bound voyages, as seen in Paul's voyage to Rome (see below, pages 221–2). In the myriad, closely-spaced islands of the Cyclades, distances between islands never surpass about 13 nm and "are commonly less than the length of individual islands."[8] Finally, the tall coastlines of northern and eastern Cyprus can usually be sighted through the sea haze from many parts of the Anatolian and Syrian coasts. One of the more common maritime corridors of antiquity

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6 Cherry 1981, 54–8; see also Patton 1996, 2–3, and fig. 1.1.
7 Braudel 1972, 1:149.
8 Broodbank 2000, 75.

and the Middle Ages, as we shall see in the next chapter and in Chapter 7, employed Cyprus as a route marker for voyages east to west.

There are also isolated islands and island groups in the western and central Mediterranean that either cannot be physically sighted from adjacent mainland areas or islands, particularly from sea level, or are often very difficult to sight due to distance and atmospheric conditions. Most of these islands were colonized, or at least visited, during the Neolithic and thus suggest a marked degree of seafaring knowledge and capability on the part of the Mediterranean's earliest navigators.[9] In the west these include the Pine (*Pityussae*) islands of Ibiza, Formentera and four islets. As extensions of the Baetic Cordillera, they emerge from the sea some 45 nm east of the Iberian coast off Cabo de la Nao (Tenebrium promontory). To the northeast at a distance of 45 nm lie the larger Balearic islands of Majorca and Menorca, the isle of Cabrera and numerous islets. The tallest peaks are found on Majorca, on whose north coast the Sierra de Tramuntana approaches 1,500 m in elevation. From here the mainland lies approximately 95 nm away, well out of sight from sea level even on the clearest of days.

Another pelagic island is the small volcanic island of Ustica, which lies 30 nm off Sicily's northwest coast in the Tyrrhenian Sea. The island's name is derived from Latin *ustum*, burnt, referring to its black lava slopes. Its central peak (248 m) can just be seen from Sicily's northwestern highlands but only on very clear days.[10]

The remaining isolated islands and island groups reside at the eastern end of the the Strait of Sicily.[11] The Maltese islands, out of view of Sicily's southern coast 45 nm away, and hidden from the North African coast some 160 nm away, consist of the large island of Malta (*Melita*), Gozo (*Gaulos*), Camino and numerous islets. As a whole, the island group is relatively low and rocky, with a maximum elevation of 253 m on Malta itself. Between Malta and Tunisia, the small archipelago known as the Pelagia (or 'High Seas') Islands comprise the limestone table of Lampedusa, the isle of Linosa and the rocky islet of Lampione. Their elevations are even less than that of Malta, with the tallest peak on Linosa reaching 186 m.

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[9] See above, n. 6.
[10] Plin. *NH* 3.8.92.
[11] Most of which are described in Strab. 17.3.16.

Lampedusa, however, mentioned by Strabo as an island "on the open sea," commands an excellent natural harbor on its south shore.

To the northwest, nearly at the midway point in the Strait of Sicily between that island and Tunisia, lies the lone rocky island of Pantelleria. Known to Strabo as Cossyra and to later Arabic sources as *Bent el Rion*, or 'Daughter of the Wind,' its central peak of 836 m acted as a convenient route marker for Phoenician, Punic, Greek and Roman ships transiting through or across the straits. Indeed, as early as the Neolithic, stone-age seafarers journeyed to the island to retrieve obsidian from one of the few such easily extractible sources in the entire Mediterranean basin.

3. The Black Sea Littoral

The Black Sea, the most isolated saltwater sea on the planet, presented to seafarers a maritime environment in some ways very similar to that of the Mediterranean. Parts of its coastal rim mirror the mountainous littoral of southern Anatolia, and the gaps are the result of many of the same natural processes that sculpted the Mediterranean. On the sea the tide is negligible, and wind-driven currents are generally comparable. But there are also distinct differences. The rim itself, particularly in the north, is breached by coastal plains and enormous river systems that provide navigable access deep into the European and Asian continents. Cooler continental weather systems govern the Black Sea's wind regimes; as we shall see in the following chapter, the greater differences in temperature and precipitation between seasons resulted in a shorter maritime calendar. In addition, the wide-open spaces and nearly complete lack of islands contrast sharply with the insularity of the Mediterranean in general, and the Aegean in particular.

The Black Sea is approached from the Aegean via three waterways linking the two seas. On the Aegean side are the narrow Dardanelles (Hellespont), a narrow and relatively straight channel that ranges between 1.2 and 6 km wide and extends for some 70 km. The waterway joins the larger Sea of Marmara (Propontis), whose north and south coasts are punctuated with numerous isolated coastal ranges with peaks under 800 m in elevation. This waterway widens to about 70 km before narrowing again toward the northeast end where the

Bosphorus begins. The Bosphorus itself is a relatively straight, 30-km-long channel ranging between 700 m and 3.7 km in width, its widest expanses found toward its northern end, whence Black Sea surface waters pour in.

The Black Sea lies in a deep depression between the Pontic Mountains of Anatolia to the south, the Caucasus mountains to the northeast, the Crimea to the north and the Balkan peninsula to the west. The sea has an east-west length of 1,150 km, an average north-south width of about 400 km and a coastline of some 4,300 km that encloses an area of about 423,000 km^2. The Crimean peninsula extends southward into the basin from the steppe and splits the basin into a western and eastern half; the narrowest crossing (263 km) is between Cape Sarych (ancient Kriou Metopon, 'Ram's Head') in Crimea and Krempe Burnu on the Turkish coast (ancient Cape Karambis).[12] These two capes, discussed in more detail below and in Chapter 3, formed natural bridgeheads for north-south routes.

The most dramatic transitions between shore and sea lie along the southern and northeastern shore, and along the southern coast of the Crimea. In these areas extremely narrow coastal strips are backed by a curtain of lofty ranges attaining heights of 1,000 m or more just a few kilometers from shore. The effect is most pronounced in the mountains west of Sinop (Paphlagonia), along the southeast coast (Pontus) and in the Caucasus Mountains. On the west coast, by contrast, the Stara Planina of modern Bulgaria, an extension of the Balkan Mountains, juts eastward to the Black Sea coast and descends gently to the sea at Cape Emine. The hinterland here is characterize more by rolling hills than by mountain barriers.[13]

Breaches in the coastal rim of the Black Sea are more numerous than in the Mediterranean. The entire northwest coast, from the Danube delta to the Gulf of Karkinitis in the Crimea, is low-lying (10 to 40 m in elevation), marshy and interspersed with brackish coastal lagoons or limans which lie at the mouths of several major rivers (Danube, Dniester, Bug and Dnieper). A similar situation is found in the northeast corner beyond the Kerch strait and within the Sea of Azov into which the Don and Kuban rivers flow. On the far

[12] Strabo (7.4.3) considered this narrowest stretch between the northern and southern shore as naturally dividing the Black Sea into two halves.
[13] Sorokin 2002, 19–20.

eastern shore, the Rioni (ancient Phasis), considered by Aelius Aristides to be the easternmost limit of navigation, permitted ships to navigate as far as 33 km upstream.[14]

It was this complex of mainland and island shores that bounded the maritime plains of the two great seas, provided the first logical order of navigational organization and, as we shall discuss further in Chapter 6, became so deeply ingrained in the geographic conceptualizations of the *oikoumenē*. The second and third orders involve those two dynamic maritime elements which were directly influenced by the shape and nature of the *ora maritima*, currents and winds.

II. Tides and Currents

Ships throughout antiquity, whether under oars or sail, were influenced for better or ill by currents. Currents in certain straits were especially noteworthy in ancient sources; one need only think of the swift Atlantic inflow at Gibraltar, the currents of the Strait of Messina, where myth elaborated on the whirling eddies and currents of Scylla and Charybdis (see below, pages 230–2 and fig. 7.5), and the challenges of transiting the Dardanelles against the swift outflow of the Black Sea. But these are relatively isolated areas. What of the rest of the Mediterranean and Black Sea? Here it is worth taking a more detailed look at behavior of and mechanisms behind the tides and currents of these basins in order to determine what effects they likely had on ancient navigation.

1. Mediterranean Tides and Currents

The Mediterranean is a mid-latitude, semi-closed, microtidal sea with an almost isolated oceanic system approaching 3,000,000 km^2 in surface area (ca. 731,000 nm^2). Due to its restricted communication with the Atlantic through the narrow Strait of Gibraltar and its shallow sill (320 m), Mediterranean tides are generally measured in centimeters, with ranges

[14] Aristid. *Ad Romam* 82 (= Dindorf 1964, 219, line 26); cf. Pseudo-Scylax 81: "the voyage up this river [Phasis] to the great barbarian city of Aia, home of Medea, is 180 stadia" (*ἀνάπλους ἀνὰ τὸν ποταμὸν σταδίων ρπ',*

in the west larger than those in the east. At Gibraltar the tidal range averages 1.2 m but falls off rapidly with distance eastward, reaching just 30 cm off northern Sicily and 14 cm at Genoa.[15] There are exceptions. Somewhat higher tides and associated tidal currents are recorded at the heads of long gulfs like the Adriatic and Gulf of Corinth. They also occur in narrow channels, especially where they are aligned with the direction of prevailing winds, such as the Strait of Messina (5+ kts),[16] the Europos channel between the Greek mainland and Euboea (up to 6 kts),[17] and the channel between Samos and the Turkish mainland (3+ kts).[18]

The general horizontal circulation of the Mediterranean's surface waters is instead governed primarily by temperature, salinity and, in certain areas, steady winds. The Mediterranean region is characterized by its warm, dry and cloudless summers, as well as its position adjacent to the immense Sahara. Evaporation, measured at about 30,000 km^3 per year, greatly exceeds replenishment from precipitation and rivers. The intense evaporation, especially in the eastern basin, results in a particularly saline sea, with the heavier saline water sinking and escaping into the Atlantic over the Gibraltar sill in a subsurface current. Since the surface of the Mediterranean lies 10–30 cm lower than the Atlantic due to this excessive evaporation, equilibrium is maintained by means of an inflow of Atlantic waters, which rush in as a swift surface current (averaging about 80 m in depth and 4 kts in speed) with the help of winds and an eastward barometric gradient. This is bolstered by a modest inflow of water from the Black Sea via the Dardanelles.[19] Table 2.1 provides an estimated water budget:

εἰς πόλιν (μάλην) μεγάλην βάρβαρον, ὅθεν ἡ Μήδεια ἦν).

15 Newbigin 1932, 13–15.

16 Currents in the Strait of Messina change direction according to the phases of the moon (see Strab. 1.3.11). The stream runs northward on the flood and southward on the ebb, attaining a velocity of up to 5 kts at the full and change of the moon (*Med Pilot* II, 560–1); speeds of 9 kts have been observed along the central stream (see Giacobbe 2005 and below, pages 231–2). One or two hours after the change in the direction of the central stream, countercurrents arise and course at various velocities (usually around 1 kt) along the coasts at least one mile offshore of either side. The meeting of the two opposing currents produces violent vortexts at the northern entrance: the *Cariddi*, ancient Charybdis, off of Sicily's Pelorus promontory (modern Capo Peloro), and *Scilla* off the headland and town of the same name opposite on the Calabrian coast (see fig. 7.5). These currents have been known to tear grass from the sea bottom.

17 Le Gras 1870, 184; Newbigin 1932, 13–15; Houston 1964, 38; *SDPGM* 134 and fig. 15; Hodge 1983, 74; Heikell 1998, 300; the tide in the Euboean channel changes up to seven times in a twenty-four hour period (see Pl. *Phd.* 90c and Strab. 9.2.8).

18 *SDEEM*, 212.

19 Houston 1964, 38; Walker 1965, 10; Beckinsale and Beckinsale 1975, 16; Grove and Rackham 2001, 40–1.

The inflow at Gibraltar establishes the general pattern of circulation for the entire sea (fig. 2.5). The surface current enters the basin at a rate of between 1 and 5 kts (depending on wind strengths) and flows swiftly along the north coast of Africa, gradually losing strength as it moves eastward. A portion of the main current flows into the Tyrrhenian Sea and is deflected by Sicily, the Italic mainland, Corsica and Sardinia into several counterclockwise gyres, eventually flowing southwest along the coasts of France and Spain to meet up with the main stream near the Balearics. The larger general current continues at a reduced speed through the Strait of Sicily heading across the Ionian Sea toward Cyrenaica. As it continues eastward, a part of the stream breaks off to the south in the Gulf of Sidra to produce small and slow clockwise gyres. Upon reaching the Egyptian coast the main current received a boost from Nile floods during spring and early summer; prior to the construction of the Nile dams at Aswan beginning in 1899, north-northeast currents reached speeds of up to 3 kts before encountering the general offshore current.[20] From here the general stream flows northward toward Cyprus in a massive but slow-moving surface gyre, rotating in a counter-clockwise direction along the Levantine coast and under Asia Minor.[21]

Upon reaching Crete the current splits in two. One branch continues westward past Cape Malea into the Ionian Sea, some of which turns south and back into the general flow heading eastward, again, toward Egypt. The other branch flows into the southern Aegean where the general current is deflected by a profusion of islands and projecting headlands between Crete and Asia Minor (fig. 2.6). Here in the southern Aegean it mixes with the current issuing from the Dardanelles. This latter current flows down the axis of the Aegean, meandering at around 1 kt on its passage from north to south and creating lateral gyres.[22] Along the Greek mainland and western islands the gyre is generally cyclonic, resulting in a southern current. In the eastern Aegean the gyre is anticyclonic, which gives rise to northerly currents along the coast of Asia Minor. Weaker gyres spin slowly between Crete and Thera

[20] *SDPGM*, 50. Today, however, surface currents along the Nile Delta's shoreline rarely exceed 0.5 kt.
[21] Below, page 30 n. 29 and 228 n. 76.
[22] Metaxas 1973, 1–23.

and in the northern Aegean basin, while several independent currents course eastward from the central Greek mainland, through the northern Cyclades, to the east Greek islands.[23]

On the western side of the Peloponnese the general current, now setting west and north, reaches into the Adriatic basin and produces minor counter-clockwise gyres before exiting into the northern Ionian basin and rejoining the main easterly flow.

Viewed on a macro scale the general pattern of circulation in both basins is essentially consistent year round, with relatively minor degrees of variation in speed, direction and consistency. Variation is more marked on the north coast than the south. In the western basin, excluding the Strait of Gibraltar, rates range from nine to sixteen nautical miles per day, with averages closer to the lower end. In the eastern basin, excluding the Dardanelles inflow, rates of travel are somewhat lower.[24] Over the entire basin, apart from major inflow areas, the rates are generally less than a knot, and in some areas less than one-half knot.[25]

The general pattern, however, is frequently altered by steady winds, which also generate tides and currents. Northerly winds, for example, have been reported in antiquity and in modern times to generate tidal ranges greater than a meter in the Gulf of Sidra, the 'quicksands' of antiquity.[26] Several ancient authors point out its hazards to navigation. According to Strabo:

> The difficulty [of navigating] both this [Syrtis Maior] and the Lesser Syrtis [arises from the circumstances of] the depth of the shoals, and it sometimes happens in the ebbing and flowing of the tide that some [vessels] fall upon the shallows and settle down, and that a hull is seldom recovered. On account of this [sailors] make coastal voyages at a distance [from shore], paying attention lest caught off their guard they should be driven into the gulfs by winds. Yet the temerity of man induces him to try everything, and especially coasting voyages along the shore.[27]

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[23] Agouridis 1997, 3–6, figs. 1–3.

[24] *Med Pilot* V, fig. 3.

[25] *Med Pilot* V, 12.

[26] Weld-Blundell (1895–1896, 115) reports that "the rise sometimes amounts to over 5 feet…due to a northerly wind piling the water up on these shoal coasts." A phenomenon around in the central Mediterranean known as the Marrobbio (or Carrobbio) is known to produce waves or surges of up to a meter or more at a time. It has been linked with abrupt changes in barometric pressure in either adjacent basin (*Med Pilot* V, 16).

[27] Strab. 17.3.20: *ἡ χαλεπότης δὲ καὶ ταύτης τῆς σύρτεως καὶ τῆς μικρᾶς…ὅτι πολλαχοῦ τεναγώδης ἐστὶν ὁ βυθὸς καὶ κατὰ τὰς ἀμπώτεις καὶ τὰς πλημμυρίδας συμβαίνει τισὶν ἐμπίπτειν εἰς τὰ βράχη καὶ καθίζειν, σπάνιον δ' εἶναι τὸ σωζόμενον σκάφος. διόπερ πόρρωθεν τὸν παράπλουν ποιοῦνται φυλαττόμενοι μὴ ἐμπέσοιεν εἰς τοὺς κόλπους ὑπ' ἀνέμων ἀφύλακτοι ληφθέντες· τὸ μέντοι παρακίνδυνον τῶν ἀνθρώπων ἁπάντων διαπειρᾶσθαι*

The phenomenon also occurs along the coast of the Maritime Atlas where easterly gales on occasion actually *reverse* the surface flow even as far as Gibraltar.[28] Along the coast of southern Anatolia, southerly and westerly winds are known to raise sea levels more than half a meter, and conversely northerly winds lower it by the same amount.[29] Similar effects also occur where winds funnel between proximate landmasses, such as in the Aegean and Adriatic islands.[30] The *Mediterranean Pilot*, one of the most detailed and authoritative modern navigational manuals, states: "The currents, at any time, are largely affected by the wind, and local drift currents of a temporary nature, but of sufficient strength to mask the general circulation, are set up when the wind has been strong and continuous from any one quarter…the wind effect may be such as to enhance the strength of the normal circulation."[31] The variegated topography throughout the Mediterranean ensures that any surface current (general or wind-generated) is diverted, reversed, sometimes intensified or, conversely, nullified.

2. Black Sea Currents

The Black Sea, unlike the Mediterranean, receives huge inflows of fresh water from several major rivers. This rich inflow, in addition to the sea's lower rate of evaporation due to a more temperate climate and its high degree of isolation, result in a higher sea level than the Aegean. At some times of year the difference in sea level between these two basins amounts to as much as half a meter. Black Sea surface waters flow swiftly southward

ποιεῖ, καὶ μάλιστα τῶν παρὰ γῆν παράπλων. cf. Mela 1.35 and Plin. *NH* 5.4.26. The crew of Paul's ship in *Acts of the Apostles* 27.17 (see Appendix A) was desperately trying to avoid the shoals of Syrtides on their stormy voyage westward from Crete.

28 *Med Pilot* V, 15.

29 *Med Pilot* V, 5. Beaufort 1818, 20–1. Such wind-generated tides may be responsible for a receding sea along the Lycian coast north of Phaselis, which Alexander the Great apparently took advantage of while marching along this coast. So the story goes (see Strab. 14.3.9; Plut. *Alex*. 17.3–5; Arrian, *Anab*. 1.26.1–2), Alexander and his party waited for the north wind to kick up, then set out along a narrow shelf on the beach as the water retreated just enough to let them make the passage. For a critical commentary on the story, see Green 1991, 205 and notes 39–40.

30 See, for example, Le Gras 1870, 184.

31 *Med Pilot* V, 12.

through the Bosphorus breach at a rate of about 3 kts. Upon reaching the less confined and deeper basin of the Sea of Marmara the main current cuts west toward the Dardanelles, creating systems of eddies along the way. Entering the narrow Dardanelles the main stream reaches a velocity of between 2 and 5 kts in extreme narrows before finally debouching into the Aegean. A slower, deeper reverse current flows northward from the Aegean into the Black Sea, carrying with it heavier, more saline waters.

In the Black Sea itself, tidal effects are nearly immeasurable. The circulation of surface waters is instead attributed primarily to winds and topography, which help form two large counterclockwise gyres, a western lobe and an eastern lobe (fig. 2.7).[32] Several smaller eddies spin clockwise off of these two gyres, such as the Sevastopol eddy west of Crimea and the Batumi eddy at the far eastern end. Another is generated in the center of the sea where the two main gyres abut, thus driving surface currents north and south in two adjacent corridors.

These two large and opposite-moving currents are often said to facilitate the movement of ships between the northern and southern shores, such as between Kriou Metopon and Sinope, just to the east of Cape Karambis.[33] The rate of these currents, however, is quite slow and inconstant year-round, traveling at speeds ranging from less than half to 1 kt, or around 18 nm per day, sometimes substantially less.[34] And their positions shift east-west relative to each other throughout the year. Hypothetically speaking, a vessel without propulsion would require nine days to drift the 160 nm from one shore to the other. A Greek or Roman merchant ship or galley, under sail, could make the crossing in favorable winds in less than two days without a current. If the correct stream can be recognized (difficult to achieve in open water) and harnessed to gain speed, a vessel may shave off only five or six hours on the journey.

Unlike the Mediterranean, the Black Sea actually develops ice in winter along its northern coasts, effectively blocking maritime communication with numerous rivers. Ice sheets form up to 50 km from shore, covering over 10,000 km^2 of coastal waters on

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[32] Oguz et al. 1993; Sorokin 2002, 79–93.
[33] Doonan 2004, 10, 19; Coleman 2003, 102; Hiebert 2001.

average.[35] At least once every other year ice can be found forming in the Danube delta and blocking access for several weeks at a time.[36] In extremely hard winters pack ice develops in the open sea in the northwest, and many of the limans in this area are covered with thick ice for up to a hundred days.[37] In most winters the Sea of Azov, the world's shallowest at 14 m maximum depth, is largely enclosed in ice from December to February.[38]

Currents, then, could assist or impede ships in their voyages depending on the vectors of their maritime movement. However, while we should highlight the effect certain swift currents had on sailing strategies in certain narrow straits, we should avoid the overstatement that the slow, half-knot to 1-kt currents that prevailed in most areas were a major consideration in the shaping of maritime corridors, or that ancient seafarers were able to recognize their own set and drift at sea. The primary determinant of maritime movement, for both galleys (which employed sails when possible) and purely sail-driven merchant ships alike, were winds. It was winds, not currents, which proved to be the lifeblood of Mediterranean seaborne commerce.

III. Climate and Weather

Weather, and its prime component, wind, impacted nearly every aspect of navigation in antiquity. At a practical level, an understanding of the behavior of winds would have facilitated estimations of a vessel's relative speed (and thus a voyage's duration) and optimal trajectories of travel. Such understandings helped to determine whether the voyage would be made in favorable conditions (with the wind abaft the beam) or foul conditions (with winds

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[34] *BS Pilot* 24, 16. The most variability is found in spring in the north-west corner, where the Danube and various others rivers dump larger volumes into the Black Sea and produce a marked eastward set.

[35] Sorokin 2002, 62–3, fig. 1.58. Sorokin also reports that in 1954, during an unusually harsh winter, floating ice reached the Bosphorus and made its way into the Sea of Marmara.

[36] *BS Pilot* 24, 139: "Maritime Danube only freezes over in very cold winters, which occur about once in two years. On average the Lower Danube is navigable for 320 days in the year."

[37] *BS Pilot* 24, 149–51.

[38] *BS Pilot* 24, 199. Strabo (7.3.18) describes the route across the Strait of Kerch (between ancient Pantikapaion and Phanagoria) as both a sea passage (in summer) and a wagon passage (in winter); cf. 2.1.16 where Neoptolemus, Mithridates' general, was reported to have engaged in both cavalry skirmishes on ice and naval maneuvers in the same place at different times of year.

blowing from some point ahead of the ship), or some combination of the two along an extended route or series of routes. Over time, as we shall see in Chapter 3, certain maritime corridors developed along which ships moved more in accord with the winds than contrary to them.

An examination here of the complex seasonal, regional, local and diurnal winds of the Mediterranean and Black Sea winds will furnish a background for discussions on how Greek and Roman seafarers determined which route or combination of routes to take to reach their destinations. This background will become essential in later chapters when we discuss how winds and weather governed daily seafaring rhythms and seasonal windows of safe navigation (Chapter 3), and how wind roses were employed as orientation devices on the open sea (Chapter 4).[39]

1. Synoptic Processes and Wind Regimes in the Mediterranean

The Mediterranean's various winds and their daily and seasonal patterns are governed to a large extent by large-scale climatic processes, with seasonal high and low pressure systems outside the region interacting with the sea's mountainous coastal rim and determining the weather for each basin.[40] The four most important systems are (1) the Atlantic subtropical high-pressure system over the Azores, (2) the North-Atlantic low-pressure system between Iceland and Greenland, (3) the Mongolian high-pressure system

[39] To understand the behavior of winds and wind regimes in the Mediterranean and Black Seas and their impact and influence on Greek and Roman navigation scholars have often assumed that meteorological data collected over the last two centuries is comparable to the weather experienced in antiquity. Such assumptions are implicit in, for example, Mohler 1948, 46–62 (voyages in the Aeneid), Hodge 1975, 155–73 (the Persians to and from Marathon in 490 B.C.), Fulford 1989, 169 (navigation conditions around Cyrenaica) and Casson 1989, 283–91 (Roman-era voyages between Africa, Arabia and India). Indeed Casson (1950, 45) compared the route and winds of Lucian's Alexandrian grain clipper *Isis* (see Appendix B) to those logged by Nelson in 1798 and found them to be identical. To my knowledge, however, only W. Murray (1987, 1995) has actually addressed the question head on in two studies of the wind patterns of the ancient eastern Mediterranean (cf. Coutant and Eichenlaub 1975, xviii–xxxv). Murray's comparisons of ancient and modern weather data led him to conclude that wind regimes have indeed changed very little, at least in the Eastern Mediterranean, and that comparisons are safe. This study relies on his findings and presupposes, at least until further studies are published, the existence of comparable conditions in the Western Mediterranean.

[40] This section relies heavily on several meteorological works: Biel 1944; Walker 1965, 16–31; Carapiperis 1962a, 1962b, 1970; Branigan and Jarrett 1969, 29–57; Beckinsale and Beckinsale 1975, 23–36; *CRMS*; Reiter

over central Asia, and (4) the Indo-Persian monsoonal low-pressure system over Pakistan (figs. 2.8 and 2.9). In their seasons these systems are pushed through the gaps in the Mediterranean rim and interact with relatively warm water and cold highlands to produce highly localized weather systems. These gaps include the Strait of Gibraltar, the Carcassonne gap between the Pyrenees and the Massif Central, the Rhône gap, the Trieste gap, the river valleys of the Vardar and Struma rivers of the Northern Aegean, the Marmara waterways just to the east and the Gulf of Iskenderun in the far northeast corner.

The meteorological year is characterized by two main seasons, a warm season centered on the summer months (June to September) and distinguished by consistent sunlight, high temperatures and little or no precipitation; and a cool season (October to May) characterized by lower temperatures, increased rainfall and numerous depressions roving generally from west-to-east across the Mediterranean. The spring transitions from winter to summer is gradual; the autumn transition from summer to winter is rather shorter, with typical transitional weather encountered in May and October.

Each basin is governed by different pressure patterns in each season. During the warm season, the Western Mediterranean is under the influence of the Azores high, which moves northward with the sun and sends high-pressure cells into the basin via Gibraltar and the Carcassonne gaps. These track north and east across the northern shore to produce moderate and highly variable winds with a slightly dominant northwesterly to northeasterly axis.

North of the Eastern Mediterranean in late spring and early summer, the heated Eurasian interior develops low pressure and pulls in an Atlantic depression across central Europe. Eventually secondary high pressure develops over the Balkan peninsula while the Indo-Persian low over Pakistan begins to intensify in April and May, reaching a peak in July. Pressure from the continental high spills wind into the Indo-Persian low. The windstream is augmented by the large region of low pressure created by the intense furnace of the Sahara, which pulls in cool air from over the European continent and intensifies these northerly

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1975; Watts 1975; Brody and Nestor 1980; Pryor 1988, 12–21; *Med Pilot* V, 25–57; King et al. 1997, 30–42; Grove and Rackham 2001, 25–36; *BS Pilot* 24; Sorokin 2002, 50–60.

gradient winds in a "massive example of sea breeze formation."[41] These winds enter the Eastern Mediterranean via the numerous gaps between the Adriatic and the northeastern Aegean and cross the Eastern Mediterranean as northerlies and northwesterlies. In antiquity they were known as the etesians (from Greek *etos* or 'year, annual,' equivalent to the Turkish *meltemi*) because they have a regular monsoonal, or trade-wind, quality, and indeed they are part of the same system that produces that regular trade winds of the Indian Ocean (fig. 2.10).[42] They blow between May and September, beginning as weak and unsteady winds (the *prodromoi* or 'forerunners' of antiquity) before reaching a peak in terms of daily consistency in July and August. They usually kick up around mid-morning, increase over the course of the afternoon (sometimes exceeding 30 kts), then abate just before sunset.[43] In the Aegean basin, the etesians begin as a northerly or northeasterly in the north, then back counterclockwise on their way south, such that by the time they exit the southeast Aegean they intensify and become northwesterly. Along the way, these winds reach dangerous velocities, create a dust haze and blow a gale as they funnel into the narrows between the myriad miniature landmasses, especially in the Cyclades where they are most intense and consistent. Tall, high-frequency waves, heavy swells and localized confused seas result, exacerbated by violent squalls in the lees of headlands and islands. Sailing vessels then and now are often forced to seek shelter in the lee of islands or headlands until they moderate. Once over open sea, the etesians continue traveling southward and eastward to Egypt and the Levantine coast.

On occasion in spring and early summer, a warm tropical airmass known as a scirocco (Arabic *sharq*, 'east') originates in the Sahara and Arabian deserts and tracks northward into the Mediterranean. Their most frequent paths originate over the basin off Cyrenaica and head toward Spain, or at Tripolitania whence they cross the Ionian Sea toward Italy and the Balkans. If these depressions move quickly, they arrive over the north shore as a dry, hot and dusty wind accompanied by a yellow haze. Weaker varieties with minimal dust

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41 Conlin 1999, 110.

42 The summer "etesians" of the western Indian Ocean, however, were southwesterly (*Libonotos*) monsoon winds utilized at least by the first century B.C. (if not earlier) for the open sea voyage between the Horn of Africa and the west coast of India. According to the anonymous author of the *Periplus Maris Erythraei* (57.19.5 [= Casson 1989, 87, 224]), this wind was named the *Hippalos* (wind) after the first Greek captain to "discover" it.

bring clear, hot air, the *Leukonotoi*, or 'white southerlies' of ancient Greece. If they pass slowly, moisture is drawn up from the sea, resulting in low clouds, drizzle and rain in the form of active fronts. For instance, the summer scirocco in southeast Spain, known as the *leveche*, is normally dry and dust-laden because of its short sea crossing, but in the Gulf of Lion the scirocco, known locally as the *marin*, undergoes a long sea crossing, consequently producing rain, thunderstorms and low visibility.

In September and October, Mediterranean pressures subside as the sun moves south and a massive high pressure system begins to dominate over Asia. The Azores High moves farther west, and the Persian monsoon low dissipates to the southeast. The once-dominant northerlies lessen slightly and give way to more variable and local winds throughout both basins.

As the cool season sets in during October-November, pressure over the sea drops due to warm seas and cooler temperatures. In the east, a ridge of high pressure around the Danube, part of the Mongolian high, generates generally cold and dry northerly winds. In the west, The North Atlantic low pressure system moves south and sends depressions eastward into Europe and the Mediterranean as cold fronts where they generate a series of more localized depressions (fig. 2.11). Some of these depressions enter the western basin directly via the Strait of Gibraltar. Others originate in the Atlas region (especially in spring), track eastward across the Sahara plateau and enter the Mediterranean in the Gulf of Gabes. Still others begin as cold fronts which move across the continent and shoulder their way into the western basin through breaches in the coastal rim, such as the Carcassonne, Rhône and Trieste gaps. The most intense areas of cyclogenesis are in fact in the Gulfs of Lion (Gallicum Mare) and Genoa (Ligusticum Mare), where tongues of cold continental air fall on the warmer sea and result in severe frontal weather. Nearly seventy percent of the seventy-six depressions that develop each year on average in the Mediterranean begin right here. They move eastward at various speeds, depending on the pressure gradient. Some dissipate completely in the Eastern Mediterranean, others reach into the Levant. In winter, the Mediterranean is rarely completely free of cold fronts and depressions.

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[43] Seneca (*Q Nat.* 5.11.1) has his brother Gollio call the etesians sleepy (*somniculosi*) and lazy (*delicati*) according to sailors because they don't know how to get up in the morning.

The wind regimes associated with these depressions have given rise to numerous regional wind names throughout Mediterranean history (see fig. 2.10). In the gulfs of Lion and Genoa, a strong pressure gradient develops in the rear of these depressions and draws in very cold air from over the continent. This gives rise to the mistral, typically a winter wind which originates as polar or arctic air over Western Europe and funnels down the Rhône valley onto the Mediterranean. It is occasionally fuelled by katabatic flows on either side of the valley resulting from the movement of the same pressure system over these mountainous flanks. Over the sea it blows at an average of about 20 kts for a hundred days of the year, and 40 kts for 11 days of the year. It can, however, in high pressure-gradient conditions, such as are induced by Genoa depressions, reach gale speeds of up to 50 and 60 kts or more offshore and last for several days. The mistral is by far the most consistent Mediterranean wind, blowing 136 days of the year specifically out of the northwest—a quality remarked upon by Pliny the Elder.[44] It is, as the mariner Eteocles learned too late in the epigram heading this chapter, also the most blustery and boasts the highest gale-force readings (figs. 2.12 and 2.13). In the eastern Pyrenees the mistral is known as the tramontana, and in Liguria as the *maestrale*. It has been known to blow violently through the Strait of Bonifacio. By the time the mistral reaches the Italic coast it often changes to a westerly and becomes the *libeccio*.

The bora of the Dalmatian coast is a similar manifestation.[45] This east-northeast wind of the cool continental interior spills through and over the Alps and Dinaric Alps as a katabatic flow onto warmer water of the Adriatic, where it triggers roving depressions. It is most violent and rain- and snow-bearing near mountainous coasts where winds can approach 100 kts. It can develop successive cold fronts accompanied by violent squalls and persistent gale winds, but when settled it becomes clear for several days (averaging three days in duration in winter, one day in summer). At Trieste the bora is encountered for forty days of the year, mostly from December to February. If it crosses the Italian peninsula into the

[44] Plin. *NH* 2.46.121: "Similarly in the province of Narbonne the most famous of the winds is Circius, inferior to none other in force" (*item in Narbonensi provincia clarissimus ventorum est Circius nec ullo violentia inferior*).

[45] Bora (from Greek *Boreas*, the north wind) is applied to several winds along the northern shore of the central and eastern Mediterranean, as well as the northern Black Sea shore. It has come to be mean any mountain or ravine wind.

Tyrrhenian Sea as a northerly it becomes known as the tramontana; if it reaches Malta as a northeasterly it is called the *greco* or *gregale*. Stronger bora winds that reach Spain and easterly winds from other sources in this area are called the *levante*. This wind, encountered in the Strait of Gibraltar (as the levanter) throughout the cool season, undergoes a funneling effect in the channel and often reaches gale force. The *vendavale*, a squally westerly entering from the Atlantic side, vies with the *levante* and brings heavy rain into the Alboran Sea (Ibericum mare).

A wintry bora-type wind is also common in winter in the northern Aegean, where it enters through the Vardar gap (the *vardarac* wind of the Mendean Gulf), the Struma valley (the *Strymonian* wind of antiquity) and, farther east, the Dardanelles (the ancient *Hellespontian*).

The depressions of the cool season also draw in southerly and southeasterly air, known generically as the scirocco, in advance as they track east. Winter and spring sciroccos, though rare (occurring just twelve days per year on average), are known to be violent, the product of extreme temperature inversions between cold continental air and warmer Saharan air over relatively warm water. In spring they are capable of picking up vast quantities of Saharan dust and sand to produce a thick haze over the sea, islands and northern shore, sometimes reducing visibility to as little as a few hundred meters or less. The restrictions that such airborne debris places on visibility at sea, and how these conditions would have affected the development of navigation, are discussed in more detail below (see below, pages 45–50). Like the mistral and bora, the scirocco has numerous surrogate names: the *chili* of Tunisia, *ghibli* of Tripoli and the *simoom* of the Levant.[46] The *khamsin* of Egypt, a southeaster blowing from between the Nile Delta and Gaza, tends to occur more frequently than the rest—five days per month from February to the end of May; its name is derived from the Arabic word for 'fifty,' a reference to the period of days this wind blows after the Coptic

[46] The simoom, or perhaps the khamsin, must be the wind to which Aristotle (*Met.* 364a 3–4) refers in his wind rose as the "Phoenician" wind: "a wind which the inhabitants of the place call the *phoinikias*" (*τις ἄνεμος ὃν καλοῦσιν οἱ περὶ τὸν τόπον ἐκεῖνον φοινικίαν*). Either of these winds may have been meant by Achilles Tatius 5.15–17.1: "And it happened that the wind called us [to depart Alexandria]…After sailing for five days in a row the ship arrived at Ephesus" (*κατὰ τύχην δὲ καὶ τὸ πνεῦμα ἐκάλει ἡμᾶς…Πέντε δὲ τῶν ἑξῆς ἡμερῶν διανύσαντες τὸν πλοῦν ἥκομεν εἰς τὴν Ἔφεσον*). Cf. a letter dated 11 May, 1141 from the Cairo Geniza (Goitein 1999, 301–2) which describes a propitious wind for ships of Alexandria going to Spain, Mahdiyya and Tripoli; a spring southeasterly, the simoon or khamsin, was most likely meant. On the simoom, see Reiter 1975, I:18, s.v.; *Med Pilot* V, 43. On the khamsin, see Ganor and Foner 1996, 164.

Easter in mid-March.[47] After the depression passes, northerly winds resume and temperatures return to pre-front levels.

These roving depressions and their strong winds are invariably accompanied by confused seas and swells that can climb to 10 m or more. Navigation is, of course, a risky pursuit in these months. However, in January and February, between periods of passing depressions, spells of mild weather occur on occasion, particularly in the Adriatic and Aegean. To the ancient Greeks, these pauses were known as the *alkuoneioi hemerai*, the "Halcyon Days."[48] They lasted a mere fortnight or less but offered a convenient—though still risky—opportunity to travel or trade by sea.

2. Local Wind Effects in the Mediterranean

While seasonal high and low pressure systems set the general pattern of airstream circulation over the Mediterranean, they are complemented by other, more local wind effects that also operate at sea level. Diurnal breezes, rising and falling winds, and those affected by their encounter with land forms are the products of more local processes determined for the most part by geography. As such, they round out the features of any one region's wind regime and lend a local character.

Diurnal winds, otherwise known as land and sea breezes, are generated by the uneven heating and cooling of land and sea (fig. 2.14). During early mornings, the rising sun heats the land more quickly than the water. Convection currents result and the heated air over land ascends. This causes lower pressure at ground level, pulling in the heavier, cooler air sitting over the sea; this pressure differential produces a sea breeze or onshore wind from sea to land. Around sunset, the land cools fairly quickly while the sea, warmed to a greater depth than the land during the day, retains the day's heat. Convection currents result, only

[47] As opposed to Aristotle's assertion (*Pr.* 945 a 19–20) that there are no southerlies in the sea districts around Egypt (*Διὰ τί ὁ νότος οὐ πνεῖ κατ' αὐτὴν τὴν Αἴγυπτον τὰ πρὸς θάλατταν, οὐδ' ὅσον ἡμέρας δρόμον καὶ νυκτός*), a notion refuted by Theophrastus, *De Ventis* 61: "That the south wind does not blow afresh in Egypt for the distance of a day and night's journey from the coast is false" (*Τὸ δὲ μὴ πνεῖν νότον λαμπρὸν ἐν Αἰγύπτῳ μηδ' ἡμέρας δρόμον ἀπέχοντι καὶ νυκτὸς ψεῦδος*). Pliny (*NH* 2.56.121) was apparently unaware of Theophrastus' refutation.

[48] Problems behind the myth and meaning of the Halcyon Days are fully discussed in Cronin 1993.

this time the heat rises over water and draws in the cooler air sitting over the land; this is known as a land breeze or an offshore wind.[49] In general, onshore winds reach their full force in late morning and last all afternoon. Offshore winds begin just after sunset and last until sunrise. The differences in the specific timing of either phenomenon depends on the orientation of the coast with respect to the sun. An east-facing coast, for example, is exposed to more sunlight earlier in the day, while a west-facing coast takes longer to heat. Thus, sea breezes (or onshore winds) begin quite early in the morning on the eastern coasts of islands and on the western margins of the Alboran, Adriatic and Aegean seas. Indeed, at Athens, the sea breeze is so prevalent and consistent that southerly onshore breezes routinely counteract etesians throughout the summer months. Conversely, toward evening, east-facing coasts cool more quickly than west-facing coasts, thus causing land breezes (onshore winds) to commence either at or just after sunset. Though subject to variations in intensities with the seasons, these diurnal winds act with such regularity at the local and micro level as "to be almost a fixture."[50] Seafarers from antiquity to the end of the age of sail planned their departures, transits and arrivals by their onset and abatement.[51]

Where valleys meet the sea, particularly along the Mediterranean's northern shore, we often find diurnal winds axially aligned with valley floors. The increased surface area of valley floors and upper slopes, and the tunneling effect produced by their length, serve to enhance diurnal breezes, particularly in the afternoon when onshore breezes reach their

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[49] The general cycle of diurnal breezes was not lost on the Greek and Romans (see, e.g., Theophr. *De Ventis* 26; Plin. *NH* 2.45.116).

[50] Conlin 1999, 113.

[51] Perhaps the most descriptive instance is Heliod. *Aeth.* 5.17.5–18.1: "When we had passed the strait and had lost sight of the Rugged Islands, we thought that we were looking upon the heights of Zacynthus, lying like a dark cloud before our eyes. The captain ordered the sails to be struck. And when we asked him why he took way off the ship despite the fair wind, he said "Because if we employed full canvas to the wind, we should arrive at the island about the first watch and there would be danger lest in the dark we run aground on sharp rocks under the sea. It is therefore wisdom to lie to at sea all night and take the wind in subdued measure to the extent that it brings us to land in the morning." Thus said the master, Nausicles, but it did not happen; as the sun was rising we were casting anchor" (*Ὑπερβαλόντες δὴ…τὸν πορθμὸν καὶ νήσους Ὀξείας ἀποκρύψαντες τὴν Ζακυνθίων ἄκραν προσκοπεῖν ἀμφεβάλλομεν ὥσπερ ἀμυδρόν τι νέφος τὰς ὄψεις ἡμῖν ὑποδραμοῦσαν, καὶ ὁ κυβερνήτης τῶν ἱστίων αραστέλλειν ἐπέταττεν. Ἡμῶν δὲ πυνθανομένων διότι παραλύει τὸ ῥόθιον τῆς νεὼς οὐριοδραμούσης "Ὅτι" ἔφη "πλησιστίῳ χρώμενοι τῷ πνεύματι περὶ πρώτην ἂν φυλακὴν τῇ νήσῳ προσορμίσαιμεν καὶ δέος προσοκεῖλαι σκοταίους τόποις ὑφάλοις τὰ πολλὰ καὶ κρημνώδεσι· καλὸν οὖν ἐννυκτερεῦσαι τῷ πελάγει καὶ τὸ πνεῦμα ὑφειμένως δέχεσθαι, συμμετρουμένους ὅσον ἂν γένοιτο αὔταρκες ἑῴους ἡμᾶς τῇ γῇ προσπελάσαι." Ταῦτα οὐκ εἶπε μὲν ὁ κυβερνήτης οὐκ ἐγένετο δέ, ὦ Ναυσίκλεις, ἀλλ' ἅμα ἥλιός*

maximum velocity. Examples of these anabatic, or rising, winds can be found in valleys that penetrate deep into the interior, such as the Rhône and Po valleys, the Gulfs of Corinth and Argos and around Smyrna; Theophrastus remarked on their character in the Euboean channel.[52] These are the winds Aristotle called *enkolpiai* and which both Callimachus and Seneca mentions in their work on winds.[53] If these valleys face south, they may be further enhanced by prevailing northerlies, making them quite dangerous indeed for seafarers sailing past them along the coast. The stormiest areas of the Mediterranean, and those with the resulting heaviest seas, are aligned in just such a position: the Gulf of Lion, the northern Adriatic, and the northern Aegean.[54]

When warm, diurnal winds ascend near the peaks of coastal ranges and ridges, the air cools quickly, grows very dense, and forms clouds. Eventually, the dense air breaks loose to fall down the leeward sides and onto the sea. In some areas, these katabatic winds "form important micro winds which local sailors can use to their advantage in navigating around [a] region."[55] In other areas, however, they can fall onto the sea with little or no warning, churning up the sea at wind speeds approaching Beaufort 10. Certain areas in Aegean waters were known for these ship-killing winds, particularly around certain headlands and in certain straits (fig. 2.15).[56]

In addition to the variability in local winds caused by the diurnal cycle, seafarers in the neighborhood of coasts and islands had to contend with the peculiarities of airstreams as they encountered geographic barriers. Airstreams generated by seasonal winds, such as the

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τε ἀνίσχε καὶ ἡμεῖς ἄγκυραν καθίεμεν). On dawn departures, see also, e.g., Syn. *Ep.* 4.1 (Appendix C) and Rutilius Namatianus, *De Reditu Suo* 1.217.

[52] Theophrast. *De Ventis* 32: "Again, during the period of the etesians, the reverse winds bypass the Hollows of Euboea [on the southeast coast], but at Karystos [on the southwest coast] they blow with such a great force that their strength is surprising" (*Καὶ πάλιν παρὰ μὲν τὰ κοῖλα τῆς Εὐβοίας ὑπὸ τοὺς ἐτησίας τροπαῖαι παραθέουσιν, ἐν Καρύστῳ δὲ τηλικοῦτοι πνέουσιν ὥστε ἐξαίσιον εἶναι μέγεθος*). This would explain the malevolent reputation of this locale to seafarers throughout antiquity (cf. Hdt. 8.13; Alciphron 1.10; Hyginus 116).

[53] Pseudo-Aristotle *De Mund.* 394b15: "Of these winds, those which blow with wet weather from the land are called *apogeioi*, while those which rush forth from gulfs are called *enkolpiai*" (*Τῶν δὲ ἀνέμων οἱ μὲν ἐκ νενοτισμένης γῆς πνέοντες ἀπόγειοι λέγονται, οἱ δὲ ἐκ κόλπων διεξᾴττοντες ἐγκολπίαι*); see also Callim. *Fr.* 404 (= Pfeiffer 1949, 328–9); Sen. *Q Nat.* 5.7.8: "So how is such a breeze formed which the Greeks call *encolpias*?" (*Quomodo ergo talis flatus concipitur quem Graeci* ἐγκολπίας *vocant?*).

[54] *WIM*, 1:figs. 1.25 and 1.27; Hodge 1983, 71, 86.

[55] Conlin 1999, 114–15.

[56] Morton 2001, 100–31.

mistral or the etesians, are deflected when they encounter such barriers as coastal headlands and islands. How and to what extent they are deflected depends on the orientation and height of the barrier and the nature of the airstream itself. When near-surface winds encounter obstacles at an oblique or parallel angle, they are simply displaced horizontally. But winds passing between islands and through island chains alter course to funnel through the channels and accelerate in the process. This is the case in the Doro and Cretan channels where strong etesians push surface currents along at 5 to 6 kts during peak periods.[57]

When airstreams run into barriers head-on, they ascend and cross directly over them (i.e. they are vertically displaced), causing turbulence along the way. This turbulence is due to the friction created as the earth's surface causes the winds to decelerate, but is also due to the fact that winds of different layers traveling at different speeds mix together on the vertical climb. Precisely how much turbulence is generated depends on the speed of the wind; higher speeds cause greater turbulence. If the barrier is of low elevation, such as a short headland or islet, friction and mixing are minimal and the airstream simply passes up and over, a bump in its path; eddies and lulls may result if wind speed is high. But if the barrier is a tall island or headland, the effect on the leeward side will depend on the degree of turbulence created on the ascent. If the speed of the wind is slow to moderate, thus keeping friction to a minimum, then the relatively stable air will climb, reach the peak, cool rapidly, then flow back down the leeward side accompanied by gusts and squalls; these can continue for some distance downstream and can run counter to prevailing winds.[58] If winds speeds are high, on the other hand, then friction is maximized and, bolstered by diurnal heating, the unstable air continues its rise well above the obstacle. Condensation takes place and rain-bearing cumulonimbus clouds form on the peaks and leeward sides. For ships unable to sight the coast, such towers of clouds, or cloud orography, are telltale signs of land. Cold, violent downdrafts feed the squalls and pound the sea downwind for a considerable distance. Ships throughout history and even today fall victim to such violent winds while seeking haven from the same elements.

[57] Carapiperis 1970, 13.
[58] Cf. Theophrast. *De Vent.* 34.

Precisely how winds behave when they encounter obstacles, and what weather they generate, is quite unpredictable due to the numerous variables involved. The leeward sides of certain barriers, low or elevated, nearly always offer protection from gale-force winds while others do so only under certain atmospheric conditions. Still others, while appearing to the inexperienced eye as obvious natural havens, can be the most violent, squalliest areas of the entire Mediterranean. Only the trained eye, complemented by local knowledge, could make the right judgment.

3. Winds in the Black Sea Region

The division of the year into cold and warm seasons is particularly applicable to the Black Sea, where differences in temperature between summer and winter are on a higher order than those in the Mediterranean.[59] The transition periods between seasons here are also shorter, occurring for the most part in May and September, when weather characteristic of both seasons is experienced. Weather over the Black Sea in each season is also not as straightforward, complicated as it is by the dynamic interactions of numerous air masses throughout the year.

During summer, the basin of the Black Sea is governed largely by the Azores High and the Siberian Low. As the Asian interior heats up in early summer and pressure drops, a ridge of high pressure stretches eastward from the Azores across Europe and into the Black Sea region. With it comes warm and calm weather characterized by light breezes and winds that rarely exceed Beaufort 6. Occasionally, the ridge will retract, permitting troughs of low pressure and attendant unsettled weather to enter the Black Sea from the north. Winds resulting from the rather weak tug and pull of these two large pressure systems are naturally variable. Over the sea, winds from the northerly quarter and the west slightly predominate. Along the northeast coast, the Caucasus mountains tend to produce northeasterlies. In the southwest corner near the Bosphorus, winds out of the northeast prevail, especially in July and August; these winds shoot down the Dardanelles into the Aegean as part of the same annual summer flow of etesian winds that effect the Aegean and Eastern Mediterranean. In the east between Trabzon (ancient Trapezus) and Sokhumi (Dioskurias), westerly and northwesterly winds predominate.

Since there is no singularly dominant wind which governs airflow over the entire basin in summer, diurnal effects play a large role in determining the behavior of winds along the coasts and up to twenty nautical miles offshore: waters off the west coast experience northerly winds; sea breezes along the north coast prevail out of the south and southwest, especially in the afternoon; the east coast is gently buffeted by easterlies and northeasterlies; and the mountainous southern shore generally deflects winds east and west, but also helps generate northwesterly land breezes by day which give way to weaker, southeasterly katabatic winds by night. Sailing from one port to another along any shore would have entailed a comprehensive local knowledge of river valleys on which these land and sea breezes acted, as well as the relative times of their changeover.[60]

During winter, the Black Sea is under the influence of several air masses: Baltic maritime air from the north, polar maritime air from the Atlantic, polar continental air over Siberia and southern Russia, polar continental air over the Caspian and warmer Mediterranean depressions that occasionally creep in along the west and southwest coasts. As in summer, winter over the sea is generally characterized by variable but much stronger winds, with predominant directions determined by the types of airmasses affecting the region, the locale and diurnal effects. When the Siberian anticyclone closes in, for example, easterly and northwesterly winds are generated over the sea. When Baltic fronts descend onto the Balkan peninsula, southerlies are generated and along with them rain and warmer weather. As weakened Mediterranean depressions enter the basin in the west and southwest they often regenerate over the Black Sea and result in heavy winds and seas throughout. Table 2.2 summarizes the frequency of wind regimes over the Black Sea throughout the year.

More localized effects are felt along the mountainous northeast coast, where a northeasterly bora wind, fueled by frequent outbreaks of continental Siberian air, often

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[59] This section relies on *WBS*; *BS Pilot* 24; and Sorokin 2002.

[60] Evidence for a detailed local knowledge of sea and land breezes in antiquity is found in Arrian's *Periplus Ponti Euxini* (3.2): "From there (Hyssou Limen, near Trapezus on the southeast coast) we first sailed with the winds that blow from the rivers in the morning and at the same time employed our oars" (*ἐνθένδε ἐπλέομεν τὰ μὲν*

occurs during the winter months, creating choppy seas that reach as high as 7 m. Northerly gales of Beaufort 8 or stronger and their resultant tall seas are also frequent along the west coast.

What ancient sources, and particularly Roman voyage narratives, make abundantly clear is that maritime movement was determined largely by the various wind regimes particular to each region and locale. While synoptic systems established general seasonal patterns over open water, those winds textured by diurnal effects and land forms added a level of complexity at the local level. Safe navigation, then, entailed the accumulation of experience and knowledge of winds at both the macro and micro level, and the formulation of sailing strategies for each environment—diurnal winds for departing harbors, synoptic winds over open water for making effective and safe way along planned routes, and diurnal winds again for safe landfall and harborage. In Chapter 4 we will examine how seafarers recognized these various wind patterns and employed them for orientation and course maintenance.

IV. Visibility

The final environmental parameter to explore is visibility. How closely connected by sight are the towering shores and mountainous islands of the Mediterranean and Black Seas? And to what extent were ancient voyages made within sight of land or on the open sea? According to Horden and Purcell, "Mutual visibility is at the heart of the navigational conception of the Mediterranean, and is therefore also a major characteristic of the way in which microregions interact across the water, along the multiple lines of communication that follow those of sight. There are only relatively restricted zones where, in the clearest weather, sailors will find themselves out of sight of land"[61] This view of the Mediterranean as being bound together by ties of mutual visibility is a variant on a persistent theme propounded in

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πρῶτα ταῖς αὔραις ταῖς ἐκ τῶν ποταμῶν πνεούσαις ἕωθεν καὶ ἅμα ταῖς κώπαις διαχρώμενοι). On this *periplus*, see below, pages 103–4, 171–2.

[61] Horden and Purcell 2000, 126.

historical and geographic writing for nearly a century.[62] It also stands in strong contrast to a view put forth by the eminent French historian Ferdinand Braudel, who described the Mediterranean as including vast areas of open sea which he termed maritime "Saharas."[63] A similar term, 'sea-desert,' was coined by Cyprian Broodbank to describe the northern and southern sea areas of the Aegean.[64] The former view calls into question the very existence, or at least relevance, of an "open sea." The latter view seemingly paints an image of the Mediterranean as impossibly large. We are then left to wonder: Which is it, large or small? Conducive to simple navigation or challenging enough to demand such advanced practices as open-sea and nocturnal navigation? Why is the topic open to interpretation?

The answers have been sought not only in terms of early and modern spatial conceptualization, but also by more scientific means, such as computing the height of each major mountain or mountain range and the curvature of the earth to arrive at a range (distance) of "theoretical visibility" during "favorable" or "optimal" weather. This is known in the modern nautical lexicon as *geographic range*: according to the parameters of optics, the higher the elevation of the observer or the observed, the more distant the visibility. The principle was known as early as Strabo.[65] A number of authors have relied on a map of the

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[62] Semple 1971, 589 ("The outbound voyager was generally able to keep in view some beacon which beckoned him on. Even before he had left the home port, distant land faintly outlined on the far horizon stirred his spirit of enterprise."); Cary 1949, 29 ("Mainland chains or island peaks will show up at ranges extending to 100 miles, thus enabling ships to hold an almost straight course over long routes without losing sight of land…Navigation in the Mediterranean is therefore not far different from the journey of a landsman along a well-defined route, and Homer spoke aptly of the sea's 'liquid lanes'"), 46–7; Aubet 1993, 142–4 ("But in normal conditions, boats were guided by the Pole star or else by reference to land, since it has been proved that in favourable weather conditions, with very few exceptions, the coast or the mainland is visible from any point in the Mediterranean…A ship leaving Tyre for Gadir could do the voyage in a more or less straight line on the open sea without losing sight of land by making one slight detour northwards between the Ionian isles and Sicily"). See also Schaus 1980, 23, and Janni 1984, 111.

[63] Braudel 1972, 1:103, 109. Horden and Purcell (2000, 126) label Braudel's view "misleading."

[64] Broodbank 2000, 289. Broodbank (2000, 40), however, also emphasizes the "high degree of inter-visibility" through-out the Mediterranean "in optimal weather conditions."

[65] Strab. 1.1.20: "For the curvature of the sea is a clear barrier to those sailing upon it, with the result that they do not see ahead to distant lights at the same level as they. At any rate, they become visible if the lights are raised higher than they eye, and yet they are more distant than it. Similarly also if the eyes are elevated they see things that were invisible…so also when sailors approach land, more and more do the different parts of the shore appear progressively, and the parts that seemed low at the beginning grow higher" (*φανερῶς γὰρ ἐπιπροσθεῖ τοῖς πλέουσιν ἡ κυρτότης τῆς θαλάττης, ὥστε μὴ προσβάλλειν τοῖς πόρρω φέγγεσι τοῖς ἐπ' ἴσον ἐξῃρμένοις τῇ ὄψει. ἐξαρθέντα γοῦν πλέον τῆς ὄψεως ἐφάνη, καίτοι πλέον ἀποσχόντα αὐτῆς· ὁμοίως δὲ καὶ αὐτὴ μετεωρισθεῖσα εἶδε τὰ κεκρυμμένα πρότερον…καὶ τοῖς προσπλέουσι δὲ ἀεὶ καὶ μᾶλλον ἀπογυμνοῦται τὰ πρόσγεια μέρη καὶ τὰ φανέντα ἐν ἀρχαῖς ταπεινὰ ἐξαίρεται μᾶλλον*); Plin. *NH* 2.65.164: "The same cause

Mediterranean, first produced by Schüle, which illustrates theoretical sighting distances at sea (fig. 2.16).[66] Thus, owing to the high elevations of the sea's coastal mountains and islands (except the southeast corner), the actual area of "open sea" in which land cannot be sighted from sea level is quite small as compared to the Mediterranean as a whole. When computed approximately, this area amounts to about 1,140,000 km^2 (251,000 nm^2), or just over one third (38%) of the nearly 3,000,000-km^2 area of the entire basin.[67] But is this a realistic assessment? Can the open-sea areas of the Mediterranean be so limited? What of Braudel's vast empty spaces?

The major problem with Schüle's map is the misleading premise that optimal or even favorable conditions of visibility exist, or can exist, in the Mediterranean. Determining the geographic range is simply a starting point for estimating the *actual* range of visibility by taking atmospheric conditions into account, a step which Schüle failed to take.[68] Numerous meteorological studies and published tabulatations of data demonstrate that there are few areas and few days per year of optimal, or even "favorable," visibility—an observation which anyone who has spent any time in summer at sea *on* the Mediterranean can confirm.[69] This is because the high pressure systems which sit over the Mediterranean during late spring, summer and early autumn (the period of busiest sea traffic) hold massive amounts of dust and evaporated salts in suspension near the surface, thus producing a near constant sea haze.

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explains why the land is not visible from [the decks of] ships when in sight from the [top of the] mast" (*eadem est causa propter quam e navibus terra non cernatur e navium malis conspicua*); cf. Theon of Smyrna, *De utilitate mathematicae* (= Hiller 1878, 122, line 26–123, line 5): "And often on a voyage, when the land or an advancing vessel is not yet seen from the ship, those who have climbed the mast see it, being in a high place they can peak above curvature of the sea that has blocked their eyes" (*κἀν τῷ πλοΐζεσθαι δὲ πολλάκις, ἀπὸ τῆς νεὼς μήπω βλεπομένης γῆς ἢ πλοίου προϊόντος, τὸ αὐτὸ τοῦτο ἀναβάντες τινὲς ἐπὶ τὸν ἱστὸν εἶδον, ἐφ' ὑψηλοῦ γενόμενοι καὶ οἷον ὑπερκύψαντες τὴν ἐπιπροσθοῦσαν ταῖς ὄψεσι κυρτότητα τῆς θαλάττης*). This was certainly the principle behind the invention of lighthouses from at least the third century B.C. The formula required to compute the theoretical maximum of optical visibility is $D = 2.2 (\sqrt{h} + \sqrt{H})$ where h and H are the respective altitudes of the observer's height and the observed height.

66 Schüle 1970, 449–62. See copies of or variations on this map in Chapman 1990, fig. 59; Aubet 1993, fig. 23; Broodbank 2000, fig. 4; Horden and Purcell 2000, Map 9 and Arnaud 2005, 30–1.

67 The open-sea areas indicated on Schüle's and Chapman's map (above n. 66) are located in the Algerian/Tyrrhenian basin (ca. 68,000 nm^2 or ca. 233,000 km^2), the Ionian basin (ca. 159,000 nm^2 or ca. 545,000 km^2) and the Levantine basin (ca. 105,000 nm^2 or ca. 360,000 km^2).

68 For computing distance to the horizon and geographic range, see Bowditch 2002, 55–7 and Table 12; the problems of visibility in the maritime environment of the Mediterranean was cursorily examined by Davis 2002, 292–4. This study expands on that publication.

69 *SSMO, MMA*, Table 11; *CRMS*, 106–9, 132–5, 158–61, 184–7, 210–13. On the dynamics of visibility in the Aegean, see Georgiou 1993, 361–2; Agouridis 1997, 16–17; Broodbank 2000, 71–3.

During the hot months of summer, when evaporation is at its peak, this sea haze often limits visibility to less than 10 nm on one out of every four days; at times the haze becomes so thick as to blot out islands and headlands that otherwise would command the entire horizon. The widely touted visibility of the Aegean is, in reality, and on average, among the worst of the entire Mediterranean: the etesians kick up enough dirt and dust during the summer months to limit visibility to nearly 10 nm one day out of two. This means that land *of any elevation* which lies more than 10 nm distant cannot be sighted. On the other hand, when the skies do clear, they do so at the onset of a roving low, which lessens air pressure and allows airborne particulates to fall to earth. Visibility during these times can be crystal clear, but not for more than a day or two before inclement weather arrives and voyaging is less than ideal.[70] While it is true that Homer speaks of the "clear-seen islands" and describes Odysseus' home as "clear-seen Ithaka," he also described the long voyage "over the misty deep" to Egypt. Such descriptions of thick sea haze can be found in numerous other authors, such as Alciphron and Quintus of Smyrna.[71] By contrast, visibility along the North African coast, especially the Gulf of Sidra, is among the best in the Mediterranean, but it is also home to the lowest shoreline which, even in conditions of optimal visibility, is visible only from six to eight nautical miles offshore.

The Sahara, separated from the Mediterranean by a narrow, semiarid coastal strip, restricts visibility even further. Every year, especially in spring and summer, recurrent wind storms pick up tens of millions of tons of dust and sand and inject them into the atmosphere over the Mediterranean Sea and Europe.[72] Such episodic storms are the result of siroccos blowing from the south in advance of eastward-roving depressions; with or without rain, they can reduce local visibility to as little as half a mile, sometimes much less.[73] As the

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[70] See [Theophr.] *De Signis* 31: "If headlands far out at sea become visible, or several islands appear instead of one, it indicates a change to the southward. If the land appears dark [from the sea], the wind will be from the north; if light it will be from the south" (*Ἐὰν ἄκραι μετέωροι φαίνονται ἢ καὶ νῆσοι ἐκ μιᾶς πλείους νοτίαν μεταβολὴν σημαίνει· γῆ τε μέλαινα ὑποφαινομένη (βόρειον) λευκὴ δὲ νότιον*).

[71] Hom. *Od.* 4.481–3, 9.21–2, 19.132; Alciphron 1.10; Quint. Smyrn. 7.392–3.

[72] Dulac et al. 1996, 25–6; Ganor and Foner 1996, 164–5; Grove and Rackham 2001, 29; Rackham and Moody 1996, 37.

[73] *Med Pilot* V, s.v. sirocco; *WIM*, 1:16. Dust storms in the western basin are more often prone to produce rain showers than the eastern, although both regions receive similar depositions of Saharan dust and sand (Molinaroli 1996, 155 and fig. 1).

satellite images in figure 2.17 demonstrate, seafarers caught in these storms would have lost nearly every natural reference for orientation (landmarks, sun, and stars) for days; only the resultant swell would give clues for determining orientation. It is no surprise that, early on, Greek and Roman seafarers recognized the weather signs that heralded the onset of such storms and avoided going to sea until they abated.

Meteorological data collected over several decades from ship and shore stations help point up mean trends in visibilities. Throughout the Mediterranean, the warm season begins in conditions of relatively low visibility in May and June when one day in three experiences visibilities of less than 10 nm. July sees a slight improvement (70% of observations over ten nautical miles). And one of four days in August and September experiences visibility of less than 10 nm.[74] Figure 2.18 applies this meteorological data to Schüle's map of optimum seaward visibility to demonstrate the range of visibilities to be encountered over the Mediterranean during the month of July. It also illustrates those areas which experience particularly obscured skies in this and other summer months due to airborne dust and sea haze. The first thing to notice is the overall narrowing of the limits of effective visibility throughout the basin, as well as the 'widening' of the crossing points between Sicily and Tunisia, Crete and Cyrene, and Anatolia and the Crimea. Moreover, miniature "sea-deserts" (to borrow Broodbank's term) appear in the Adriatic, between Crete and the Cyclades, in the central Aegean, and between Cyprus and the Levantine littoral. The consequence is that, with such mercurial atmospheric conditions, voyages made between islands and coasts could and often did place ships in waters devoid of landmarks. Even in some areas in the island-rich archipelago of the Aegean, such short crossings as those between Lesbos and Euboea or between Thera and Crete would have been made using one's departure point as the only navigational reference; *and it would have disappeared before another landmark was acquired*. This is not to state that these areas were in a constant haze throughout the summer; conditions of visibility are never uniform over the whole of the Mediterranean. It does demonstrate, however, that *seafarers could not necessarily rely on landmarks alone* in traversing these waters on any given voyage. In such conditions, subject to daily, even hourly changes, the line between nearshore and offshore navigation becomes quite blurred, as do the differences between coastal and open-sea voyages: the dogmatic distinction from a practical standpoint is unnecessary, for the complexity and sophistication of local navigational practices would have, to a large degree, emulated those of interregional, open sea navigational practices. Beginning in Chapter 4 we will explore the implications that these dynamic conditions of visibility had on navigation, and how Greek and Roman seafarers developed methods of wayfinding in the absence of landmarks.

V. CONCLUSIONS

The Mediterranean region uniquely combines the proximity of large, enclosed and temperate sea areas with mountainous littorals, strings of elevated islands, immense deserts and continental weather systems. These individual elements together comprise an incredibly complex navigational environment. The mainland and island shores serve to define convenient and static maritime boundaries and thus establish a first logical order of navigational organization, but the sea and its air masses above undergo intense seasonal variability. The recognition of seasonal weather patterns and pattern of winds in various sub-regions and locales went a long way toward establishing the navigational rhythms of time and trajectory. The one dynamic typically overlooked in studies of ancient navigation is the variability of visibility at sea and the impact such daily and seasonal variability had on the choice of routes and the techniques required to maintain orientation in the absence of normally detectable landmarks. In the following chapter, we shall see that it was against this physical backdrop that Greek and Roman maritime communities developed ships to withstand harsh seas, established daily and seasonal rhythms of maritime movement and relied on coastal and open-sea corridors defined to a large extent by both static and kinetic forces. It is these human responses to the maritime environment to which we now turn.

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[74] The data are culled from *CRMS*, 158–61.

Chapter 3: *Ships, Seasons and Seaways*

> And when, tell me, Sea, is your passage free from the whirlwind, if we are to weep even in the days of the halcyons, for whom the sea has always steadied its waves into a calm, that they judge it more trustworthy than land? But even when you boast of being a nurse easing the pangs of childbirth you have sunk Aristomenes with his cargo.
>
> —Apollonides of Nicaea[1]

In the preceding chapter we explored the four natural factors—coasts, winds, currents and visibility—that together conditioned the navigational environment of the Mediterranean and Black Seas. The current chapter describes and discusses some of the technological and commercial responses to that environment. This includes the various types and sizes of merchant ships themselves, their respective sailing rigs and their (hypothetical) sailing characteristics, as well as the seasonal patterns that Greek and Roman seafarers established to effect maritime movement safely and efficiently. These investigations form a prelude to an exploration of maritime movement itself and its traditional conceptions. I argue that the conventional notion of consistently traveled, straight-line routes is misleading, and that movement at sea should instead be viewed in terms of broad maritime corridors through which ships moved in accord with environmental, technological and commercial factors. These discussions will then serve to contextualize the remaining four chapters, which deal with other navigational aspects relating to the determination of direction, position and distance.

I. Merchant Ships

The navigational requirements of a vessel are intricately related to its size, its mode of propulsion and the environment in which it was designed to operate. If we were to attempt a categorization of commercial vessels from the Greek and Roman era we would

[1] *Gr. Anth.* 9.271: *Καὶ πότε δινήεις ἄφοβος πόρος, εἰπέ, θάλασσα, | εἰ καὶ ἐν ἀλκυόνων ἤμασι κλαυσόμεθα, | ἀλκυόνων, αἷς πόντος ἀεὶ στηρίξατο κῦμα | νήνεμον, ὡς κρῖναι χέρσον ἀπιστοτέρην; | ἀλλὰ καὶ ἡνίκα μαῖα καὶ ὠδίνεσσιν ἀπήμων | αὐχεῖς, σὺν φόρτῳ δῦσας Ἀριστομένην.*

find two broad classes existing side by side—the merchant galley (descendant from Bronze Age forerunners) with its mixed propulsion of oar and sail, and the purely sail-propelled merchant ship. Each class was populated by a multitude of vessels of various types and sizes. Merchant galleys ran the gamut from smaller vessels such as those used for fishing, dispatch or small-scale passenger service, to larger cargo vessels such as those engaged in cabotage (coastal tramping with cargos of opportunity) or interregional trade. Their maximum size and tonnage probably did not exceed 200 tons. The scale of sailing ships, on the other hand, was occupied chiefly by those of medium and larger tonnages capable of navigating in coastal and open-sea environs and equipped to sustain more extended voyages. With their more robust sea-keeping abilities they could endure heavier seas and operate using diurnal winds and the wind regimes of multiple regions. At the extreme upper end of the scale are the handful of behemoths of the Hellenistic and Roman eras that captured the imaginations of several authors.

The names of over eighty types of seagoing merchant galleys and sailing ships have been preserved in the compilations of Aulus Gellius, Iulius Pollux, Nonius Marcellinus, and Isidore of Seville.[2] About a quarter of these ships are depicted schematically, with names, in the fourth-century-A.D. Althiburus mosaic from Tunisia (fig. 3.1).[3] Unfortunately, many of the ships lack any corroboration in other sources, and thus we are left with enormous gaps which the studies of Torr, Duval, Morrison and Williams, Casson and de Saint Denis attempt to fill.[4]

1. Seagoing Merchant Galleys

From the Archaic and Classical periods to the end of the Roman era numerous types of merchant galleys engaged in commercial hauls of various commodities, and at times saw

[2] Gell. *NA* 10.25.5; Poll. *Onom.* 1.82–3; Non. 13; Isid. *Etym.* 19.1. Cf. the Elder Pliny's short list of inventors of various vessel types (*NH* 7.56.206).
[3] Gauckler 1905b; Duval 1949.
[4] Torr 1964, 105–24; Duval 1949; Morrison and Williams 1968, 244–54; Casson 1995, 157–82; de Saint-Denis 1974. This overview derives its overall structure from Casson's concise and illuminating study.

compulsory service as naval auxiliaries or even as proxies for war galleys.[5] They appear in the literature under various names beginning with Homer's broad-beamed *eikosoros* (a 'twenty-oared' merchant galley),[6] the *pentekonteros* ("fifty'er") of Herodotus' colonizing and warring Phocaeans[7] and Polycrates' beamy merchantman the *samaina*.[8] Others appear in the iconographic record, especially after the first century B.C., thus allowing us to identify some of their features. The smaller types appear to have relied solely on oar power for propulsion.[9] The medium and larger types employed oars only for maneuvering into and out of port, or in times of calm, but typically relied on a single square sail as the main driver (e.g., Gr. *akatos*, Lat. *actuaria*, *lembos-lembus*, *kerkouros-curcurus*, *kybaia-cybaea* and *phaselos-phaselus*).[10] Some of the larger versions were rigged also with a foremast and *artemon* (Lat. *dolon*) or bow-sail.[11]

The Althiburus mosaic and others from Roman North Africa contain a good deal of information as to their relative size, form, function and appurtenances. The typical length-to-

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[5] See Caesar *BA* 44.3, for example, where *actuariae* were pressed into naval service and outfitted with rams due to a shortage of warships. For examples of other uses of merchant galleys in naval contexts, see Casson 1995, 159–68 and below, n. 12.

[6] Hom. *Od.* 9.321–23: "and looking at it, we likened it [the staff of the Cyclops] to the mast of a black ship of twenty oars, a broad-beamed merchantman which crosses the great gulf" (*τὸ μὲν ἄμμες ἔΐσκομεν εἰσορόωντες | ὅσσον θ' ἱστὸν νηὸς ἐεικοσόροιο μελαίνης, | φορτίδος εὐρείης, ἥ τ' ἐκπεράᾳ μέγα λαῖτμα*). According to Casson (1995, 169 n. 5), the *eikosoros* had become (contra Morrison and Williams 1968, 245) a synonym for a sailing ship by the fourth century B.C. He cites in particular Demosthenes' mention (35.18–19) of an *eikosoros* carrying 3,000 jars from Piraeus to Pontus via Mende and doubts that a galley could have carried such a large cargo. *P. Bingen* 77, 24, however, lists a merchant galley (*akatos*) as carrying 2,500 jars from Crete to Egypt (on the *akatos*, see below, pages 54–5), which calls into question the rest of Casson's adduced evidence. The *eikosoros* may well have been a true twenty-oared galley well into Hellenistic times (cf. Wallinga 1993a, 41–3).

[7] The pentekonter is encountered already in Homer (*Od.* 8.34) as a swift ship. Cf. Hdt. 1.163, where the Phocaeans' fifty-oared ships were employed for colonizing, transport and warfare (see Wallinga 1993a, 34, 72–3).

[8] The *samaina*, a decked galley with two banks of oars (*dikroton*), was known for its speed, cargo capacity and ability to travel the high seas and under sail. See Plut. *Pericles* 26.3–4: "The *samaina* is a ship with a upturned, pig-snouted prow, but rather capacious and big-bellied, so that it can both carry freight and travel swiftly" (*ἡ δὲ σάμαινα ναῦς ἐστιν ὑόπρωρος μὲν τὸ σίμωμα, κοιλοτέρα δὲ καὶ γαστροειδής, ὥστε καὶ φορτοφορεῖν καὶ ταχυναυτεῖν*); see also Wallinga 1993a, 93–6.

[9] Cic. *Ad Att.* 14.16.1: "I sent off this letter as I board…an oared phaselus" (*conscendens…in phaselum epicopum has dedi litteras*). On the slim *camarae* used by predatory natives of the eastern coast of the Black Sea, see Strab. 11.2.12 (cf. Tac. *Hist.* 3.47). The "swift" κέλης/*celox*, appreciated for its speed as a naval auxiliary and favored among pirates, appears to have relied more on oars than sail for propulsion (Casson 1995, 161 and notes 19–20).

[10] Casson 1995, 157. By the second century B.C., however, fore-and-aft sails make their appearance on smaller vessels (Casson 1995, 243–5).

[11] Representations of merchant galleys with artemon sails include a mosaic from the second or third century A.D. found at Tebessa in Algeria (Casson 1995, fig. 140) and several others on mosaics from Hadrumentum from around the same period (Foucher 1957, figs. 2, 9 and 12).

beam ratio appears to have been between 5 and 7 to 1, a dimension broader than warships (typically 10 to 1) but much more slender than characteristically beamy sailing ships (3 to 1). Most went in for a cutwater bow to part the water ahead, and nearly all maintained a single bank of oars.[12] The larger types must have been decked,[13] and indeed some deck features (such as the stern cabin and goose-head sternpost) mirrored those of pure sailing ships.

While the mosaics and literary evidence harbor some evidence for relative sizes, there are very few windows into their actual dimensions, and even fewer into the cargoes they hauled or the routes they traveled. Noteworthy exceptions include those papyri from Egypt which detail the role of *kerkouroi*, the oared grain carriers which brought their cargoes down the Nile to Alexandria.[14] For seagoing merchant galleys we have a recently published papyrus from Karanis, Egypt, located some 60 km southwest of Memphis.[15] *Papyrus Bingen* 77 dates to the early second century A.D. and was apparently a port registry that recorded the arrival of eleven vessels—along with their travel times, craft types, individual names and cargos—into an unidentified Delta port, probably Alexandria. Six of the eleven craft are of the *akatos* type (Lat. *actuaria*), and another is recorded as a *plauda*;[16] a lacuna hinders the identification of the four other ships.

Here the seagoing *akatoi* are of interest to us (see fig. 3.1, no. 13). These vessels arrived in Egypt from all over the Eastern Mediterranean—from Laodicea with an unknown cargo; from Aigeai with a cargo of wine; from Side with wine and thirty-two tree trunks of pine; from Anemurium with, again, a cargo of wine; and from Libya (one of the ports of Cyrenaica) on ballast.[17] The ships were classified according to their cargo capacity, ranging

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12 According to Livy (24.40.2), however, a naval version of *lembi* employed in Philip's attack on Apollonia in 214 B.C. were double banked (*lembis biremibus*). Cf. the *samaina* , above n. 8.

13 Wallinga 1993a, 95.

14 *P. Teb.* 856; *P. Cairo* 59053, 59054; Casson 1995, 164–6. *Kerkouroi* were also encountered as oared cargo carriers in the Mediterranean fleet of Xerxes (Hdt. 7.89, 97) and in various war fleets from the third to first centuries B.C.

15 *P. Mich.* 5760a (= *P. Bingen* 77, Heilporn 2000).

16 According to Heilporn (2000, 351) πλαῦδα is not attested elsewhere. The word may, however, be a corruption of βᾶρις, βάριδες (Egyptian *barit*, Latin *paro*?) a type of boat used extensively on the Nile and Nile Delta (Torr 1964, 106–7). Cf. Hdt. 2.41, 96, 179 and *P. Hib.* 1.100.13 from ca. 267–266 B.C. The *paro* is depicted in the Althiburus mosaic (see fig. 3.1, no. 23; cf. *myoparo* at no. 11).

17 Heilporn (2000, 354) reaches the conclusion that Λιβ[–] cannot be Λιβύης because (a) a three-week sailing time cannot be justified in light of the proximity of this region to Alexandria (over 400 nm) and (b) all the other ship origins are cities and not regions. Instead he offers Libyssa or Liviopolis on the southern shore of the

from one thousand to seven thousand artabs, the Egyptian standard measurement of wheat.[18] Heilporn used the artab to compute their various cargo volumes at between 30 and 280 m^3.[19] The actual tonnage they were capable of carrying is difficult to derive from these figures due to the question of container size and weight, but ranges of 30 to 200 tons are reasonable if computed for grain cargoes. The actual length and beam of the ships are unspecified.

The departure and arrival dates (excluding specified months) of each ship are also listed, and from each entry Heilporn derived average speeds of between 1.6 and 3.5 kts (on the speeds of ships under sail, see below, pages 61–3).[20] Behind the figures lies the assumption that the ships from the ports of Asia Minor coasted eastward to Syria, then southward along the Levantine coast toward the Delta ports, rather than make a direct crossing via Cyprus.[21] The slow speed, he elaborates, may have been due to the "conditions météorologiques défavorables à la navigation à voile."[22] Although *akatoi* are equipped with oars (and, we may presume, the crew to man them) for precisely these conditions, we simply do not know the month during which the vessels were at sea; attempts to reduce the distance by making the crossings from Anatolia direct to the Delta result in dubiously slow rates of progress. The derived speeds of these *akatoi* may well be attributed to stops at other Levantine ports along the way, stops which a royal customs agent in Alexandria likely had no interest in recording.

Black Sea. Since we do not know the month the ship sailed, and because coasting voyages along the Libyan coast are dangerous and problematic (see Appendix C), delays could well be expected. *Λιβύης* is certainly a better reading.

18 The artab varied between a 30-choenix artab and a 40-choenix artab. A choenix of wheat weighs approximately 1.5 lbs, so a 40-choenix artab weighed approximately the same as a bushel (see Pestman 1981, 549–50).

19 Heilporn 2000, 347, Table 2.

20 Heilporn 2000, 346, Table 1.

21 Cf. the unremarkable maritime loan *P Gr Vindob* 19792 (= Casson 1957) from the reign of Antoninus Pius which records an *akatos* making a haul between Ascalon and Egypt.

22 Heilporn 2000, 342.

2. Seagoing Sailing Ships

Broader, deeper, taller, and usually larger than their oar-propelled counterparts, sailing ships relied solely on wind for the majority of their propulsion. The emergence of pure sailing ships (*holkades*,[23] *strongyla ploia*) in the Greek sphere is somewhat obscure. Their earliest literary attestations are found in authors of the fifth century B.C.,[24] but the ships themselves appear fully developed on two Athenian black-figure vases during the latter half of the sixth century B.C., and on a wall painting in an Etruscan tomb at Tarquinia from the early fifth century B.C.[25] The latter displays two masts (a mainmast and foremast), thus suggesting an arc of development stretching back several generations. These early representations provide but a brief glimpse into one of the critical components of the developing economies of Greek *poleis* and the rise of bulk trade. Thereafter, with the falloff in painted pottery and the lack of survival of other artistic media from the fourth century B.C. onwards, we lack even schematic representations of merchant ships in art, which instead preferred the depiction of warships. Merchant ships under various names, however, continue to receive mentions in the background noise of Greek literature. Only the discovery and excavation of a handful of Greek merchant ships from the Classical and Hellenistic eras have supplemented our meager knowledge of this important class of vessel, although we cannot be sure of their specific mode(s) of propulsion.[26]

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[23] The term *holkas* is derived from *ἕλκω*, to tow (cf. English 'hulk'). The term may have referred originally to a barge (for grain, wine, etc) that was towed by a galley from port to port (cf. Dem. 50.22) and perhaps used a sail for auxiliary power before adopting it as a primary means of propulsion without tow (Wallinga 1993a, 36), in which case the term stuck. Alternatively, the term may refer to the towing required of these larger ships upon arrival in harbor (see Morrison and Williams 1968, 244–5).

[24] Pind. *N.* 5.2: "…go on every merchantman (*holkas*) and rowboat that leaves Aegina" (…*ἀλλ' ἐπὶ πάσας | ὁλκάδος ἔν τ' ἀκάτῳ…| στεῖχ' ἀπ' Αἰγίνας…*). The context is meant to convey the full range of craft that one should embark on to proclaim the winner, the *holkas* being the largest, *akatos* the smallest. Hdt. 1.163: "…they [Phocaeans] did not sail in round ships but in fifty-oared vessels" (*ἐναυτίλλοντο δὲ οὐ στρογγύλῃσι νηυσὶ ἀλλὰ πεντηκοντέροισι*). One of Aristophanes' plays, the *Merchantmen* (*Holkades*) of 422 B.C., featured talking ships as the chorus, but it survives in only a few fragments.

[25] Athenian kylix in the British museum: Morrison and Williams 1968, pl. 19; Casson 1995, pls. 81–2; Spathari 1995, 96, fig. 108 (color). Attic black-figure bowl at Heidelberg University: Gropengiesser 1970, 44–5, pl. 162. 10–11; Casson 1996, fig. 1. Tomba della Nave at Tarquinia: Moretti 1961, pls. 12–13, 18–19.

[26] The corpus of excavated (as opposed to surveyed) wrecks from the Classical period numbers just five: the Alonnesos wreck found in the northern Aegean from the late fifth century B.C. (Hadjidaki 1996), the Ma'agan Mikha'el shipwreck in Israel (Kahanov 1991) from the same period, the Tektas wreck from the same period found off the Aegean coast of Turkey near ancient Teos (Carlson 2003), the Porticello wreck in the Strait of Messina from the later fifth or fourth century B.C. (Eisman and Ridgeway 1987), the Kyrenia ship, wrecked off

In the Roman sphere references to *naves onerariae* ('ships of burden') abound in and after the first century B.C., as do artistic representations in several media. While specialized ships can be identified with their cargo (e.g., *hippago*, *lapidaria navis*), the only two specific types of ships to appear in the sources are the *corbita* and *ponto* (see fig. 3.1 nos. 1 and 3). The *corbita*, with its plain, raking stem and goose-head sternpost, was employed throughout the Mediterranean and Black Seas.[27] The *ponto*, a large vessel with a concave prow, projecting forefoot and curved figurehead, was native to Gaul.[28] The larger ships carried or towed a small boat and employed it in turn to tow them into and out of berths under oars.[29]

For rig these vessels carried a main mast and sail set slightly forward of amidships as the primary driver. The mast was socketed into the keel or keelson and held in place near deck level by through-beams and mast partners. To secure it aloft one or two forestays ran from the top to the base of the foremast, and shrouds tightened with deadeyes held it fast to either side. A lengthy spar constructed of two pieces fished together served as the yard; these could be as long as the mast was tall. It hung from lifts and halyards which stretched down from the top of the mast and could be controlled from deck level via fairleads. On the yard hung a large, quadrangular sail assembled from bolts of linen sewn together in squares and reinforced with rope or leather strips. On the front face of the sail were sewn vertical rows of bronze rings, or brails, through which brailing lines passed from the foot of the sail upward and over the yard and downward to the helm station. These lines, together with other running rigging, such as sheets and braces, permitted the shaping of the sail and the movement of the yard to achieve the optimal setting for making headway on a desired course. During the Roman era vessels also harnessed the wind above the yard by employing

northern Cyprus in the late fourth century B.C. (Swiny and Katzev 1973). The Alonnesos wreck, its mound measuring 25 m x 10 m, is estimated at well over 100 tons with a cargo consisting of between three and four thousand amphoras; its excavator, however, suggests that the ship may have been a *kerkouros* (Hadjidaki 1996, 590). The Tektas wreck, by contrast, measured no more than 12 meters long and carried a cargo of some 200 amphoras weighing no more than 7 tons. The Kyrenia and Porticello shipwrecks strike more of a middle ground with their cargoes of amphoras amounting to between 25 and 30 tons.

[27] Depictions of *corbitae* are abundant in the Mediterranean (see, e.g., Casson 1995, figs. 142–7, 149, 151, 156), but those from the Black Sea are quite rare (see Emetz 1995, 135, fig. 2c). An unpublished fragmentary Roman relief in the museum at Crimean Chersonesos depicts a complex sailing rig akin to those carried by *corbitae* on Roman reliefs in Italy.

[28] Caes. *B. Civ.* 3.29: "*pontones*, which are a type of Gallic ship" (*pontones, quod est genus navium Gallicarum*). See, e.g., Casson 1995, fig. 145.

a triangular topsail (Gr. *sipharos*, Lat. *siparum*) which stretched from the ends of the yard to an apex atop the mainmast.[30]

Many, though not all, ships employed a foremast and *artemon* sail to aid with propulsion and steering in quarter and beam winds, in other words, in conditions during which the *artemon* stood outside of the wind shadow created by the mainsail.[31] This configuration with the center of sail area placed well forward resulted in a balanced sailing rig that permitted steering well into the wind.[32] On some ships the foremast slants over the bow and holds a smaller yard. On others it stands more upright, raking gently forward and holding a larger yard. In all cases the *artemon* is smaller in dimension than the main mast and mainsail. Ships of three masts appear to have been rare: the best example is found in a mosaic from the Foro delle Corporazioni at Ostia (ca. 200 A.D.) which shows a ship with a small third mast, or mizzen, placed between the main mast and the stern.[33]

Obtaining an average size of these sailing vessels is beyond our grasp. The evidence is simply too sporadic to make anything other than general statements. Earlier researchers tended to underestimate their size and tonnage. Wallinga, Casson and Rougé have all treated various aspects of the issue, particularly the shortcomings of the evidence, and have generally concluded that an average size is impossible to calculate, and in any event lacks explanatory relevance.[34] Casson nonetheless adopted a framework of tonnage based on Hellenistic inscriptions from Thasos and several other criteria.[35] The framework comprises three rough categories of seagoing sailing ships: (1) 70–80 tons burden; (2) 100–150 tons burden; (3) 350–500 tons burden. These figures suffice to give some idea of how the Greeks of the

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[29] See, e.g., *Acts of the Apostles* 27.15–16 (Appendix A); Casson 1995, 248–9; see also pages 214–15, 234–5.

[30] Casson 1995, 241–2.

[31] Basch 1982, 355; Basch 1983, 413; Morton 2001, 282 n. 47.

[32] Tilley 1994, 312; Roberts 1995, 311.

[33] Casson 1995, fig. 145. So far this is the only instance of three masts discovered in the ancient pictorial record, but see Philostratus, *Vita Ap.* 4.9, who describes a three-masted ship: "behold the ship of three masts getting underway." (*ναῦν εἶδε τῶν τριαρμένων ἐκπλέουσαν*). Lucian implies that *Isis* also had three masts (*Navigium* 14).

[34] Wallinga 1964; Casson 1956 (but see also 1995, 170–3, 183–90); Rougé 1966, 66–71. Rougé (71) concludes that the typical ship ranged from 150 to 500 metric tons burden.

[35] A third-century B.C. inscription from the port of Thasos (*IG* XII Suppl., 151 no. 348; *SEG* XVII, 417) divides ships between different harbors—those less than 80 tons, those between 80–130 tons, and those of more than 130 tons. Casson (1995, 171, 183) interprets these figures as ancient categories of small, medium and large ships.

Hellenistic era conceived of contemporary size categories. The ratios of these categories, however, is elusive, although Casson maintains that those of the third category, while big, "were by no means rare."[36] By the Roman imperial era a fourth size category appears in the massive, purpose-built grain carriers of over 500 tons burden which hauled twenty-million *modii* of grain from Alexandria to Rome each year in the service of Rome's *annona*.[37] They were clearly in a class of their own, complete with their own guilds, wharfs and imperial infrastructure.[38] The dimensions of at least some of them, as Casson convincingly argues, were most likely akin to those of the *Isis* described by Lucian: nearly 55 m in length by 14 m in beam, with a capacity of about 1,200 tons.[39] Parker's tonnage categories are only slightly different, but he noted a trend in which Roman ships (judging from hundreds of wrecks found primarily off southern France) reached their maximum size in the Late Republic and Early Empire, then trailed off in average size toward Late Antiquity.[40] Casson's framework remains relevant, although the trend of late has been to replace the emphasis on the larger wine- and grain-carriers so visible in literature and iconography with an emphasis on smaller, short-haul traders engaged in more modest hauls and caboteur commerce.[41] Unfortunately, our sample size remains too limited to compute ratios of tonnage in any meaningful way.

3. Sailing Capabilities

Our knowledge of the sailing capabilities of ancient merchantmen, such as it is, comes from ancient sources and experimental voyages of replicas. The classical square-rigged ship was designed for sailing with favorable winds, that is, with wind directly astern or on the quarters. The record runs that Pliny records were made by large ships employing

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[36] Casson 1995, 171–2.

[37] The minimum size for *annona* ships, according to the Roman jurist Scaevola (*Digest* 50.5.3) writing in the second century A.D., was "no smaller than 50,000 *modii* [that is, 340 tons each], or a number of vessels no smaller than 10,000 *modii* [70 tons each]." On the practical demands of the grain supply in the maritime sphere, see Rickman 1980, 263–4.

[38] Aur. Vict. *Caes*. 1.6; see Casson 1995, 188, n. 21; Horden and Purcell 2000, 145.

[39] Casson 1995, 186–9. Casson's application of these dimensions to all Alexandrian grain freighters of the time is reasonable, although there are those who disagree without citing any evidence: cf. Wallinga 1964, 27 and Ericsson 1984, 88.

[40] Parker 1992, 26–7.

[41] Houston 1988, 554–60; Horden and Purcell 2000, 145; Arnaud 2005, 25.

maximum canvas before steady, favorable winds.[42] In these conditions, it appears that the central part of the main sail (the bunt) was brailed above the corners (clews), which would allow the wind to pass through to fill the artemon sail, a configuration that probably steadied the ship against yawing in the waves and provided directional stability.[43] If a destination lay at an oblique angle to the direction from which the wind was blowing, a ship could steer close-hauled directly toward it by swinging the yard around and bracing it at bow and quarter; this maneuver entailed furling or reefing the sail aft and letting the wind fill the sail forward.[44] Estimating to what extent a ship from antiquity could sail into the wind has been a thorny problem due to a lack of evidence. Figures of between six and eight points have been offered.[45] However, the experimental voyages of *Kyrenia II*, a replica of a late-fourth-century-B.C. merchantman found and excavated off Cyprus, have shown that a square-rigged vessel without an *artemon* could sail as much as five points, or about 60º, off the wind.[46] In these conditions, with the vessel heeled over on its tack, leeward drift becomes a serious problem and the course had to be adjusted either en route or toward the end of the voyage. If a destination lay directly in the eye of the wind or just a few points off it, then ships had to beat to windward on different tacks, that is, to steer a zigzag course with the wind on one bow, then the other, making slow headway. The most vivid example of this practice in the

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42 See below, notes 117 and 124.

43 Morrison and Coates 1986, 225; Roberts 1993, 33, 35. For an illustration of this sail configuration at work aboard *Olympias*, see Shaw 1993a, fig. F1b.

44 As so vividly described in Arist. [*Mech*.] 851b: "Why is it that sailors after sailing with a favorable wind, when they wish to maintain course even when the wind is not favorable, brail up the part of the sail toward the helmsman, and yet, as they go close-hauled, leave the part toward the prow unfurled? It is because the rudder cannot fight against the wind when it is stiff, but can when it is not, and this is why they shorten it. Therefore, the wind moves the ship forward, and the rudder converts it into a favorable breeze, striving against it and using the sea as a fulcrum. At the same time, the sailors contend with the wind, for they lean [their bodies] in the direction opposite to it." (*Διὰ τί, ὅταν ἐξ οὐρίας βούλωνται διαδραμεῖν μὴ οὐρίου τοῦ πνεύματος ὄντος, τὸ μὲν πρὸς τὸν κυβερνήτην τοῦ ἱστίου μέρος στέλλονται, τὸ δὲ πρὸς τὴν πρῷραν ποδιαῖον ποιησάμενοι ἐφιᾶσιν; ἢ διότι ἀντισπᾶν τὸ πηδάλιον πολλῷ μὲν ὄντι τῷ πνεύματι οὐ δύναται, ὀλίγῳ δέ, ὃ ὑποστέλλονται. προάγει μὲν οὖν τὸ πνεῦμα, εἰς οὔριον δὲ καθίστησι τὸ πηδάλιον, ἀντισπῶν καὶ μοχλεῦον τὴν θάλατταν. ἅμα δὲ καὶ οἱ ναῦται μάχονται τῷ πνεύματι· ἀνακλίνουσι γὰρ ἐπὶ τὸ ἐναντίον ἑαυτούς*); cf. Achilles Tatius 3.1.1–2.

45 A point of wind is 11.25°, or 1/32 of 360°; Smith (1848, 178) guessed a windward capability of between 6 and 8 points (68º-90º) off the wind based on the performance of square sailers in his day. Casson (1995, 273–4, n. 16) adopted Smith's mean of 7 points (79º).

46 Cariolou 1997, 92–3. The *Olympias* trireme in sea trials managed to sail up to 60 degrees off the wind (that is, with the wind 30 degrees forward of the beam) and managed just 7 degrees of leeway (Roberts 1993, 35–7).

literature is Strabo's description of Posidonius' voyage from Spain to Italy: the exhausting, thousand-mile voyage took three months and made as little progress as ten miles per day.[47]

The practice of sailing into the wind is well documented in the literature from the fourth century B.C. forward, complete with evident nautical jargon akin to the later Age of Sail (see below, page 203). The actual type of maneuver practiced to bring the ship about on an opposite tack is still a matter of conjecture. *Kyrenia II* demonstrated in its voyage from Cyprus to Piraeus in 1987 that tacking in the tradition of modern sail boats—that is, swinging the rudder to bring the head directly into and across the wind to the other side—while possible in calmer winds (less than Beaufort 4), became very difficult in moderate and heavy winds (fig. 3.2).[48] Its wear and strain on the sail, mast, yards and standing and running rigging–not to mention the crew and passengers—was considerable.[49] Instead, the crew chose to wear ship, that is, to turn away from the wind and loop around to come about on the opposite tack (fig. 3.3). This maneuver would have proven much gentler on the rigging and could be accomplished, with practice, in winds of up to Beaufort 10 without any trouble. Here the *artemon* would have been of great utility in helping to maintain way while wearing off.[50]

Finally, if the wind freshened to gale force and wearing ship was no longer effective or practicable, then either shelter was sought or the crew had little choice but to allow the vessel to scud before the wind with lowered sails or bare poles. These were the highly dramatic moments so often captured by generations of Greek and Roman writers (see Chapters 1 and 7).

[47] Below, n. 124.

[48] Cariolou 1997, 93–5.

[49] See, e.g., Aristid. *Hieroi Logoi* 4.33 (= Dindorf 1964, 329): "When I disembarked at Delos I was furious with the sailing master who had behaved like a madman, sailing against the winds and plowing through the sea. Immediately I swore that I would not depart by ship for two days" (*ὡς γὰρ ἐξέβην εἰς τὴν Δῆλον, ἀχθεσθεὶς τῷ κυβερνήτῃ, ταραχώδει τε ὄντι καὶ ὑπεναντία τοῖς ἀνέμοις πλέοντι, καὶ οἷον ἀροῦντι τὸ πέλαγος, εὐθὺς ὅρκῳ καταλαμβάνω ἦ μὴν μήτε ἐκπλεύσεσθαι δυοῖν ἡμερῶν*).

[50] Ericsson 1984, 87; cf. Isid. *Etym.* 19.4: "the artemon was invented to direct the ship rather than to increase its speed" (*Artemon dirigendae potius navis causa commentatum quam celeritatis*).

4. The Speeds of Ships under Sail

The speeds that particular classes and sizes of vessels could attain depended on a complex of factors that included the size and shape of the hull, the amount of sail employed, and the orientation of the ship with respect to the wind on a given course. Here replicas of ancient ships have provided some data. The voyage of *Kyrenia II* in 1987, for example, demonstrated that a modest, fifteen-meter-long merchant vessel, lightly loaded, could manage between 7 and 12 kts in heavy winds (45–50 kts) on runs and broad reaches, but made much slower headway while jibing against strong contrary winds.[51] The *Olympias*, simulating the hull form and rigging of a trireme, easily reached 6 kts under sail in light following winds (of 4–12 kts) during early sea trials.[52] The insights that they have made possible on ancient navigation and seamanship are important, but they apply only to those classes and sizes of vessel. Of the great majority of other types we can only speculate based on the limited amount of information derived from literary sources.

As Greek and Roman seafarers had no apparent means of measuring their speed at sea,[53] the method among most ancient authors was to employ speed's two other functions—time and distance. The twenty-four-hour day was a natural, convenient and consistent block of time by which to measure the length and duration (and therefore speed) of voyages, and in fact we find numerous references to the duration of time expected to make certain passages.[54] The earliest *periploi* also list distances between coastal locales in terms of a day's or

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[51] Cariolou 1997, 92, 94. The cargo on *Kyrenia II*'s experimental voyage was comprised of thirty-five empty amphoras. The original ship, however, was laden with 404 full amphoras, part of a total cargo of 25 tons. The added weight (and thus greater wetted-hull area, would have slowed the ship down considerably in the same conditions.

[52] Welsh 1988, 199–200; Shaw 1993b, 40. Tim Severin's *Argo* managed between 5 and 6 kts when under sail in their recreation of the Argonaut voyage between Volos, Greece and Georgia on the far eastern shore of the Black Sea (see Severin 1985, 83–4).

[53] The log that was used during the Middle Ages finds no correlate in Greek and Roman sources. The inability to gauge speed in antiquity, however, was felt. Vitruvius (*De arch.* 10.9.5–7), for example, describes in theoretical terms a shipboard hodometer used to measure progress at sea in increments of miles. The inclusion of an axle penetrating the hull near the waterline, and the investment in personnel required to operate and maintain it, likely precluded its actual use.

[54] See the sampling of references in Casson 1995, 287–8. Cf. Metrodorus' epigram in the *Greek Anthology* (14.129): "A seafarer plowing the broad gulf of the Adriatic [Ionian Sea] in a ship said to the sailing master, "How much sea remains still to be crossed?" And he answered him, "Sailor, between the Ram's Head of Crete and Sicilian Peloris are six thousand stades, and twice two-fifths of the distance remains [to be traversed] till the Sicilian channel"" (*Εἶπε κυβερνητῆρι πλατὺν πόρον Ἀδριακοῖο τέμνων νηί· "Ἁλὸς πόσα λείπεται εἰσέτι μέτρα;"*

several days' sail,[55] and most later geographers and periplographers employed stades as a measurement at sea (a stade amounted to ca. 185 meters[56]), with some writers providing the number of stades per day that a ship was expected to traverse. The fourth-century-B.C. periplographer Pseudo-Scylax (see below, pages 165–6), for example, stated that ships could travel 500 stades in a "day's voyage."[57] As he distinguished a "day's voyage" from a "day and a night's voyage," without specifying the time of year, we may presume that this is merely a rough average of daylight hours, and that in a twenty-four-hour period ships could average between 3 and 4 kts.[58] Menippus of Pergamum (see below, pages 169–70), was more specific: "…a ship running before a fair wind accomplishes 700 stades in one day [averaging ca. 3 kts], but one may find a ship making a passage of 900 stades [averaging ca. 4 kts], having tacked on additional speed as a result of skillful fabrication, or having accomplished another passage of scarcely 500 stades [averaging ca. 2 kts] due to construction contrary to the art."[59] The ships that the learned second-century-A.D. author Aelius Aristides describes must have been skillfully built indeed, for he states that "a vessel running day and night with a wind blowing from the stern can cover perhaps more than 1,200 stades [ca. 5 kts]." He

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τὸν δ' ἀπαμείβετο· "*Ναῦτα, μέσον Κριοῖο μετώπου Κρηταίου Σικελῆς τε Πελωρίδος ἑξάκι μέτρα χίλια·δοιῶν δ' αὖτε παροιχομένοιο δρόμοιο πέμπτων διπλάσιον Σικελὴν ἐπὶ πορθμίδα λείπει*"). The solution (*contra* Patton 1993, V: 95) requires that they have traveled 1,200 stades and still had 4,800 stades remaining.

55 For a sample passage from Hanno's *periplus*, see pages 163–4.

56 There are 5.4 stades to the kilometer, and roughly 10 to the nautical mile. For a discussion on the standard of the stade employed by most geographers, see Dicks 1960, 42–6.

57 Pseudo-Scylax 69: "From the Pillars of Herakles in Europe to one sailing around coasts of the gulfs the voyage past Europe is one hundred and fifty-three days. This total is derived by calculating the nights that have been recorded as days and, where stadia have been recorded, calculating 500 stadia as a day's voyage" (*Ἀπὸ Ἡρακλείων στηλῶν τῶν ἐν τῇ Εὐρώπῃ περιπλέοντι τοὺς κόλπους παρὰ γῆν, λογιζομένῳ δὲ ὅσαι γεγραμμέναι εἰσὶ, νύκτες ἀντὶ τούτων ἡμέρας, καὶ, ὅπου στάδιά εἰσι γεγραμμένα, ἀντὶ τῶν φ΄ σταδίων ἡμεραῖον τὸν πλοῦν, γίνεται τῆς Εὐρώπης ὁ παράπλους, τοῦ ἡμίσεος μέρους τοῦ Πόντου ὄντος ἴσου τῆς Μαιώτιδος λίμνης, ἡμερῶν ρν΄ τριῶν*).

58 See, e.g., Pseudo-Scylax 47, where the crossing between Lacedaemon (Cape Malea) and Phalasarna, a distance of approximately 60 nm, is listed as a "day's sail." In June, with 14.5 hours + of daylight, this would require a speed of 4.1 kts. Note that winds in this area are predominantly northwesterly in June (*CRMS*, 146), and therefore highly favorable for such a crossing.

59 Marc. *Epitome Peripli Menippei* 5:…*ἑπτακοσίους οὐριοδρομοῦσα ναῦς διὰ μιᾶς ἀνύει (τῆς) ἡμέρας, εὕροι [δέ] τις ἂν καὶ ἐννακοσίους σταδίους διαδραμοῦσαν ναῦν ἐκ τῆς τοῦ κατασκευάσαντος τέχνης τὸ τάχος προσλαβοῦσαν, καὶ ἑτέραν μόλις πεντακοσίους διανύσασαν, διὰ τὴν ἐναντίαν τῆς τέχνης αἰτίαν*.

then adds, "Even we have accomplished this many times on fair voyages."[60] Interestingly, this is the same speed that Herodotus ascribes to merchant vessels in the fifth century B.C.[61]

Another and perhaps more helpful corpus of evidence is found in references in which the origin, destination, and duration of the voyage, along with the detail of whether it was made with favorable or contrary winds, are specified. Casson in his studies on the speeds of ships under sail demonstrated that under favorable conditions ships could attain speeds of between 4 and 6 kts over open water, and 3 to 4 kts when working through islands or along the coast. In unfavorable conditions (with winds forward of the beam) their speeds ranged between 1 and 2.5 kts.[62] These figures accord remarkably well with the observations made by Pseudo-Scylax, Menippus and Aristides. Those runs that reached into the 6- to 7-kt-range in the Roman period, such as Ostia-Africa (Carthage) and Messina-Alexandria, were made in maritime areas in which geography, winds and currents favored downhill voyages over long distances.[63] Their speeds and the distances involved imply that the ships must have been multi-masted grain freighters that were only lightly ballasted for the open sea. On the other hand, as the sea trials of *Kyrenia II* have shown, the smaller commercial vessels of antiquity likely reached much higher speeds in certain conditions, particularly when unburdened or only lightly ballasted.

The seagoing merchant galley and the pure sailing ship existed side by side by at least the sixth century B.C. and endured to the end of antiquity and beyond. Their modes of propulsion and the cargos they were built to carry served as the primary determinants of the routes they would have run. What evidence we have strongly suggests that merchant galleys varied in size from rowboats to vessels greater than 200 tons, but still remained at the lower

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60 Aristid. *Aigyptios* (=Dindorf 1964, 360, lines 24–5):…*ναῦς πανημερία θέουσα ὑπ' ἀνέμου κατὰ πρύμναν πνέοντος, ἴσως μᾶλλον διακοσίους καὶ χιλίους. καὶ ἡμεῖς τοσούτους ἐν εὐπλοίᾳ πολλάκις ἠνύσαμεν*.

61 Herodotus (4.86) observed that a ship could cover 70,000 *orguiai*, or fathoms (a unit of about six feet) by day, and 60,000 by night. In a twenty-four-hour period, then, and presumably with favorable winds, a ship was expected to cover 130,000 fathoms, or about 128 nm. This equates to nearly 5.3 kts. Herodotus, it should be noted, is not stating that ships purposefully slowed their speed at night, but merely acknowledges that there is more daylight during the fairer months of the year when ships are usually at sea.

62 Casson 1951, 143; Casson 1995, 283 Table I, 287, 291. Arnaud (2005, 98–107) adduced and discussed other evidence, but made no substantial modifications to Casson's framework.

63 See below, n. 117.

end of the size spectrum. Generally speaking they confined their movement to coastal areas and cabotage, taking advantage of the options offered by sail and oar to make headway under various weather conditions. Their adaptations to nearshore waters made them attractive as auxiliaries to war fleets, which generally stuck to coastal routes for logistical and meteorological reasons. Sailing ships, on the other hand, ranged up and down the size spectrum, but essentially occupied the middle and upper categories of tonnage. Their high sides and larger overall dimensions permitted better sea-keeping abilities and made them better equipped to make longer, open-water traverses in heavier wind and swell. They were forced to rely on their own sailing and windward capabilities to make headway in adverse conditions.

II. SEASON(S) OF MARITIME ACTIVITY

The same natural and commercial factors that influenced the shape and construction of ancient commercial vessels and their modes of propulsion also influenced the seasonal patterning of maritime movement. As we saw in Chapter 2, the weather regimes of the Mediterranean and Black Seas split the year into two halves: a warm season (May-September) characterized by long days and clear skies with predominant northerly or variable winds in the western basin and northerly and northwesterly trade winds in the eastern basin; and a cold season (October/November-March) characterized by short days, long nights, increased cloud cover, reduced visibility and intermittent, roving low-pressure systems which cause unsettled weather throughout both basins.[64] The seasonal margins experienced aspects of both the warm and cool seasons, with oppressive northerly winds giving way by fits and starts to helpful winds from other quarters, particularly the south.

The peak of maritime activity overall naturally centered on the summer months when time spent at sea was safe, productive and lucrative, but precisely how far seafaring stretched into marginal times, and even into winter, is a matter of debate. The two most

[64] See Veg. *Mil.* 4.39: "…the minimal daylight and long nights, the density of clouds, foggy air, and violence of winds compounded by rain and snow not only keep fleets from the sea but also those making journeys by land" (…*lux minima noxque prolixa, nubium densitas, aeris obscuritas, ventorum imbri vel nivibus geminate saevitia non solum classes a pelago sed etiam commeantes a terrestri itinere deterbat*); cf. Rutilius Namatianus, *De Reditu Suo* 1.183–4.

cited sources on the sailing season of antiquity are sections of Hesiod's *Nautilia* in the *Works & Days* and Book IV of Vegetius' *De Re Militaris*. Both are worth quoting in full:

> *Hesiod*: If ever the urge for hard seafaring seizes you, when the Pleiades chased by gigantic Orion fall into the misty sea [end of October], well, don't do it. Gales of all kinds are whipping about. No longer keep your ship on the wine-dark sea…The fifty days after the solstice [ca. 20 June to 10 August], when the season of wearisome heat has come to an end, is the right time for mortal men to sail. Then you will not wreck your ship, nor will the sea destroy men, unless Poseidon the Earth-Shaker is bent on it, or Zeus, king of the deathless gods, wish to kill them…At that time the winds are steady and the sea is propitious. Then trust in the winds without care, and haul your swift ship down to the sea and put all the freight on board; but make haste to return home again and do not await the new wine and autumn rain and oncoming storms with the fierce gales of Notus, who stirs up the sea and accompanies the heavy autumn rain of Zeus, and stirs up the sea and makes the sea hazardous.
>
> There is for men another season for sailing, in the spring: When the new fig-leaves on the highest branch open up to the size of a crow's footprint, then you can get on the sea. That's the spring sailing season—I for my part don't care for it, for it is not agreeable in my mind. It's steeling time, and only with heartache will you escape destruction. Still, men do it in their ignorance of mind. Money's the breath of life for mortal men. But terrible it is to perish among the waves.[65]

> *Vegetius*: The next question is to consider months and dates. For the violence and roughness of the sea do not permit navigation year round, but some months are quite suited, some are doubtful, and the rest are impossible for fleets by a law of nature. When Pachon has run its course, that is, after the rising of the Pleiades, from six days before the Kalends of June [27 May] until the rising of Arcturus, that is, eighteen days before the Kalends of October [14 September], navigation is deemed safe, because thanks to the summer the roughness of the sea is abated. After this date until three days before the Ides of November [11 November] navigation is doubtful (*incerta*) and more exposed to danger, as after the Ides of September [13 September] rises Arcturus, a most violent star, and eight days before the Kalends of October [24 September] occur harsh equinoctial storms, and around the Nones of October

[65] Hes. *Op*. 616–21, 663–82: *Εἰ δέ σε ναυτιλίης δυσπεμφέλου ἵμερος αἱρεῖ· | εὖτ' ἂν Πληιάδες σθένος ὄβριμον Ὠρίωνος | φεύγουσαι πίπτωσιν ἐς ἠεροειδέα πόντον, | δὴ τότε παντοίων ἀνέμων θυίουσιν ἀῆται· | καὶ τότε μηκέτι νῆα ἔχειν ἐνὶ οἴνοπι πόντῳ, …| Ἤματα πεντήκοντα μετὰ τροπὰς ἠελίοιο, | ἐς τέλος ἐλθόντος θέρεος, καματώδεος ὥρης, | ὡραῖος πέλεται θνητοῖς πλόος· οὔτε κε νῆα | καυάξαις οὔτ' ἄνδρας ἀποφθείσειε θάλασσα, | εἰ δὴ μὴ πρόφρων γε Ποσειδάων ἐνοσίχθων | ἢ Ζεὺς ἀθανάτων βασιλεὺς ἐθέλῃσιν ὀλέσσαι· |…τῆμος δ' εὐκρινέες τ' αὖραι καὶ πόντος ἀπήμων· | εὔκηλος τότε νῆα θοὴν ἀνέμοισι πιθήσας | ἑλκέμεν ἐς πόντον φόρτον τ' ἐς πάντα τίθεσθαι· | σπεύδειν δ' ὅττι τάχιστα πάλιν οἶκόνδε νέεσθαι | μηδὲ μένειν οἶνόν τε νέον καὶ ὀπωρινὸν ὄμβρον | καὶ χειμῶν' ἐπιόντα Νότοιό τε δεινὰς ἀήτας, | ὅς τ' ὤρινε θάλασσαν ὁμαρτήσας Διὸς ὄμβρῳ | πολλῷ ὀπωρινῷ, χαλεπὸν δέ τε πόντον ἔθηκεν. | ἄλλος δ' εἰαρινὸς πέλεται πλόος ἀνθρώποισιν· | ἦμος δὴ τὸ πρῶτον, ὅσον τ' ἐπιβᾶσα κορώνη | ἴχνος ἐποίησεν, τόσσον πέταλ' ἀνδρὶ φανήῃ | ἐν κράδῃ ἀκροτάτῃ, τότε δ' ἄμβατός ἐστι θάλασσα· | εἰαρινὸς δ' οὗτος πέλεται πλόος· οὔ μιν ἔγωγε | αἴνημ', οὐ γὰρ ἐμῷ θυμῷ κεχαρισμένος ἐστίν· | ἁρπακτός· χαλεπῶς κε φύγοις κακόν· ἀλλά νυ καὶ τὰ | ἄνθρωποι ῥέζουσιν ἀιδρείῃσι νόοιο· | χρήματα γὰρ ψυχὴ πέλεται δειλοῖσι βροτοῖσιν. | δεινὸν δ' ἐστὶ θανεῖν μετὰ κύμασιν*). On the audacity (or ignorance) of men to sail winter seas, cf. Soph. *Ant*. 332–6: "Many things are formidable, and none more formidable than man. He crosses the gray sea under the winter wind, passing beneath the waves that surround him" (*πολλὰ τὰ δεινὰ κοὐδὲν ἀνθρώπου | δεινότερον πέλει· | τοῦτο καὶ πολιοῦ πέραν | πόντου χειμερίῳ νότῳ | χωρεῖ περιβρυχίοισιν | περῶν ὑπ' οἴδμασιν*).

> [7 October] the rainy Haedi, and five days before the Ides of the same [11 October] Taurus. But from the month of November the winter setting of the Pleiades interrupts shipping with frequent storms. So from three days before the Ides of November [11 November] until six days before the Ides of March [10 March] the seas are closed. The minimal daylight and long nights, dense cloud-cover, foggy air, and violence of winds doubled by rain and snow not only keep fleets from the sea but also traffic from making journeys by land. But after the birthday of navigation, so to speak, which is celebrated with annual games and public spectacles in many cities, it is still dangerous to embark upon the sea right up to the Ides of May [15 May] by reason of very many stars and the season of the year itself—not that the activities of merchants cease, but greater caution should be shown when an army sails by warships than in a hasty venture of private commerce.[66]

Both sources effectively describe four seasons: an optimal window in mid-summer;[67] a more hazardous period in the autumn up to the setting of the Pleiades; a 'closed' period from November to March/April; and finally a risky though still observed period in April and May (see Table 3.1).

To these specific dates designating the resumption and cessation of seafaring we should add evidence from the religious festival known as the *Ploiaphesia*, or *Navigium Isidis*, a festival of the *Ship of Isis* designed to inaugurate the sailing season in the spring—the "birthday" (*natalis*) to which Vegetius alluded in his passage above. This festival, so vividly described in Apuleius' *Metamorphoses* from the late second century, comprised a festive march of Isiac initiates and general public down to the waterfront where the ornamented and unmanned ship of Isis was "let go" (*πλοιαφέσια*) from shore to symbolize the opening of the sailing season.[68] In Apuleius' novel, this Graeco-Roman version takes place at Kenchreai, the

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[66] Veg. *Mil.* 4.39: *Sequitur mensum dierumque tractatus. Neque enim integro anno vis atque acerbitas maris patitur navigantes, sed quidam menses aptimssimi, quidam dubii, reliquit classibus intractabiles sunt lege naturae. Pachnitae decurso, id est post ortum Pleiadum, a die .vi. Kal. Iun. usque in Arcturi ortum, id est in diem .xviii. Kal. Oct., secura navigatio creditor, quia aestatis beneficio ventorum acerbitas mitigatur. Post hoc tempus usque in .iii. Id. Nov. incerta navigatio est et discrimine propior propterea quia post Id. Sept. oritur Arcturus, vehementissimum sidus, et .viii. Kal. Oct. aequinoctialis evenit acerba tempestas, circa Non. Vero Oct. Aedi pluviales, .v. Id. easdem Taurus. Novembri autem mense crebris tempestatibus navigia conturbat Vergiliarum hiemalis occasus. Ex die igitur .iii. Id. Nov. usque in diem .vi. Id. Mart. maria clauduntur; nam lux minima noxque prolixa, nubium densitas, aeris obscuritas, ventorum imbri vel nivibus geminate saevitia non solum classes a pelago sed etiam commeantes a terrestri itinere deturbat. Post natalem vero, ut ita dicam, navigationis, qui sollemni certamine publicoque spectaculo multarum urbium celebratur, plurimorum siderum ipsiusque temporus ratione usque in Id. Mai. periculose maria temptantur, non quo negotiatorum cesset industria sed quia maior adhibenda cautela est quando exercitus navigat cum liburnis quam cum privatarum mercium festinate audacia*.

[67] Snider (1978) hold the untenable view that Hesiod's *Ἤματα πεντήκοντα μετὰ τροπὰς ἠελίοιο* meant *starting* fifty days after the solstice, ending with the grape harvest and new vintage in September. As the scholiast on Hes. *Op.* 663 points out, however, July and August were considered the best time to sail the Aegean.

[68] Apul. *Met.* 11.8–17. On the *Navigium Isidis* of Apuleius, see Dunand 1973, 223–30; Gwyn Griffiths 1975; Witt 1997, 165–84.

Saronic port of Corinth, but the festival flourished between the first century B.C. and the sixth century A.D.[69] Some sources schedule the festival on the spring equinox (approximately 20–22 March),[70] although a late source lists it as occurring as early as 5 March.[71]

Most modern writers consider these sources sufficient to explain some eleven-hundred years of seafaring activity with no regard to their respective contexts[72]—Hesiod, a Boeotian bard from the Homeric period reciting didactic poetry with a distinctly local flavor;[73] Vegetius (whom we will discuss in more detail in Chapter 4), a fifth-century-A.D. imperial administrator writing generally on the movements of *war galleys*; and the festival of the *Ship of Isis*, celebrated in several coastal cities but confined almost exclusively to the Aegean area.[74] However, in a 1947 article, de Saint-Denis surveyed the literature and concluded, against popular wisdom, that while winter voyaging was curtailed it was certainly never suspended, neither for commercial ships nor for war vessels, as the Latin term *mare*

69 See Peek 1930, 100; cf. Vidman 1969, §80 (= *CIG* 12, *Supp.* 557) and Witt 1997, 178 n. 26, the latter of whom cites an Euboean (Eretrean) hymn inscription as the earliest reference to the *ploiaphesia* festival, again from the first century B.C. Other hymns dating from the first century B.C. to the fourth century A.D. have been found at Byzantium, Cyme, Chalchis, Ios and Cyrene. Collectively they stem from a lost text referred to as the Isis aretalogy (see, e.g., Festugière 1949).

70 A Roman *fasti* inscription from the *menologium rusticum Colotianum*, now in the Naples Museum, lists the *Isidis Navigium* to be held on the *aequinoctium*: *CIL* VI 2305; *ILS* 8745; Limentani 1991, 110. Cf. Ovid, *Fast.* 4.131–2: "In spring [April] she tells the curving ships to sail over her native seas and fear the threat of winter no more" (*vere monet curvas materna per aequora puppes | ire nec hibernas iam timuisse minas*).

71 Lydus *Mens.* 4.45: "On 5 March is celebrated the voyage of Isis which is still called *ploiaphesia*" (*Τῇ πρὸ τριῶν Νωνῶν Μαρτίων ὁ πλοῦς τῆς Ἴσιδος ἐπετελεῖτο, ὃν ἔτι καὶ νῦν τελοῦντες καλοῦσι πλοιαφέσια*). Cf. the Oxford *parapegma* (first century B.C.), which lists the *ploiaphesia* on 9 March (Lehoux 2007, 393, 396).

72 See, e.g., Navarrete 1846, 27; Kroll 1923, 410; Thomson 1948, 46; Neuburger 1969, 499; Aubet 1993, 144; Arenson 1990, 95; Meijer and van Nijf 1992, 4–6, 165–7; Long 1992, 363–4, 368, 370, 373–5; Casson 1995, 270–3; Humphrey et al. 1998, 443 (but cf. 444); Patai 1998, 64–5; Medas 2004, 36–9.

73 Wallinga (1993b) convincingly argues that Hesiod's fifty days are associated with a lull in the agricultural year, and that the reference to "fifty days after the summer solstice" pertains to small farmers getting their grain to market, at times employing small and more exposed vessels to do so.

74 Above n. 69. Isis held a peculiar dual role as the goddess presiding over the opening of the sailing season and the protectress of seafarers at sea, particularly during the stormy months of winter. Isidorus, for example, in *Hymn One* (1.25–33, parts) of the *Four Hymns of Isidorus* from ca. 50 B.C., states that those "sailing the winter seas" called out to her for salvation from storms: "Deathless Savior…and as many sail on the Great Sea in winter when men may be destroyed and their ships wrecked and sunk. All are saved if they pray that you be present" (*σώτειρ' ἀθανάτη…καὶ ὅσοι ἐμ πελάγει μεγάλωι χειμῶνι πλέουσι ἀνδρῶν ὀλλυμένων νηῶν κατὰ ἀγνυμενάων, σώζονθ' οὗτοι ἅπαντες, ἐπευξάμενοί σε παρεῖναι*). More research is sorely needed on the origin and purpose of the *ploiaphesia* from both a religious and maritime aspect, and whether the 'season' it was designed to inaugurate had more to do with the season's first send-off of wine or grain cargos rather than all vessels of commerce.

clausum would imply.[75] Aside from the popular *topoi* on seasonal harbingers and the folly of winter navigation (see Chapter 1), he noted the peculiar contradiction between prescription and practice; there were simply more exceptions to the rule than citations of the rule itself. Rougé responded in 1952 by arguing that only "grand navigation commerciale" in the service of the state (e.g., Alexandrian grain clippers) was halted, but that *petit cabotage* continued year round with oar-propelled coasting vessels (*naves orariae*) operating throughout winter.[76] Casson, to add a third voice, considered the winter sea lanes "nearly deserted," although he noted one exception in the Rhodes-Alexandria run described in Demosthenes as occurring year round.[77] This single exception has been amplified by the discovery of papyri in Egypt which strongly suggest that the entire eastern basin witnessed merchant traffic nearly year round from at least the fifth century B.C.

The earliest is the Ahiqar scroll, a palimpsest papyrus from Elephantine written in Aramaic and dated to the fifth century B.C., a time of Achaemenid hegemony over Egypt.[78] This royal customs register records the arrivals, departures, cargoes, owners/captains and customs dues of forty-two merchant ships—thirty-six from *Yawan* (Ionia) and six from Syro-Palestine (apparently Sidon). The Ionian ships are described as 'large' and paid a duty consisting of coinage and jars of Ionian wine and oil, among other things—apparently part of the cargo they hauled to Egypt. They quit Egypt loaded with natron, a bicarbonate material used in glass manufacture and other industries. According to the dates listed beside each customs account, these ships made round-trips between an Egyptian port[79] and the

[75] de Saint-Denis 1947.

[76] Rougé 1952, 316–17; echoed in Horden and Purcell 2000, 142–3.

[77] Casson 1995, 270–3 and n. 3. See Dem. 56.30: "there [Rhodes] the sailing season is year round, so [those who specialize in bottomry loans] can put the same money to work two or three times. But here [in Athens] they had to stay all winter long and wait for the season [before starting out]" (*ἐκεῖσε μέν γε ἀεὶ ὡραῖος ὁ πλοῦς, καὶ δὶς ἢ τρὶς ὑπῆρχεν αὐτοῖς ἐργάσασθαι τῷ αὐτῷ ἀργυρίῳ· ἐνταῦθα δ' ἐπιδημήσαντας παραχειμάζειν ἔδει καὶ περιμένειν τὴν ὡραίαν*). The use of this route in winter, however, may be inferred from as early as the early fifth century B.C. Pindar (*Isthm.* 2.39–42), for example, has one Xenokrates sail to the Nile [sc. Delta] in winter: "in summers he voyaged as far as Phasis, and in the winter sailed to the bank of the Nile" (*ἀλλ' ἐπέρα ποτὶ μὲν Φᾶσιν θερείαις, | ἐν δὲ χειμῶνι πλέων Νείλου πρὸς ἀκτάν*). See Isager and Hansen 1975, 59–60.

[78] Porten and Yardeni 1993, xx–xxi, 82–193, 284–95; Yardeni 1994; Briant and Descat 1998; Tammuz 2005, 151–2.

[79] Tammuz's suggestion (2005, 151) that the port in question lay in the western Nile Delta is attractive: the ships are recorded as departing with loads of natron, a sodium bicarbonate used in glass manufacture, inter alia, and mined in and around Wadi Natrun south of modern-day Alexandria. Alternative ports include those of the eastern Delta, such Migdol (upriver from Pelusium) Taphanhes (Daphnae) or Memphis, all of which had

Aegean continually for a ten-month period, from late February (*Athyr*) to November/December (*Mesore*). Phoenician ships arrived with cargos of Sidonian wine, metals, wood, wool, clay and other materials and commodities, some of which was used to pay the duty, then departed with an unknown cargo during the same autumn, from late September to mid-December. No ships are recorded during the months of January (*Thoth*) and February (*Paophi*), months when, as Fabre reminds us, the Nile was at low water and entry into any of the Nile mouths was likely impossible (Table 3.2).[80]

The other source is the Zenon papyri, which document the business dealings of one Zenon, son of Agreophon of Kaunos, who lived and worked in Ptolemaic Egypt during the mid-third century B.C. Three papyri from this collection describe or allude to voyages made in unspecified vessels during the winter months.[81] *P. Cairo Zenon* 59029 is dated to 5 December of 258 B.C. and specifies that two people, Doris and Ariston, boarded ship and sailed in stormy weather from Alexandria to Patara on the Lycian coast.[82]

P. Mich. Zenon 10 continues to detail the stormy voyage of Doris and Ariston to Patara, where they arrived in late December of 258 B.C. or early January of 257 B.C.[83] Here the captain insisted on waiting until the sailing season had arrived before continuing. Instead of waiting the two passengers hired a boat for thirty-five drachmae to transport them either to Cilician Arsinoë or Arsinoë-Ephesus,[84] where they arrived on or before January 31.

And finally *P.Lond.* 1979, a letter sent to Zenon from Rhodes, arrived in Alexandria by ship in early December of 253 B.C. and was recorded into Zenon's archive, in

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significant Jewish populations at this time (cf. Jer. 43.9, 44.1, 46.14, Ezek. 29.10, 30.6; see also Porten and Yardeni 1993, xx).

[80] Fabre 2004–2005, 23.

[81] The dating is worked out by Tammuz 2005, 153–5.

[82] *P. Cairo Zenon* 59029. Edgar (1971, 50–1) recreates the voyage by comparing other letters in the archive.

[83] *P. Mich. Zenon* 10 = Edgar 1931, 70–1 (no. 10): "…Know that they were driven in to Patara by the storms; from there they hired a boat and sailed along the coast to us in Arsinoë" (*γίνωσκε δὲ ὑπὸ τῶν χειμῶνων κατενεγχθέντας εἰς Πάταρα, κεῖθεν δὲ μισθωσάμενοι πλοῖον παρέπλεθσαν πρὸς ἡμᾶς εἰς Ἀρσινόην*).

[84] Arsinoë was a ubiquitous place name during and after Ptolemaic times. Three candidates for this Arsinoe include Patara/Arsinoë, Cilician Arsinoë or Ephesos/Arsinoeia. The first is ruled out from context, since Patara was the port at which they first arrived. Edgar (1931, 69) reasonably identified this Arsinoë as Cilician Arsinoë, although the city lies far to the east of Patara and was apparently founded just shortly before this letter was written. Ephesos/Arsinoeia is an equally strong candidate, as that city had come into Ptolemaic power in 258 B.C., just a short time before the voyage of Doris and Ariston. It subsequently became the Ptolemaic naval base on the Ionian coast (see Fraser 1972, 1:163 and n. 239).

Philadelphia, on 2 January 252 B.C.[85] Again, inclement weather and the arrival of the sailing season are mentioned.

These chance accounts hardly suggest that the sea lanes of antiquity were "nearly deserted." On the contrary, they describe winter maritime activity as a matter of everyday practice, albeit with a greater degree of risk. From the Demosthenic evidence we can only conclude that the availability and affordability of bottomry loans (that is, loans secured by the value of the ship itself) placed some greater constriction on specific sectors of commercial shipping (e.g. wine and grain cargos) in the Black Sea and Aegean.[86] The restricted sea-room of these two seas, as we saw in Chapter 2, is indeed more risky for ships in winter than some of the wide open spaces of the Mediterranean. In the Ionian Sea and the Eastern Mediterranean, for instance, the roving cyclones that scream in periodically from the west give warnings of their advent in the atmosphere, and after they pass there are short periods during which alternative winds blow, particularly southerlies—just the sort of windows that ensured the safety of quick winter crossings and coastal jumps. Even in the greater Eastern Mediterranean, however, there appears to be no reason to suspect a universally observed law that governed *all* merchant shipping throughout the year.

What do Roman sources before Vegetius have to say about seasonal demarcations of maritime activity? Latin literature was keen to adopt the Greek *topoi* on the folly of winter sailing and the harbinger stars that betokened the limits of the sailing season.[87] Of the scientific authors before the fourth century A.D., however, only the Elder Pliny offers specific dates for the sailing season, 8 February to 11 November:

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85 *P. Lond.* 1979; Skeat 1974, 74–6.

86 The effect of seasonal weather conditions on bottomry loans is reinforced in two Demosthenic speeches. In his *Against Lacritus* (35.10) he describes an increase in interest charged if a captain "embarked from Pontus to Hieron [port opposite Byzantium] after the rising of Arcturus [in early October]" (*μετ' Ἀρκτοῦρον ἐκπλεύσωσιν ἐκ τοῦ Πόντου ἐφ' Ἱερόν*). In *Against Apatourius* (33.23), he states that merchants (*emporoi*) may bring action every month from Boëdromion [September/October] to Mounichion [April/May], "in order to obtain their rights without delay and put to sea" (*ἵνα παραχρῆμα τῶν δικαίων τυχόντες ἀνάγωνται*). In other words, merchants could be expected to wait out the winter in Athens before good weather set in.

87 On the *topos* of the folly of winter navigation, see page 5, n. 18. On the *topos* of harbinger stars that told of the onset or ending of the season, see Verg. *Aen* 1.1038 (Arcturus), 1.754 (Orion), 1.1039 (Hyades). On the Hyades, cf. Manilius *Astron.* 1.365 and Ov. *Trist.* 1.11.1–20. On the Pleiades closing the seas, see the *Aratus Ascribed to Germanicus Caesar* 268–9.

> Therefore, the spring opens the seas to voyagers; at its beginning the West winds soften the winter sky, when the sun occupies the twenty-fifth degree of Aquarius; the date of this is 8 February...The rise of the Pleiades (*Vergiliae*) in the same degree of Taurus on 10 May brings summer; it is a period of South wind (*Auster*), the opposite of north (*Septentrio*). But in the hottest period of summer the Dog-star (Sirius) rises, when the sun is entering the first degree of Leo; this day is 17 July…But two days after his rising the northeast winds (*Aquilones*) begin again, and continue blowing steadily for 40 days; these are called etesian winds…No other winds are more constant. They are followed in turn by south winds, continuing to the rise of Arcturus, which begins forty days before the autumnal equinox...About forty-four days after the autumnal equinox the setting of the Pleiades (*Vergiliae*) marks the beginning of winter, which it is customary to date on 11 November; this is the period of the winter Aquilo, which is very unlike the summer one mentioned above; it is opposite to the southwest wind (*Africus*)…The rest of the time there is wintry weather. However, not even the fury of the storms closes the sea; pirates first compelled men by the threat of death to rush into death and venture on the winter seas, but now avarice does the same thing.[88]

Pliny's is the longest specified sailing season from antiquity, a testament to the degree to which the volume and demands of Roman shipping had stretched the traditional dates reflected in Hesiod and other Greek and Roman writers while at the same time giving nod to the "customary" (*consuesco*) date of the setting of the Pleiades (11 November) as a seasonal marker in autumn. The tag on *avaritia* does more than harmonize with the literary *topos* we discussed in Chapter 1; at Rome's apogee of economic enterprise it as much reflects commercial reality as it does the numerous historical attestations of winter sailing among Roman writers.[89]

The only sector of Roman shipping that ostensibly observed a tight schedule based on seasonal weather appears to have been Rome's Alexandrian grain fleet—Rougé's *grand navigation commerciale* mentioned above. The ships that wintered in Alexandria departed under convoy with full holds in April and traveled a slow, circuitous route via Cyprus, Asia Minor,

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[88] Plin. *HN* 2.47.122–5: *Ver ergo aperit navigantibus maria, cuius in principio favonii hibernum molliunt caelum sole aquarii XXV obtinente partem. Is dies sextus Februarias ante idus…Dat aestatem exortus vergiliarum in totidem partibus tauri VI diebus ante Maias idus, quod tempus austrinum est, huic vento septentrione contrario. Ardentissimo autem aestatis tempore exoritur caniculae sidus sole primam partem leonis ingrediente, qui dies XV ante Augustas kalendas est…Post biduum autem exortus iidem aquilones constantius perflant diebus XL. Quos etesias appellant…nec ulli ventorum magis stati sunt. Post eos rursus austri frequentes usque ad sidus arcturi, quod exoritur XI diebus ante aequinoctium autumni…Post id aequinoctium diebus fere IIII et XL vergiliarum occasus hiemem inchoat, quod tempus in III idus Novembres incidere consuevit; hoc est aquilonis hiberni multumque aestivo illi dissimilis, cuius ex adverso est Africus…Reliquum tempus hiemat. Nec tamen saevitia tempestatum concludit mare. Piratae primum coegere mortis periculo in mortem ruere et hiberna experiri maria; nunc idem avaritia cogit.* Cf. the contemporary *Fasti Praenestini* of Verrius Flaccus (*CIL*, 1:316), which specifies the opening of the sailing season in April: *maria et terrae aperiuntur.*

[89] On the high volume of Roman shipping during the first centuries B.C. and A.D., see Parker 1992, figs. 3–5.

Crete, Malta, and Messina (see below and Chapter 7).[90] This arduous voyage of some 1,700 nm, made largely against prevailing winds, could take as long as one or two months, sometimes longer. Arriving at Puteoli or Ostia in May or June, they unloaded their cargo and sped back to Alexandria with the help of following winds and seas, arriving around the month of July. Setting out with a second cargo they again followed the torturous northerly circuit, some making it as far as Italy under favorable conditions, others encountering autumnal weather and forced to winter somewhere en route. It was under these circumstances that the ship Paul caught in Myra made it only to Malta before wrecking, a point reached also by the ship that took him on to Puteoli the next spring (see Appendix A). Those who wintered in Rome departed under ballast for Alexandria in April,[91] arrived in May, loaded their cargoes of grain, and returned to Rome as soon as possible, sometimes as late as August. They could then either winter in Rome again or return to Alexandria to await the spring voyage. Their centuries-long adherence to a strict and conservative sailing schedule appears to have been a mark of prudence and a strategy of minimizing financial risk; sailing during periods of unsettled weather with such large and valuable cargoes, along with a typically large complement of passengers, was simply too chancy. Thus, when the Emperor Claudius attempted to import grain out of season in order to quell riots in Rome spurred on by a shortage, he was forced to insure ship-owners against financial loss out of the imperial treasury.[92]

The caveats expressed by Hesiod, Pliny and Vegetius, and the myriad references to winter navigation in both Greek and Roman sources, give more than a nod to de Saint Denis' assertion of the existence of *some* winter sailing in antiquity: they demonstrate that winter sailing was *routinely* practiced in numerous sectors of commercial shipping. The shift in emphasis is important because it speaks not only to the existence of economic risk-taking strategies that drew ships out to sea in winter, but also to some measure of navigational

[90] For evidence on convoys of grain ships arriving in Rome from Alexandria (at least for the first spring sailing), see Rickman 1980, 264–5.
[91] Or with holds filled with supplies required of the garrisons in Egypt. Morgan (2004, 312–14) for example, interprets the *Alexandrina* ship filled with weaponry which appeared without crew off Dertosa in Spain in A.D. 68 (Suet. *Galba* 10.4) as one that originally departed from Rome bound for Egypt in April, but was blown off course by storm en route and abandoned, fortuitously for Galba, near that general's camp.
[92] Suet. *Claud.* 18–19.

confidence and competence in foul-weather seamanship, encouraged no doubt by the wide availability of seafaring labor in port cities during the winter slowdown. This is not to argue that perceived navigational capabilities always and everywhere transcended the risk of putting to sea in winter, for there must have been reductions in volume during the months of most inclement weather, particularly in the Aegean and Black Seas, and possibly the upper Adriatic and Gulf of Lion. These were locales where extraordinarily harsh weather and local effects made winter navigation dangerous.[93] But even in these locales commercial shipping never ceased completely except during extremely inclement weather, such as when intense roving lows passed through the region.[94] The regular pauses in December's heavy weather known as the Halcyon Days remained popular in the literature throughout antiquity as convenient windows for travel and transport by sea (see, e.g., Apollonides' epigram heading this chapter), but other, shorter weather windows must have allowed local coastal and island-to-island commerce to continue.

What little anecdotal evidence we have suggests that winter navigation may be divided into three groups based on ship type, size and route:

- *Smaller vessels*. A reduced percentage of galleys or vessels of mixed propulsion engaging in fishing, small-scale commerce/cabotage,[95] and passenger service at important crossings such as the corridors between the Aegean and Black Seas, those

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[93] A shorter Aegean sailing season does appear to be the case judging from the initiate inscriptions from Samothrace (see Guettel Cole 1984, 38–40 and notes there, esp. 325). This northern Aegean island was home to the sanctuary and mysteries of the Kabeiroi (or *Theoi Megaloi*, Great Gods), twin gods of protection (especially at sea) and moral edification. Over a hundred inscriptions ranging in date from the second century B.C. to the end of the third century A.D. record well over 600 names of *mystai* (first tier) and *epoptai* (second tier) initiates. Of these, some fifteen Latin names list the Roman consular date and month, thereby giving us a microcosm of the region's typical sailing schedule, at least for passengers: 1 initiate in April, 3 in May, 5 in June, 1 in July, 1 in August, 2 in September, 1 in October, and 1 in November. None are listed in December, January, February, or March.

[94] The *Greek Anthology*, though replete with stock themes, provides dramatic testimony to the relative frequency of winter navigation. See, e.g., 7.653: "Fierce Lips rose and destroyed Epierides himself, his ship and his crew in the Aegean Sea at the setting of the Hyades [late October/early November]; and for his child his father in tears erected this empty tomb" (*Ὤλεσεν Αἰγαίου διὰ κύματος ἄγριος ἀρθεὶς | Λὶψ Ἐπιηρείδην Ὑάσι δυομέναις | αὐτὸν ἑῇ σὺν νηὶ καὶ ἀνδράσιν· ᾧ τόδε σῆμα | δακρύσας κενεὸν παιδὶ πατὴρ ἔκαμεν*); 7.500: "The wintry storms of the east wind cast you out naked, Phillis, on the surf-beaten shore beside a foothill on Lesbos rich in wine, and you lie on the sea-washed foot of the lofty cliff" (*Εὔρου χειμέριαί σε καταιγίδες ἐξεκύλισαν, | Φίλλι, πολυκλύστῳ γυμνὸν ἐπ' ἠιόνι, | οἰνηρῆς Λέσβοιο παρὰ σφυρόν· αἰγίλιπος δὲ | πέτρου ἁλιβρέκτῳ κεῖσαι ὑπὸ πρόποδι*).

[95] *Gr. Anth.* 7.498 (see the heading of Chapter 7).

between Aegean islands and their adjacent mainland areas, and across the Strait of Otronto[96] and Messina, among others.

- *Medium-sized vessels*. A small proportion of merchant galleys and sailing ships, probably without bottomry, making short traverses and coasting voyages during optimal weather windows.[97] Coasting was done usually during daylight hours if possible to avoid long nights of darkness under overcast skies.[98] But longer traverses were typical in the Eastern Mediterranean year round between Rhodes and the Delta (see above, page 79), as well as between Africa and Rome.[99]

- *Larger vessels*. In the Eastern Mediterranean year round at a scale likely less than that during the summer months,[100] but probably even more limited in the west due to

[96] Indeed the short but busy route between the Balkan peninsula and the heel of Italy appears never to have closed in winter except during exceptionally poor weather. Julius Caesar (*B Civ* 3.25), for instance, managed to cross his troops to Greece via Brundisium during winter. Lucian (*Tox*. 19) describes a storm-tossed voyage that occurred in the Ionian Sea en route from Italy to Athens at the setting of the Pleiades: "Euthydicus of Chalcidice…sailed from Italy about the setting of the Pleiades, bound for Athens, with an assorted shipload of passengers…They had a good voyage as far as Sicily, but no sooner had they passed through the straits into the Ionian Sea than a huge storm overtook them" (*Εὐθύδικον τὸν Χαλκιδέα…πλεῖν μὲν γὰρ ἔφη ἐξ Ἰταλίας Ἀθήναζε περὶ δύσιν Πλειάδος συλλογιμαίους τινὰς ἀνθρώπους κομίζων…Ἄχρι μὲν οὖν Σικελίας εὐτυχῶς διαπλεῦσαι…ἐπεὶ δὲ τὸν πορθμὸν διαπεράσαντες ἐν αὐτῷ ἤδη τῷ Ἰονίῳ ἔπλεον, χειμῶνα μέγιστον ἐπιπεσεῖν αὐτοῖς*).

[97] See, e.g., *Gr. Anth*. 7.273 (cf. 7.395): "The fierce and sudden squall of the southeast wind, and the night and waves that Orion stirs up at his dark setting [early November] were my downfall, and I, Callaeschrus, floated out of life as I sailed the middle of the Libyan deep…" (*Οὗτος ὁ Καλλαίσχρου κενεὸς τάφος, ὃν βαθὺ χεῦμα | ἔσφηλεν Λιβυκῶν ἐνδρομέοντα πόρων, | συρμὸς ὅτ' Ὠρίωνος ἀνεστρώφησε θαλάσσης | βένθος ὑπὸ στυγερῆς οἴδματα πανδυσίῃ*). The ship Synesius took from Alexandria to Pentapolis (see *Ep*. 4 in Appendix C) was probably a medium-sized vessel (the owner/captain and twelve crew); Synesius dropped several hints that point to a late January sailing (see Pando 1940, 22 and n. 197; but cf. Long 1992, esp. 373–5).

[98] See, e.g., Arat. *Phaen*. 300–2: "After much suffering at sea even in the previous month, when the sun inflames the Bow and the Drawer of the Bow [end of November], you should put ashore in the evening and no longer continue to trust the night." (*Καὶ δ' ἂν ἔτι προτέρῳ γε θαλάσσῃ πολλὰ πεπονθώς, | τόξον ὅτ' ἠέλιος καίει καὶ ῥύτορα τόξου, | ἑσπέριος κατάγοιο, πεποιθὼς οὐκέτι νυκτί*).

[99] Marius (Plut. *Mar*. 8.5; see below, n. 128) sped his way from Utica to Rome in late fall/early winter of 107 B.C., probably in a sailing ship, to stand for consul. The Theodosian code forbade African shippers from winter sailing (below, n. 102), which of course implies the former practice.

[100] On winter voyages between Rhodes and Egypt see Demosthenes 56.30 in n. 49 above. Thuc. 8.35: "The same winter [412/411 B.C.] the Spartan Hippocrates sailed out from the Peloponnese with ten Thurian ships…and one Laconian and one Syracusan vessel and arrived off Cnidus…When their arrival was known at Miletus orders came to them to leave half their squadron to guard Cnidus, and with the rest to patrol around Triopium and capture all the merchant ships (*holkades*) coming up from Egypt" (*Ἐκ δὲ τῆς Πελοποννήσου τοῦ αὐτοῦ χειμῶνος Ἱπποκράτης ὁ Λακεδαιμόνιος ἐκπλεύσας δέκα μὲν Θουρίαις ναυσίν… μιᾷ δὲ Λακωνικῇ, μιᾷ δὲ*

intense cyclogenesis and a resultant higher degree of economic risk. The Alexandrian grain fleet (discussed above) appears to have been markedly exempt from winter navigation.

By the fifth century of our era what was once a sailing season governed by *lex naturae* would become a *lex iuris*, at least for state-sponsored commerce.[101] The body of imperial law known as the *Codex Theodosianus* of A.D. 438 mandated a suspension of navigation between 15 October and 13 April for shippers of Africa.[102] This can only mean that, heretofore, these shippers sailed during winter months and relied on the state to assume the liability. Thereafter till the Middle Ages, Rome, Byzantium and the various maritime republics of the Mediterranean would pass edict after edict to straitjacket the rhythms of commerce only in the safest months.[103] Even so, as McCormick has shown, shippers of the early medieval era, and the passengers that took advantage of them, continued to sail winter seas for a variety of reasons, not least for routine commerce.[104]

III. SEAWAYS

The imperatives of topography, weather and sea conditions that we explored in Chapter 2, together with their technological and seasonal responses we examined above,

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Συρακοσίᾳ, καταπλεῖ ἐς Κνίδον·…καὶ αὐτοὺς οἱ ἐν τῇ Μιλήτῳ, ὡς ᾔσθοντο, ἐκέλευον ταῖς μὲν ἡμισείαις τῶν νεῶν Κνίδον φυλάσσειν, ταῖς δὲ περὶ Τριόπιον οὔσαις τὰς ἀπ' Αἰγύπτου ὁλκάδας προσβαλλούσας ξυλλαμβάνειν). Herod, according to Josephus (*BJ* 1.14.2–3) began his voyage to Rome in mid winter, but wrecked off Pamphylia and made his way only with difficulty to Rhodes. The type of ship he engaged is not specified, although he surely would have traveled in some degree of comfort. Similar winter-time voyaging in the Eastern Mediterranean is attested in the early medieval era (McCormick 2001, 458–62).

101 On Vegetius' *lex naturae*, see de Saint-Denis 1947, 197.

102 *Cod. Theod.* 13.9.3.3 (= Pharr 1952, 399): "From the month of November, navigation will be discontinued; the month of April, since it is near summer, shall be employed for the acceptance [of cargo]. The necessity of this acceptance shall be preserved permanently from the kalends of April [1 April] to the kalends of October [1 October]; but navigation shall be extended to the day of the ides [13 and 15, respectively] of the aforesaid months." (*Novembri mense navigatione subtracta, Aprilis, qui aestati est proximus, susceptionibus adplicetur. Cuius susceptionis necessitas ex kal. Aprilib. in diem kal. Octob. mansura servabitur; in diem vero iduum earundem navigatio porrigetur*).

103 Ashburner 1909, cxlii–cxliii; Braudel 1972, 1:248–9; Goitein 1999, 316–18.

104 McCormick 2001, 450–68.

place the character and details of maritime movement into a clearer context. For any planned itinerary, seafarers faced a range of choices to consider, each conditioned by a number of significant factors requiring evaluation before sailing and while conditions evolved en route. These choices depended on crucial environmental factors, such as the nature and outline of the coast, the season of voyaging and the associated dominant wind regime along the intended route. An assessment was required of the technological capabilities of the hull and its rig, as well as a consideration of the commercial implications of these navigational decisions, such as the duties assessed by various ports en route, the details of trade agreements or the threat of piracy. Longer, multi-leg voyages required the same range of considerations for each leg as well as a larger store of navigational knowledge from which to draw (see Chapter 7).

The myriad decisions required to plan and execute voyages resulted in myriad routes, which are highly resistant to modern mapping at any meaningful resolution. Evidence of specific routes sailed by Greek and Roman ships simply does not exist, nor were the coordinate systems of antiquity designed to render anything so accurate. As Horden and Purcell emphasize, "the myriad possible combinations of port, shelter, detour and accident comprised by even short journeys could hardly be mapped or set in writing."[105] And no route, no matter how short or how often made, was ever repeated precisely. At odds with this notion, however, are the ubiquitous maps of finely delineated sea routes we find in studies of ancient seafaring, trade and economics. The long lines stretching in graceful arcs between ports and regions, traced as if by steam ships able to ignore the effects of wind and wave, can easily lead to a false sense of accuracy. Such lines should be seen instead as trajectories or arrows of maritime 'flux,' that is, the general direction (often back and forth) of the flow of goods and ideas between one city/region and another.[106] At least one recent attempt to revise and replace these conceptions essentially substituted these assumed lines for others of similar character based on information culled from ancient geographies.[107] But here it must be emphasized that the geographers likely derived these so-called routes from

[105] Horden and Purcell 2000, 140.
[106] Arnaud 2005, 11.
[107] See, e.g., the various maps in Arnaud 2005.

reported *averages of times* required to make crossings and voyages between points;[108] they could hardly be expected to express, much less have first-hand knowledge of, the exact course or series of courses steered on a particular voyage.

Based on our source material, and taking into account the multitude of variables involved in each voyage even in optimal conditions, we should instead envision ancient sea 'routes,' whether short- or long-haul, as wide maritime *corridors* of general movement between one place and another. These corridors were defined by environment and meteorological factors, by technological responses to the demands of sea travel and by the ever-shifting realignments of trade trajectories throughout the seasons, years and centuries. The aggregate effect was of loose bundles of overlapping lines connecting coastal and island nodes, and not of straight, single paths overlaced multiple times. The factors and sources examined above and in the last chapter allow us to recognize these corridors in each of the major basins of the Mediterranean and Black Seas.

1. Maritime Corridors of the Eastern and Central Mediterranean

One of the better documented corridors linked the eastern and southeastern shores of the Mediterranean with the Aegean and points farther west by using the advantages of wind and shelter offered by the northern littoral (fig. 3.4). Heavily trafficked by passing merchantmen, caboteurs and warships throughout antiquity and the Middle Ages, this corridor—attested so vividly in the voyage narratives of Luke (*Acts of the Apostles* 27) and Lucian (*Navigium* 7–9)—grew in response to the adverse conditions experienced in traveling

[108] The concept of averaging is best expressed by Marcian (*Periplus Maris Externi* 1.2.45–53): "…so also with the bays, in delineating their circumference, it is possible for those who sail around them also to determine their voyage in a greater or less number of stadia. The same thing is clear in a direct crossing. If one should prefer not to navigate around the bay, but to make a direct crossing, that crossing would be the shortest, so that in the opinion of seafarers the number of stadia in bays is always variable" (*οὕτω καὶ ἐπὶ τῶν κόλπων, καθάπερ ἔν τινι περιγραφῇ περιφερειῶν, ἔξεστι τοῖς περιπλέουσι καὶ διὰ πλειόνων σταδίων ποιεῖσθαι τὸν πλοῦν, καὶ δι' ἐλαττόνων. Τοῦτο δὲ καὶ ἐκ τῶν διάπλων σαφὲς ἂν κατασταίη. Εἰ γάρ τις μὴ περιπλεῖν ἐθέλοι τὸν κόλπον, ἀλλὰ διαπλεῖν ἐπ' εὐθείας, βραχύτατος ἂν ὁ διάπλους ὀφθείη, ὥστ' εἰκότως ἐπὶ τῇ τῶν περιπλεόντων κεῖσθαι γνώμῃ τὸν ἀριθμὸν τῶν σταδίων ἐν τοῖς κόλποις καὶ τοῖς ἀκρωτηρίοις*). Because the unpredictability of winds and weather in certain areas prevented accurate estimates of voyage times (and therefore distances), Marcian adopted the practice, influenced perhaps from the seafaring community, of listing minimum and maximum voyaging times/distances (cf. 2.5.1–12).

west and north in the eastern and central Mediterranean.[109] It first touched at the Nile Delta or Alexandria, followed by a sequence of Levantine ports such as Caesarea and Sidon.[110] It then forked, with one path leading north toward eastern Cilicia, the other heading west and under Cyprus, using that island as a route marker,[111] then toward the northwest with the current but against etesian headwinds to reach the southern Anatolian coast. Here, sheltered from the etesians, ships used alternating sea and land breezes to effect the difficult passage westward along the Cilician, Pamphylian and Lycian coasts toward Rhodes, the gateway to the Aegean.[112] Merchant galleys returning to Levantine and Egyptian ports likely retraced their steps, as *P. Bingen* suggests (see above), while sailing ships simply utilized prevailing northerlies and northwesterlies to push them across the wide-open Levantine Sea toward their point of origin—a corridor well attested throughout antiquity.[113] But if the destination lay west of Crete, that island was kept on the starboard side and used as a wind screen, its steep southern coast, as in Anatolia, serving as a weather shore with its own suite of diurnal winds.[114] Once past Crete, seafarers had the choice of struggling northward (against prevailing northerlies) along the western coast of the Peloponnese to the Strait of Otranto where the crossing distance between Corcyra and the Iapygia promontory (Cape Sta. Maria

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109 Signs of this counter-clockwise route first appear in the Middle and Late Bronze Age, when trade among Aegeans, Egyptians and Syro-Canaanites flourished in the eastern Mediterranean (see Wachsmann 1998, 295–301).

110 Caesarea: *Acts of the Apostles* 25.13, 27.1 (see Appendix A); Palladius, *Lausiac History* 54.3; see also Dagron and Rougé (1982, 120–3) on the record of a voyage on 1 October, A.D. 474 from Caesarea Maritima to Abydos on the Hellespont. Sidon: Lucian, *Navigium* 7, Appendix B (forced to Sidon after departing Alexandria).

111 Cyprus is often attested as a route marker for the westward leg of the voyage: e.g. *Acts of the Apostles* 21.1–3 (sighted between Patara and Tyre), 27.4 (sighted between Caesarea and Myra: see below); Lucian, *Navigium* 7 (see below). Strabo (14.6.3) calls the port of Curium in southwest Cyprus a launch point for the voyage toward Rhodes (*ἀρχὴ δ' οὖν τοῦ δυσμικοῦ παράπλου τὸ Κούριον τοῦ βλέποντος πρὸς Ῥόδον*). Cf., however, Lucan's description (8.456–66) of Pompey's flight to Egypt, which employed Cyprus as a jump-off point.

112 See, e.g., Thuc. 2.69 where in 430/29 B.C. Melesander took six ships to Caria and Lycia to prevent Peloponnesian pirates from hassling merchantmen from Phaselis and Phoenicia heading west along this coast. Porphyry of Gaza (Marcus Diac. *Via Porph.* 33–7) departed that city on 23 September ca. A.D. 400, then touched at Rhodes on his way to Constantinople, arriving there on 5 October.

113 See, for example, Hom. *Od.* 14.252–8 (Odysseus' tall-tale voyage from Crete to the Nile); Hdt. 4.152 (the ship of Colaeus the Samian was originally headed for Egypt before being blown off course to Cyrenaica, then afterwards, so the story goes, through the Pillars of Hercules); Dem. 56.30 (above n. 77); Strabo 1.2.17, 2.5.24, Diod. Sic. 3.34.7 (sea voyage between Rhodes and Alexandria is 4000 stadia); Plut. *Arat.* 12.1–5 (Aratus of Sicyon intending a voyage to Egypt); Lucan 9.1004–5 (Caesar pursuing Pompey on a voyage from Rhodes to Alexandria; below, pages 89–90); Appian *B Civ.* 2.13.89 (*idem*).

114 But cf. Hom. *Od.* 14.299–300, where Odysseus and his fictitious Phoenician master sail, curiously, above Crete, that is, along the windward side (*ἡ δ' ἔθεεν βορέῃ ἀνέμῳ ἀκραέϊ καλῷ μέσσον ὑπὲρ Κρήτης*).

di Leuca) was minimal (about 60 nautical miles),[115] or to attempt to save time by sailing for many days, possibly weeks, on a broad reach and against contrary currents westward across the spacious Ionian Sea, a distance of some 400 nm; once the lofty eastern coast of Sicily was sighted, the Strait of Messina and Italy's west coast—typically the start of the last leg of the voyage—lay a short distance away.[116] This long, east-west corridor required several weeks of difficult sailing and seamanship and involved both coastal and open-sea navigation. The voyage back to the east from Sicily or Italy, on the other hand, was facilitated by following winds and helpful currents, taking as little as nine to ten days to bridge the distance (on a navigational reconstruction of this route and its navigational considerations, see below, pages 208–38).[117]

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[115] The jump from Corcyra to the Iapygia promontory was already time worn in Thucydides' day when it was used by the Athenian fleet on their way to Syracuse in 415 B.C. (Thuc. 6.30, 44; see note below). During the Roman era, Brundisium served as the primary port of disembarkation for those headed to Rome from the east. See Strab. 6.3.7: "For those who cross from Greece or Asia, the more direct route is to Brentesium, and, in fact, all who seek to go to Rome by land put in here." (*Ἔτι δὲ τοῖς ἀπὸ τῆς Ἑλλάδος καὶ τῆς Ἀσίας διαίρουσιν εὐθύπλοια μᾶλλόν ἐστιν ἐπὶ τὸ Βρεντέσιον, καὶ δὴ καὶ δεῦρο πάντες καταίρουσιν οἷς εἰς τὴν Ῥώμην πρόκειται ὁδός*). Cf. the epigram by Crinagoras of Mytilene (below, page 157) who desired a *periplus* to show him how to get from Lesbos (presumably) to Italy via Corcyra ("Scheria").

[116] Evidence of this split in the corridor between Greece and Italy/Sicily is plentiful from the Classical and Roman periods. For example, Nicias (Thuc. 6.13.1), in his speech on the eve of the Sicilian campaign in 415 B.C. urges the assembly "to vote that the Sicilians maintain the limits now existing between us, limits which are not blameworthy—namely the Ionian gulf if one makes a coasting voyage, and the Sicilian gulf across the open main" (*ψηφίζεσθαι τοὺς μὲν Σικελιώτας οἷσπερ νῦν ὅροις χρωμένους πρὸς ἡμᾶς, οὐ μεμπτοῖς, τῷ τε Ἰονίῳ κόλπῳ παρὰ γῆν ἤν τις πλέῃ, καὶ τῷ Σικελικῷ διὰ πελάγους*). In 44 B.C., Cicero deliberated with Atticus (*Att.* 16.3.6) about whether he should make his way to Greece from the Strait of Messina by way of Leucopetrae and Corcyra in a merchant galley (*actuariola*), or directly from the Strait or from Syracuse across the open sea to Patras in a large merchantman (*corbita/oneraria*). Plutarch's tale about the death of Pan (*Mor.* 419 = *Def. Orac.* 17) describes part of the voyage of a merchant ship headed to Rome from the west coast of Greece near Acarnania (via the Echinades and Paxoi islands) and presumable about to make the shorter hop across the Strait of Otranto. Heliodorus (*Aeth.* 4.16.6–7) describes the voyage of a Phoenician merchant forced by storms into shelter at Cephallania while en route from the Levant to Carthage with a large cargo. No doubt the open-sea route was reserved for these larger, well-provisioned merchant ships (although cf. Joseph. *Vit.* 15). Indeed, as Parker 1992, fig. 13 illustrates, the cluster of large, third- and fourth-century Roman wrecks carrying Aegean-manufactured Kapitän 2 amphoras discovered off the Sicilian and Calabrian coasts is highly suggestive of an east-west open-sea route across the wider Ionian Sea.

[117] See for example Philo, *In Flaccum* 26–7 "And when he was about to set out to take over his kingdom, Gaius advised him to avoid the voyage from Brundisium to Syria, being a long and troublesome one, and rather to take the shorter one to Alexandria, waiting for the etesians; for he said that the merchant vessels which set forth from there were fast sailers, and that the pilots were most experienced men, who like professional coaches guiding their horses guide their ships and keep them on a straight course… So, going down to Dikaiarcheia [Puteoli], and seeing some Alexandrian vessels in the harbor, looking all shipshape and fit for sea, he embarked with his followers and had a fair voyage, and a few days later he put into shore, unexpected and unforeseen, having bid the pilots (for the Pharos was sighted in the evening) to furl their sails, and to stand out to sea a short distance until it became late in the evening and dark, and then at night he entered the port"

While northern corridors bore a large share of sea traffic in antiquity and influenced coastal settlements and economies, there was also a corridor along the southern lee shore—the product of practical and economic necessity when the numerous ports along the African coast required extensive maritime intercommunication. Throughout antiquity, the ports of Cyrene's pentapolis communicated and traded with the wider Mediterranean world. They flourished especially during the Roman imperial era, participating in far-flung trade networks which attracted ships into their commercially and architecturally developed harbors from all over the Mediterranean. Seafarers frequenting these ports developed navigational strategies to ameliorate the harsh geographic and meteorological conditions. There are very few attestations of this North African coastal route in the Greek and Roman periods.[118] However, a very detailed description not only of this corridor but also of ancient navigation practices in general is found in the epistles of Synesius, the Bishop of Cyrene, who in the late fourth century traveled as a passenger on a freighter from Alexandria to Ptolemais (see Appendix C).

(*μέλλοντι δ' ἀπαίρειν συνεβούλευσεν ὁ Γάιος τὸν μὲν ἀπὸ Βρεντεσίου μέχρι Συρίας πλοῦν μακρὸν ὄντα καὶ καματηρὸν παραιτήσασθαι, χρῆσθαι δ' ἐπιτόμῳ τοὺς ἐτησίας ἀναμείναντι τῷ διὰ τῆς Ἀλεξανδρείας· τάς τε γὰρ ἐκεῖθεν ὁλκάδας ταχυναυτεῖν ἔφασκε καὶ ἐμπειροτάτους εἶναι κυβερνήτας, οἳ καθάπερ ἀθλητὰς ἵππους ἡνιοχοῦσιν ἀπλανῆ παρέχοντες τὸν ἐπ' εὐθείας δρόμον…καταβὰς δ' εἰς Δικαιάρχειαν καὶ ναῦς ὑφόρμους Ἀλεξανδρίδας ἰδὼν εὐτρεπεῖς πρὸς ἀναγωγήν, ἐπιβὰς μετὰ τῶν ἰδίων, εὐπλοίᾳ χρησάμενος, ὀλίγαις ὕστερον ἡμέραις ἀνεπιφάτως καὶ ἀφωράτως κατάγεται, κελεύσας τοῖς κυβερνήταις—περὶ γὰρ δείλην ὥραν ὁ Φάρος ἀναφαίνεται—τὰ μὲν ἱστία συνάγειν, ἔξω δὲ περὶ αὐτὸν μὴ μακρὰν ἀφισταμένους θαλαττεύειν ἄχρι τοῦ βαθεῖαν ἑσπέραν ἐπιγενέσθαι καὶ νυκτὸς τοῖς λιμέσι προσσχεῖν*); Plin. *NH* 19.1.3: "what is more amazing than the fact that there is a plant which brings Egypt so close to Italy that of two prefects Galerius reached Alexandria from the Strait of Sicily [Messina] in seven days and Balbillus in six [A.D. 55], and that in summer fifteen years later Valerius Marianus, the praetorian senator, [reached Alexandria] from Puteoli in nine days with a very gently breeze" (…*quodve miraculum maius, herbam esse quae admoveat Aegyptum Italiae in tantum ut Galerius a freto Siciliae Alexandriam septimo die pervenerit, Balbillus sexton, ambo praefecti, aestate vero post xv annos Valerius Marianus ex praetoriis senatoribus a Puteolis nono die lenissumo flatu?*). For other examples see Casson 1995, 297–9.

[118] Cf., e.g., *P. Mich.* 8.490, dated to the second century. An Egyptian recruit traveling from Alexandria to Rome routes a letter to his parents via a traveler he met in Cyrene: "Finding someone headed toward you I felt obliged to let you know that I am safe and sound" (*ἀπό Κυρήνης εὑρὼν τὸν πρός σε ἐρχόμενον ἀνάνκην ἔσχον σοι δηλῶσαι περὶ τῆς σωτηρίας μου*). Casson (1995, 297) assumes the ship must be an Alexandrian grain freighter taking a southerly route toward Rome, but there is not enough evidence to support this conclusion. Indeed, as Synesius makes clear (*Ep.* 4.50–54, Appendix C), the larger freighters were noted for taking the usual northern corridor.

2. Maritime Corridors in the Western Mediterranean

In the Western Mediterranean the several regional and periodic wind streams over the sea helped shape multiple corridors both along the coasts and over stretches of open water (fig. 3.4). Winds in the Strait of Gibraltar and the Alboran Sea in summer are strongly conditioned by diurnal effects of flanking coasts, shifting back and forth between westerly (17%, the *vendeval*, occurring usually in the morning) and easterly (35%, the *levanter*, afternoon and evening). The strategy for ships exiting the Mediterranean was not to fight the strong central inflow, but to wait for easterly winds and skirt the coastal margins where countercurrents develop.[119] Entering the Mediterranean, on the other hand, simply entailed using a westerly wind and steering mid-channel on the back of the Atlantic inflow.

Over the open sea between the Balearics and Sardinia, Rome's Mare Sardoum, the mistral would have easily carried ships from northern ports south and east toward the Strait of Bonifacio (between Corsica and Sardinia), and through it to the Italic coast or south past Sardinia into the Sicilian Channel, there aided by eastbound currents. However, while northerlies and northwesterlies predominate here, conditions mirrored for the most part by surface currents, winds from nearly every other quarter arise at different times of day and for certain short periods in summer, as well as frequent conditions of calm.[120] Closer to the Maritime Atlas, easterlies tend toward the majority and flow counter to the strong surface current, often resulting in steep seas, while in the Tyrrhenian Sea—bounded on three sides by large landmasses—northerlies (the tramontana), northwesterlies and diurnal winds govern that region's wind regime.

These primary wind streams influenced the patterning of Greek and Roman maritime corridors in this region, but corroborating evidence in ancient sources is sorely lacking. Instead, despite a rich representation of some Greek but primarily Roman-era shipwrecks discovered throughout the region, we receive only a smattering of references to point-to-point voyages, nearly all from the first four centuries of our era and all only partially indicative of communications between the four major economic centers: Rome/Italy, Gaul,

[119] Hodge 1983, 80; Ponsich 1974.

Spain and Africa (Carthage). Rougé assumes three *grandes routes* in the western basin under the Empire based on their relevance to the Roman economy.[121] Here we may consider them more broadly as maritime corridors:

- *Spain to Italy/Sicily*. Merchant ships filled with wine, oil and garum departed the main ports of Baetica (e.g., Gadeira), transited through the Strait with the Atlantic inflow (where winds could be favorable or foul, depending on the time of day and year). Keeping the Pityussae and Balearic islands on their port beam and quarter as far as possible, they then made an open-sea crossing toward Sardinia (with the current, sometimes with head winds).[122] On the approach to the island they either made for the Strait of Bonifacio at the northern end or doubled Cape Caralitanum in the south before heading to the ports of Rome or Sicily.[123] Judging from the discovery of a Roman wreck carrying Baetican oil amphoras just south of Elba, an alternative corridor apparently paralleled the northern shore and entailed rounding northern Corsica before heading south toward Ostia. The length of the voyage depended on the sequence of winds encountered along the way, taking as little as seven days between Gadeira and Ostia, but as much as three months if winds were consistently contrary.[124]

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[120] Indeed, one wonders to which winds was Strabo (3.2.5) referring when he stated that "winds on the high seas blow regularly" (*ἔχουσι δὲ καὶ οἱ ἄνεμοι τάξιν οἱ πελάγιοι*). Perhaps he was referring to the periodic winds off the along the Maritime Atlas which Posidonius remarked upon (below, n. 124)

[121] Rougé 1966, 93–6.

[122] The reverse of this course is described in Agathem. 16: "to Gadeira [from Caralis in Sardinia] by sailing under the Gymnasiae islands, 10,000 stadia [total]" (*ἐπὶ Γάδειρα ὑπερπλεύσαντι Γυμνησίας νήσους στάδια μύρια*). This open-sea route is discussed in Arnaud 2005, 67, 158 no. 4.

[123] Both maritime corridors from Spain to Italy around Sardinia are archaeologically attested in the numerous Roman wrecks carrying Spanish Dressel 7-11 amphora cargoes found off Sardinian shores. The majority of wrecks cluster in the Strait of Bonifacio, but others have been found at the southern end of Sardinia (Parker 1992, 19 and fig. 9). A reference by Varro to a corridor between southern Sardinia and Sicily is preserved in Servius *In Verg. Aen*. (1.108): "There are those who direct their course from Sardinia to Sicily or the other way. For if they let both [islands] slip from their sight they know they are navigating dangerously and are fearful of a hidden island [i.e., shoals of Skerki Bank, below, n. 129] on the open sea which they call the Altars" (…*qui ab Sardinia Siciliam aut contra petunt. Nam si utramque ex conspectus amiserunt, sciunt periculose se navigare ac verentur in pelago latentem insulam, quem locum vocant aras*).

[124] According to Pliny (*NH* 19.1.4), a voyage from Gadeira to Ostia took seven days, from Hither Spain four (*herbam esse quae Gades ab Herculis columnis septimo die Ostiam adferat et citeriorem Hispaniam quarto*). Strabo (3.2.5) relates an exceptional voyage of Posidonius from Spain (Gadeira at 17.3.4) to Italy, during which crew and

- *Gaul to Italy*. Merchant ships from Gallic ports (Narbonne, Arelate, Massilia, among others) bound for Ostia either coasted through the Ligurian Sea using diurnal winds and the mistral (Lat. *circius*) until they reached northern Corsica (Sacrum Promontory, modern Cap Corso), or harnessed the same wind to transit directly southeast over open water to the Strait of Bonifacio, thence to the Tiber mouth.[125] The voyage could take as little as three days with favorable winds.[126] Return voyages may have used Populonia as a jump-off point.[127]

- *Africa/Sicily to Italy*. Allusions to this route are abundant, but the details are wanting.[128] Ships from Utica or Carthage relied on southerly or westerly winds to strike out across the Sicilian Channel toward Italy. They took either of two routes: (1) toward Lilybaeum, whence they rounded western Sicily, sighted the small island of Ustica (northwest of Sicily), then headed northeast across the Tyrrhenian Sea for Puteoli or the ports of Rome;[129] or (2) toward Caralis on the southern shore of Sardinia, after which they paralleled the eastern coast of that island (using diurnal

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vessel fought against southeast winds (*οἱ εὖροι*) for three months on several long tacks (*ἴδιον δέ τί φησι Ποσειδώνιος τηρῆσαι κατὰ τὸν ἀνάπλουν τὸν ἐκ τῆς Ἰβηρίας, ὅτι οἱ εὖροι κατ' ἐκεῖνο τὸ πέλαγος ἕως τοῦ Σαρδῴου κόλπου πνέοιεν ἐτησίαι· διὸ καὶ τρισὶ μησὶν εἰς Ἰταλίαν κατᾶραι μόλις παραδιενεχθεὶς περί τε τὰς Γυμνησίας νήσους καὶ περὶ Σαρδόνα καὶ τὰ ἄλλα ἀπαντικρὺ τούτων μέρη τῆς Λιβύης*). For commentaries on this specific passage see Wallinga 2000 and El Houcine 2002, esp. 118–21.

125 The northerly corridor around Cap Corso is implied by the Elder Pliny (*NH* 2.46.121), who explains that the *Circius* wind, the modern mistral (see pages 37 and 90), usually carries a vessel "directly across the Ligurian Sea to Ostia" (*Ostiam plerumque recto Ligustico mari perferens*). On a Roman *dolia* ship from Gaul attempting (but failing) to round this cape in the first century B.C. cf. Marlier and Sibella 2002, 169. Working northward against prevailing northerlies in this region was accomplished either under oars or under sail using diurnal winds close in, or both, as Rutilius Namatianus (*De Reditu Suo*) described in his galley voyage from Rome to Gaul A.D. 416. His late autumn voyage saw occasional southerlies (1.237).

126 Plin. *NH* 19.1.4.

127 Agathem. 5.20: "The jump-off point to Sardinia and Corsica is Tyrrhenian Populonia" (*Ἀφετήριον δ' εἰς Σαρδὼ καὶ Κύρνον Ποπουλώνιον τῆς Τυρσηνίας*).

128 See, e.g., Plin. *NH* 15.20.75 (the three-day transit time, *tertium…ante diem*, was used by Cato the Elder, along with a Carthaginian fig, to show the Senate Carthage's proximity to Rome); *NH* 19.1.4 (a two-day record transit set by one Gaius Flavius); Plut. *Marius* 8.5 (Marius departed Africa for a three-four day transit to Rome with favorable winds).

129 A route now dramatically attested by the minor graveyard of Roman ships, five in all plus amphora trails of numerous others, discovered lying on the seabed in a tight cluster at Skerki Bank, a submerged geological feature off in the Sicilian Channel (McCann and Oleson 2004).

breezes to make progress) on their way northward to the Strait of Bonifacio.[130] From here, as above, they struck due east toward the ports of Rome.[131]

3. Maritime Corridors in the Black Sea

The Black Sea's open configuration, variable winds and generally weak currents resulted in a wide variety of navigational options throughout the warm and marginal seasons. Here, although the patterning of corridors akin to those of the Mediterranean generally resists mapping, we may safely assume that the slightly predominating northerly winds would have facilitated the development of routes over the open sea from the northern quarter southward (fig. 3.4). This is particularly the case in the western half where northeasterlies from July to September flow toward the Bosphorus, funnel down the Dardanelles and feed the etesian flow into the Aegean and beyond. But this axis did not exist to the exclusion of other potential and simultaneous corridors. Others, we may postulate, were shaped by a combination of coastal voyages using helpful diurnal winds on the one hand, and efficient crossings determined by trading ties and alternating winds on the other.

Unfortunately, in spite of the Black Sea's important role in intensive Greek colonization during the Archaic and Classical periods and the ensuing vibrant intra- and extra-regional trade between Pontic cities and Aegean centers, particularly in the fourth century B.C., our sources for such corridors are not abundant. Indeed, literary evidence attesting to routes along any stretch of coast or in the open sea is generally limited to the

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[130] Caesar, *B Afr.* 98: "After he had settled these affairs he embarked the fleet at Utica on the ides of June, and three days after arrived at Caralis in Sardinia…and on the third day before the kalends of July the ship departed from Caralis and proceeded by sea sticking close to land, and after a voyage of twenty-eight days, during which he was several times constrained by bad weather to put into port, arrived at Rome" (*His rebus gestis Idibus Iun. Uticae classem conscendit et post diem tertium Caralis in Sardiniam pervenit…et ante diem IIII Kal. Quint. navis conscendit et a Caralibus secundum terram provectus duodetricensimo die, ideo quod tempestatibus in portibus cohibebatur, ad urbem Romam venit*). The Africa-Caralis route is attested also by Roman-era shipwreck discovered off ancient Caralis and carrying Africana 2B-D amphoras (Parker 1992, 20 and fig. 14).

[131] Rougé (1966, 95, n. 3) attributes to Strabo (5.2.7) and Caesar (*B Afr.* 98, above) a roundabout coastal route from Africa to Ostia, one that took in the east coasts of Sardinia and Corsica as far as Elba, then crossing to Populonia before heading south to Ostia. Neither passage indicates any such route, although Caesar's voyage to Rome (above n. 130), made most likely in a galley, may have been constrained to follow the coast to provision the rowers.

simple statements of historians and geographers from which we may derive some general observations:[132]

- *Coastal Corridors*: Maritime trade and trade agreements among Black Sea coastal cities and with the Aegean are well-documented archaeologically, epigraphically and in the literature, but the actual routes that were utilized remain generally unknown. Only three authors use language to describe coastal voyages: Demosthenes in his speech *Against Lacritus* (a merchant voyage from Athens to Borysthenes [Dnieper] via the Thracian Bosphorus, and another between Pantikapaion and Theodosia);[133] Strabo (describing a coasting voyage between Amisus/Sinop and Colchis);[134] and Arrian, the Emperor Hadrian's governor of Cappadocia, in his *Periplus Ponti Euxini* (describing in some detail a voyage in state galleys between Trapezus and Dioscurias).[135] Arrian's voyage is remarkable for detailing the utility, and dangers, of using diurnal winds for coastal voyages along the southern and eastern shores of the Black Sea.

- *Open-Sea Corridors*: Greek and Roman historians and geographers who specify north-south and east-west distances within the Black Sea may preserve some vestige of

[132] Arnaud (1992) provides a useful overview of the sources that touch upon Black Sea geography, but from them constructs maps with scores of implausible straight-line routes between ports.
[133] Dem. 35.10: "Androcles of Sphettus and Nausicrates of Carystus lent to the Phaselites Artemo and Apollodorus three thousand drachmae in silver for a voyage from Athens to Mende or Scione, and thence to Bosporus, or if they should wish, for a voyage to the left parts of the Pontus as far as the Borysthenes, and thence back to Athens" (*Ἐδάνεισαν Ἀνδροκλῆς Σφήττιος καὶ Ναυσικράτης Καρύστιος Ἀρτέμωνι καὶ Ἀπολλοδώρῳ Φασηλίταις ἀργυρίου δραχμὰς τρισχιλίας Ἀθήνηθεν εἰς Μένδην ἢ Σκιώνην, καὶ ἐντεῦθεν εἰς Βόσπορον, ἐὰν δὲ βούλωνται, τῆς ἐπ' ἀριστερὰ μέχρι Βορυσθένους, καὶ πάλιν Ἀθήναζε*); 35.31: "This man, Lacritus, said that the ship had been wrecked while coasting from Pantikapaion to Theodosia" (*Λάκριτος δὲ οὑτοσὶ ναυαγῆσαι ἔφη τὸ πλοῖον παραπλέον ἐκ Παντικαπαίου εἰς Θεοδοσίαν*). Cf. Pseudo-Scylax 68: "From Kriou Metopon to Pantikapaion the voyage is a day and a night" (*Ἀπὸ δὲ Κριοῦ μετώπου πλοῦς εἰς Παντικάπαιον ἡμέρας καὶ νυκτός*).
[134] Strab. 2.1.11: "And that the voyage from Amisus to Colchis lies in the direction of the equinoctial east is demonstrated by the winds, by the seasons, by the crops and by the risings of the sun themselves" (*Ὅ τε ἐξ Ἀμισοῦ πλοῦς ἐπὶ τὴν Κολχίδα ὅτι ἐστὶν ἐπὶ ἰσημερινὴν ἀνατολήν, καὶ τοῖς ἀνέμοις ἐλέγχεται καὶ ὥραις καὶ καρποῖς καὶ ταῖς ἀνατολαῖς αὐταῖς*); 11.2.17: "On the Phasis lies a city of the same name, an emporium of the Colchii…From there the voyage to Amisus and Sinope is two or three days" (*ἐπίκειται δὲ τῷ Φάσιδι ὁμώνυμος πόλις, ἐμπόριον τῶν Κόλχων…ἐντεῦθεν δὲ πλοῦς ἐπ' Ἀμισοῦ καὶ Σινώπης τριῶν ἡμερῶν ἢ δύο*).
[135] Arrian, *Periplus Ponti Euxini* 3–17.

otherwise unattested shipping routes.[136] The fourth-century-B.C. *periplus* of Pseudo-Scylax describes a coasting voyage from the Thracian Bosphorus to the mouth of the Ister (Danube), thence due east across the open sea of the Gulf of Karkinitis (some 200 nm) to Kriou Metopon on the southern tip of Crimea, a voyage of three days and three nights.[137] During the same century grain ships of the Bosporan Kingdom, bound for the Piraeus, likely sailed with favorable, northeasterly winds from the Cimmerian Bosphorus and Theodosia to the entrance of the Thracian Bosphorus,[138] although some stress the importance of Heraclea Pontica as a rest or compulsory stop for ships headed either way.[139] Strabo's comment that people sailing across the strait between Kriou Metopon and Karambis can sight both headlands at the same time, albeit a physical impossibility,[140] nevertheless bespeaks the existence of an open-sea passage spanning the narrowest distance between northern and southern

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[136] See, e.g., Hdt 4.86.2 (Nine days and eight nights from the [Thracian] Bosphorus to Phasis); 4.86.3 (Three days and two nights for the longest crossing between the Cimmerian Bosphorus and the River Thermodon); Ammianus Marcellinus 22.8.20 (2,500 stades between Karambis and Kriou Metapon).

[137] Pseudo-Scylax 68: "Strait from the Ister to [cape] Kriou the voyage takes three days and three nights, but along the coast the voyage is double, for it is a gulf" (*εὐθὺς ἀπὸ Ἴστρου ἐπὶ Κριοῦ μέτωπον τριῶν ἡμερῶν καὶ τριῶν νυκτῶν, ὁ δὲ παρὰ γῆν διπλάσιος· ἔστι γὰρ κόλπος*). For commentary on this passage, see Gajdukevich 1969, 11–14; Arnaud 1992, 61.

[138] Cf. Plin. *NH*, 4.12.77: "Between the two Bospori, the Thracian and the Cimmerian, there is a distance in a straight line of 500 miles, as Polybius says" (*at inter duos Bosporos Thracium et Cimmerium derecto cursu, ut auctor est Polybius, D intersunt*).

[139] Isager and Hansen 1975, 61. For a thorough discussion of the trade of Heraclea Pontica with north Pontic centers see Saprykin 1997, 91–129, esp. 100–2.

[140] Strab 7.4.3: "At any rate, many who have sailed across the strait say that they have seen both promontories on either side at the same time" (*συχνοὶ γοῦν τῶν διαπλευσάντων τὸν πορθμὸν ἅμα φασὶν ἰδεῖν ἀμφοτέρας ἑκατέρωθεν τὰς ἄκρας*). Leaf (1916, 4 and n. 3b) took Strabo's hyperbole on faith and wrote that "in clear weather it is…possible to cross without ever losing sight of land." Hind (2001, 25) modified this somewhat: "…in favourable circumstance it seems that it was possible to set sail, see night fall before losing sight of land, and then see the destination-coast as soon as dawn broke the next morning." The narrowest distance between the northern and southern shores is in fact 160 nm (260 km). To satisfy either hypothesis, a ship would have to travel at 15 kts or more, although it is well-established (Casson 1995, 280–96) that merchantmen and galleys rarely exceeded 6 kts. The crossing more likely took between 30 and 36 hours: a ship leaving in the morning in highly favorable conditions (a relative rarity) could arrive in the afternoon of the next day. Cf. Agathemerus 4.18, where Karambis (a cape renowned in epic: see Ap. Rhod. *Argon.* 2.361) is recorded as the terminus or, more likely, a jump-off point to the north shore for a route originating in Rhodes.

coasts, possibly from as early as the later sixth century B.C.; such a passage is well-attested by archaeological finds at Chersonesos and Sinope.[141]

In addition to these major and minor corridors there were countless others crisscrossing the Mediterranean and Black Seas and paralleling their shores, each trafficked by various kinds of ships serving various purposes—bulk grain freighters under government commission, point-to-point merchantmen, caboteurs, fishing boats, ferry and passenger vessels, dispatch galleys, warships in convoy and generals fleeing naval defeats by the quickest and safest route. And it should be stressed that navigational choices, decisions and preferences were subject to change on a daily (if not hourly) basis *while en route* due to any number of circumstances, whether evolving weather and sea conditions or more human agents such as piracy, trade agreements, commercial rivalries, inflated port tolls[142] and political unrest affecting destinations.

IV. CONCLUSIONS

Several factors influenced the patterning of maritime movement in antiquity. In the last chapter we explored the *natural* factors that conditioned the navigational environment—coastal and island configurations, the set and intensity of surface currents, the character of seasonal, regional, local and diurnal winds and the various degrees of visibility at sea level. In this chapter we explored the technological and human responses to this natural environment—the classes, sizes, rigs and speeds of ships developed in the shipyards of the Mediterranean to endure and operate successfully within their intended environments, and the seasonal rhythms of navigation expressed as a fluctuating scale of risk, necessity and commercial motivation. The resultant dense and shifting network of routes traversed by

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[141] Doonan 2004, 9–11, 80; Hiebert 2001; Hiebert et al. 1997; Saprykin 1997, 91–129; Gajdukevich 1969; Maksimova 1956, 145–68; Maksimova 1959. On the possible earliest date of this north-south route, see Tsetskhladze 2007, 168.

[142] Cassiodorus (*Variae* 4.19), for example, observed that sailors dreaded customs collectors more than shipwreck. In general terms, it would have been natural for traders to alter there accustomed routes to avoid particular harbors undergoing proactive customs collection. Understandable in this respect was the popularity

Greek and Roman commercial ships is, as we saw, impossible to map at any scale, but ancient sources and the distribution of known shipwrecks reveal roughly defined *corridors* of movement—some involving coastal passages, others short or extended open-sea voyages, still others both modes of navigation—through which some commercial shipping, perhaps even a majority of it, moved.

The next three chapters will explore the implications of these navigational conditions vis-à-vis the actual practice of navigation, that is, how Greek and Roman seafarers solved the universal problems of navigation—the determination of direction, position and distance—within this maritime environment.

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of "Thieves' Harbor" (*limen phoron*), an anchorage and haven unsupervised by customs agents somewhere near Athens between Phaleron and Piraeus (see Dem. 35.28).

Chapter 4: *Wind Roses*

The sailor talks of winds, the plowman his oxen,
the soldier counts his wounds, the herdsman his sheep.
—Propertius[1]

I used to command the Rhodian winds and the
quarters of Ocean, when I wanted to sail, when I
wanted to stay there, I used to say to the quarters of
Ocean, "Let not the seas be smitten! Subdue the
Ocean to the seafarers! Lo, in full strength the wind
Is rising! Shut up your storm-winds, Night, and
Make the waters smooth to cross!"
—Greek sailor's song, third century A.D.[2]

In late summer of 48 B.C., Caesar was chasing the vanquished general Pompey eastward in the aftermath of the battle of Pharsalus. As soon as Caesar crossed the Hellespont onto Asian soil he learned that Pompey had fled to Egypt. Having dashed to Rhodes he immediately organized ships for the pursuit to Alexandria. According to Appian's version, Caesar did not wait for his army to catch up, but took a small squadron of Rhodian triremes and what few men he had with him and set sail: "Letting nobody know whither he intended to go he embarked toward evening and told the other pilots to steer by the torch of his own ship by night and his signal by day. After he had gained some distance from shore he ordered his pilot to bear him to Alexandria, and after a three days' sail on the open sea he arrived there."[3]

Appian's otherwise innocuous description of Caesar's pursuit of Pompey encapsulates the core challenges of navigation in antiquity, challenges that pertained as much to merchant ships as they did to warships: How did Caesar's pilot know which *direction* to steer to bear the squadron to Alexandria? How did he estimate his *position* on the open sea, if he did so at all? And how did he estimate the *distance* the voyage entailed? This chapter is

[1] Prop. 2.1.43–4: *navita de ventis, de tauris narrat arator, | enumerat miles vulnera, pastor ovis.*
[2] From a papyrus fragment found in Oxyrhynchus and translated by Page 1970, 431.
[3] App. *B Civ.* 2.13.189: *οὐδενί τε ἐκφήνας, ὅπῃ τὸν πλοῦν ποιήσεται, περὶ ἑσπέραν ἀνήγετο, ἐπαγγείλας τοῖς λοιποῖς κυβερνήταις πρὸς τὸν λαμπτῆρα τῆς ἑαυτοῦ νεὼς καὶ μεθ' ἡμέραν πρὸς τὸ σημεῖον εὐθύνειν· τῷ δ' αὐτοῦ*

devoted to answering the first question by exploring the ways in which Greek and Roman seafarers exploited winds for the purposes of determining orientation, maintaining course steerage and developing voyaging strategies.

As we saw in Chapters 2 and 3, numerous winds in the wider Mediterranean region are characterized by their regular frequency, strength and directional flow at certain times of the year. The etesians (meltemi) in the east and the circius wind (mistral) in the west represent the best known periodic winds, popularized as they were in the literature. These and many other winds blew so regularly from one area on the horizon that they became virtually synonymous with direction, not only conceptually but also in terms of nomenclature: *Zephyros*, for instance, meant not only a wind that blew from the west, but also expressed the direction we call West. Likewise for *Notos/Auster* (south), *Apeliotes/(Sub)solanus* (east), *Boreas/Septentrio* (north) and the quarters in between. Seafarers relied heavily on these steady winds to gain directional and orientation information at sea and to maintain the heading required to reach their destinations. A deep knowledge of winds and how they played on the movement of the ship was thus crucial to maintaining an effective course: "The wind and the helmsmen did the steering" was one of Homer's formulaic phrases.[4]

The expression of this wind-referenced system of orientation was a circular arrangement representing the observer's 360-degree horizon and divided into a certain number of sectors associated with specific winds. Aristotle referred to it variously as a *theseis anemōn*, *horizontos kyklos* and *hypographē*, Varro simply as an *orbis ventorum*.[5] Today we refer to it as a wind rose, a term taken from the physical compass card which at one time depicted under a floating needle the arrangement of Mediterranean winds in the Italic seafaring tradition. In antiquity it appears to have been largely a mental construct, although, as we shall see later, some monumental forms in marble have survived. As a conceptual tool its value to the history of navigation is considerable, as it informs us not only of the rich and fluid nautical idiom in use throughout antiquity and beyond into the Middle Ages, but also of changing frames of reference and concepts of orientation.

κυβερνήτῃ, πολὺ τῆς γῆς ἀποσχών, προσ αὑτοῦ κυβερνήτῃ, πολὺ τῆς γῆς ἀποσχών, προσέταξεν ἐς Ἀλεξάνδρειαν φέρεσθαι. καὶ ὁ μὲν τρισὶν ἡμέραις πελάγιος ἀμφὶ τὴν Ἀλεξάνδρειαν ἦν. Cf. above, page 79 n. 113.

[4] Hom. *Od.* 9.78 (*ἄνεμός τε κυβερνῆταί τ' ἴθυνον*). The formula is also found at *Od.* 11.10, 12.152 and 14.256.

[5] Arist. *Met.* 363a21, 26–7 respectively; Varro *RR* 3.5.17.

This chapter explores four aspects of Greek and Roman wind roses as they relate to ancient navigation: (I) their origin and evolution as expressed in scientific, geographical and historical writings, (II) the wind rose or roses utilized in the maritime sphere, (III) the possible manifestation of wind roses aboard ship, and (IV) how winds and wind roses may have been used in association with specific routes.

I. Greek and Roman Wind Roses

The history of the wind rose among both ancient writers and modern scholars is relatively well known. The Elder Pliny could cite more than twenty Greek authors who recorded their observations of winds and the respective directions from which they blow,[6] and nearly as many modern works on the topic have appeared in print between 1837 and 1958.[7] The numerous extant works on winds permit us to trace the various ways in which winds were organized.

1. Homer to Aristotle

Discussions of ancient wind roses begin with Homer's simple and consistent use of four cardinal winds, *Boreas* (north), *Notos* (south), *Zephyros* (west) and *Euros* (east).[8] By the late Archaic period Ionian writers such as Hecataeus added other directional references based on the movement of the sun at rising, setting and midday; the Bear (*Arktos*) supplemented

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[6] Plin. *HN* 2.45.117. Cf. Seneca, *Q Nat.* 5.17.5: "I would have an infinite chore if I wished to discuss each and every wind" *(Infinitum est si singulos velim persequi*). This great variety of winds and wind roses prompted Aulus Gellius (*NA* 2.22) to ask the learned Favorinus to clarify the names and quarters of winds due to a lack of general agreement as to their designations, positions or number (*neque de appellationibus eorum neque de finibus neque de numero*).

[7] The subject is treated as early as 1837 by von Raumer. The critical and comprehensive studies are Kaibel 1885, Gilbert 1967 [1907], Rehm 1916, Thompson 1918 (correcting Kaibel, but ignoring Rehm), Nielsen 1945 (especially on the etymologies of wind names and Latin equivalents to Greek names) and, most importantly, Masselink 1956 (a lengthy study in Dutch, with an English summary).

[8] See Hom. *Od.* 5.295–6 where they all appear together. Masselink (1956, 239) suggests that Homer (*Il.* 9.5) couples *βορέας* with *ζέφυρος* to imply a northwest wind, but this is guesswork. Wood (1894, 77–8), followed by Thompson (1918, 53) and Nielsen (1945, 7–8), maintain the possibility that the twelve colts begotten by Boreas of the mares of Erichthonius (*Il.* 20.225) represent intermediate winds, as may the six sons and six daughters of Aeolus (*Od.* 10.2–7). It is clear, however, that whatever the anemological idiom of Homer's day he chose to include just four winds.

Boreas as a north reference.[9] Herodotus expanded the vocabulary to include not only solstitial points on the eastern and western horizons, but also two new winds: *Lips* from the southwest, and *Apeliotes* from due east. By the fifth century B.C. *Euros* had inexplicably moved to the southeast sector.[10] This combination of terms resulted in an eight-point system of orientation (fig. 4.1).

The first horizon reference system based solely on wind names is found in Aristotle's Meteorology (fig. 4.2).[11] Aristotle's rose of ten winds has at its core the Ionian eight-point system. In place of solstitial points, however, are a new set of wind names. The two northerly winds *Thraskias* (north-northwest) and *Meses* (north-northeast) are localized by the imaginary line of the 'ever-visible circle.' This was the maximum diameter of the circumpolar constellation *Arktos*. The two opposing winds at south-southwest and south-southeast remain unnamed, although he does allow for a local wind in the south-southeast called *Phoinikias*. These ten winds, in Aristotle's view, could be reduced further to four, and even two (with a northerly and southerly grouping).[12]

Worthy of notice are the numerous wind names associated with specific geographic locales around the Aegean seaboard: *Thraskias* blows out of Thrace; *Olympias* spills down from Mt. Olympus; *Skirōn* originates at the Scironian rocks of the Megarid; and *Kaikias* was thought to derive from the wind exiting the valley of the river Kaïkos in Mysia (near Aristotle's residence on Lesbos). Only two winds arrive from outside the Aegean orbit—*Lips*, a wind associated with Libya, and *Phoinikias*, a wind whose origins were associated with

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[9] Hecataeus, for example, referred to east as "toward the rising sun" (*πρός ἥλιον ἀνίσχοντα*: *FGrHist* 204); west as "from the setting [of the sun]" (*ἀπὸ δύσιος*: 217); north as "toward the Bear" (*πρὸς ἄρκτον*: 29b) and "toward Boreas" (*πρὸς βορεω*: 100); and south as "toward the middle" (*πρὸς μεσημβρίαν*: 163) and "toward notos" (*πρὸς νότον*: 102b).

[10] See Hdt. 1.193, where the canal of Babylon is described as running "toward the winter sunrise" (*πρὸς ἥλιον τετραμμένη τὸν χειμερινόν*), a reference to the southernmost point the sun reaches on the eastern horizon. On *λίψ*, see 2.25: "and, as expected, those blowing from that country [Libya], the south and the southwest, are the most rainy of all winds." (*καὶ εἰσὶ οἰκότως οἱ ἀπὸ ταύτης τῆς χώρης πνέοντες, ὅ τε νότος καὶ ὁ λίψ, ἀνέμων πολλὸν τῶν πάντων ὑετιώτατοι*). On the shifting of *εὗρος* to the southeast position in the Classical period, see Nielsen 1945, 18.

[11] Arist. *Met.* 363a21–365a13.

[12] Aristotle's tendency toward reduction may have been influenced by Thrasyalces of Thasos, whose name Strabo (1.2.21) associated with a two-wind (northerly/southerly) system.

Phoenicia.[13] Despite the outliers it is possible to surmise a maritime origin (naval, commercial, or both) to the rose based on a frame of reference located in the central Aegean.

Wind roses after Aristotle follow two different paths—a full twelve-wind system as represented by Timosthenes (but with a variant in the Aristotelian corpus, discussed below) and an eight-wind system employed by Hellenistic scientific writers.

2. Timosthenes' Rose of Twelve Winds

Timosthenes, a Rhodian naval commander under Ptolemy II Philadelphus (308–246 B.C.), wrote an influential geographical work in ten books entitled *On Harbors* (*Peri Limenōn*), only fragments of which survive in later authors and scholia.[14] Judging from the fragments, it contained lengthy descriptions of harbors and coasts of the Mediterranean and adjacent seas, as well as measurements of coastlines, crossings and meridian coincidences from the east coast of Africa to as far west as the Atlantic coast of Spain. One of Timosthenes' major contributions to geography was an improved wind rose, attributed to him by the third-century A.D. geographer Agathemerus.[15] Agathemerus first establishes Aristotle's core eight-wind system based on solstitial and celestial points, then introduces the four additions made by Timosthenes:

> But Timosthenes, the writer of circumnavigations (*periploi*), says that there are twelve [winds]. He placed *Boreas* between *Aparktias* and *Kaikias*; *Phoinix* also called *Euronotos* between *Euros* and *Notos*; *Leukonotos* or *Libonotos* between *Notos* and *Lips*; and *Thraskias* or *Kirkios* (the latter so called by those who dwell there) between *Aparktias* and *Argestes*. The tribes who inhabit the borders toward *Apeliotes*, he says, are the Bactrians; toward *Euros* are the peoples of India; toward *Phoinix* are the Red Sea and Ethiopia; toward *Notos* is Aethiopia beyond Egypt; toward *Leukonotos* live the Garamantes beyond the Syrtides, toward *Lips* are the western Ethiopians beyond Moors; toward *Zephyros* are the Pillars [of Hercules] and the

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13 So it is stated by Timosthenes (= Agathemerus 7) and the author of the pseudo-Aristotelian treatise *Situations and Names of Winds* (12–13; below, pages 95–7). Böker (1958a, 2316), however, in order to explain one of Aristotle's two exceptions to the pan-Aegean wind rose, suggests that φοινικίας may have been derived from Mt. Phoenix, a prominent peak in the Rhodian peraia east of Loryma (described in Strabo 14.2.4; see Talbert 2000, 61, G4) rather than from Phoenicia in the Levant. This idea has much to commend it, especially because Aristotle (364a3) provides no specific localization of the wind ("so-called by people in that area").

14 On Timosthenes' work, see below, pages 101–2, 177–9.

15 *GGM* 2:471–87; Diller 1975.

> beginnings of Libya and Europe; toward *Argestes* is Iberia which is now called Hispania; toward *Thraskias* are the Celts and their neighbors; toward *Aparktias* are the Scythians who live beyond Thrace; toward *Borras* is Pontos Maeotis and Sarmatians; and toward *Kaikias* is the Caspian Sea and the Sacae.[16]

The precise inspiration behind this new geometric rose is uncertain. Timosthenes' credentials as a master mariner suggest that the maritime community of the Eastern Mediterranean were employing a twelve-wind rose divided into convenient 30° sections, and Timosthenes was simply reporting general practice. On the other hand, his equation of winds with regions and peoples strongly suggests that Timosthenes was incorporating his observations into a general framework of geographic writing (see below, page 178). In particular, the association of the Pillars with due west and Bactria with due east suggests the strong influence of Dicaearchus of Messene (Sicily). Dicaearchus (ca. 326–296 B.C.), a pupil of Aristotle, wrote a *Periodos gēs* or *Periegēsis* in which he established a main parallel of latitude that took in the Strait of Gibraltar, Sardinia, the Strait of Messina, Rhodes, the Taurus Mountains, the Elburz range, the Hindu Kush and the Himalayas.[17] The work later influenced the geographies of Eratosthenes, Strabo and Ptolemy. Timosthenes' rose, then, may have blended a practical rose of twelve winds with emerging geographic knowledge of the *oikoumenē*. The result was a rose that was applicable not just to the Aegean, as Aristotle's rose was, but to all regions of the Mediterranean, Red Sea and Indian Ocean (fig. 4.3).[18]

The wind names blend tradition with innovation. *Boreas*, apparently a more widely recognized wind than *Meses*, takes that wind's place at north-northeast, while *Aparktias* assumes position as cardinal north. Aristotle's *Phoinikias* returns as *Phoinix* but with the alternative name *Euronotos*, a combination of *Euros* and *Notos*. This name, like

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[16] Agathem. 6–7 (*GGM* 2:473; Wagner 1888, fr. 6; Diller 1975, 61–2, 67–8): *Τιμοσθένης δὲ, ὁ γράψας τοὺς περίπλους, δώδεκά φησι, προστιθεὶς μέσον ἀπαρκτίου καὶ καικίου βορέαν, εὔρου δὲ καὶ νότου Φοίνικα τὸν καὶ εὐρόνοτον, μέσον δὲ νότου καὶ Λιβὸς τὸν λευκόνοτον ἤτοι Λιβόνοτον, μέσον δὲ ἀπαρκτίου καὶ ἀργέστου Θρασκίαν ἤτοι κίρκιον ὑπὸ τῶν περιοίκων [ὀνομαζόμενον]. Ἔθνη δὲ οἰκεῖν τὰ πέρατα κατ' ἀπηλιώτην Βακτριανοὺς, κατ' εὖρον Ἰνδοὺς, κατὰ Φοίνικα Ἐρυθρὰν θάλασσαν καὶ Αἰθιοπίαν, κατὰ νότον τὴν ὑπὲρ Αἴγυπτον Αἰθιοπίαν, κατὰ λευκόνοτον τοὺς ὑπὲρ Σύρτεις Γαράμαντας, κατὰ Λίβα Αἰθίοπας δυσμικοὺς [τοὺς] ὑπὲρ Μαύρους, κατὰ ζέφυρον Στήλας καὶ ἀρχὰς Λιβύης καὶ Εὐρώπης, κατ' ἀργέστην Ἰβηρίαν τὴν νῦν Ἱσπανίαν, κατὰ δὲ Θρασκίαν [Κελτοὺς καὶ τὰ ὅμορα, κατὰ δ' ἀπαρκτίαν] τοὺς ὑπὲρ Θρᾴκην Σκύθας, κατὰ δὲ βορρᾶν Πόντον, Μαιῶτιν, Σαρμάτας· κατὰ καικίαν Κασπίαν θάλασσαν καὶ Σάκας.*

[17] Dicaearchus, *GGM*, 1:97–110, 238–43. The title may not be his. The extended parallel of latitude is referenced in Agathemerus 1.5 (*GGM* 2:472).

[18] Aujac 1966, 261; Kidd 1988, 521.

Libonotos/Leukonotos in the south-southwest, found little usage in the general literature, although the anonymous author of the *Periplus Maris Erythraei* from the mid first century A.D. (see below, pages 170–1) employed the term *Libonotos* to describe the annual monsoon wind in the Indian Ocean.[19] *Kirkios*, the modern mistral, is the first name of a western Mediterranean wind to appear in a Greek wind rose; it derives its name from a convenient promontory in Latium (Kirkaion Akron, Monte Circello; see below, page 233)[20] and no doubt acquired its name as a generally northwesterly wind which paralleled the western Italic coast and pushed ships in the Tyrrhenian Sea to the Strait of Messina. It was, however, as we saw in Chapter 2, infamous for its episodic violence. The mistral nearly twice destroyed the fleet of the emperor Claudius while transiting the Gulf of Lion; and it was held in honor by Augustus, who built a temple to the wind atop the aptly named Mt. Ventoux near Orange.[21]

The Timosthenic twelve-wind rose endured to the end of antiquity and beyond in both Greek and Latin forms. We find it (with occasional variations in some of the wind names) in Pseudo-Aristotle's *De Mundo* and in Posidonius, Varro, the Elder Pliny, Favorinus, Ptolemy and Vegetius (see Table 4.1).[22] It is also found in mosaics and inscribed in several stone versions during and after the first century A.D. Before discussing the eight-wind rose, it is necessary to examine another twelve-wind rose.

3. Pseudo-Aristotle's *Situations and Names of Winds (ΑΘ)*

Roughly contemporary with or slightly later than Timosthenes' *On Harbors* appeared a short, fifty-eight line treatise entitled *Situations and Names of Winds* (*ΑΝΕΜΩΝ ΘΕΣΕΙΣ ΚΑΙ ΠΡΟΣΗΓΟΡΙΑΙ*, henceforth abbreviated *ΑΘ*). The text is found originally in the ninth-century codex Palatinus Graecus 398, which also contained several periploi and works on geographical subjects (see below, page 162). Below the title is the citation *ΕΚ ΤΩΝ ΑΡΙΣΤΟΤΕΛΟΥΣ ΠΕΡΙ ΣΗΜΕΙΩΝ*—hence its entry into the Aristotelian corpus.

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[19] Anon. *Periplus Maris Erythraei* 57.5 (= Casson 1989, 87, 224, fig. 14).
[20] Talbert 2000, 44 D3.
[21] Suet. *Claud.* 17.2; Sen. *Q Nat.* 5.17.5. French excavations here uncovered a cache of small terra-cotta trumpets, offered as dedications for ritual wind invocations (see Hodge 1983, 82, n. 32, with references).

The treatise describes a rose of eleven winds: *Borras*, *Kaikias*, *Apeliotes*, *Euros*, *Orthonotos*, *Notos*, *Leukonotos*, *Lips*, *Zephyros*, *Iapyx* and *Thraikias*. Only *Aparktias* is missing, either as a result of a copy error or an indication that *Borras* designated both north and north-northeast. Ten of the eleven winds have correspondences with Timosthenes' wind rose (see below, Table 4.1). The two innovations are *Orthonotos*,[23] which is given in place of Timosthenes' *Phoinix*/*Euronotos* in the south-southeast, and *Iapyx*, which takes the place of *Argestes* in the west-northwest. Associated with each of these winds are various local wind names, to which we shall return below (see below, pages 115–17).

The author and date of *ΑΘ* are difficult to determine. It is generally agreed that Aristotle was not the author,[24] not only because the wind rose in his *Meteorology* differs significantly from *ΑΘ*, but also because no such work is otherwise attested.[25] Since its discovery there have been numerous attempts to demonstrate authorship, with Theophrastus and Posidonius suggested as likely candidates.[26] In the absence of incontrovertible proof it is safer to conclude, with Hett,[27] that *ΑΘ* was written by an unknown author of the peripatetic school.

Such general attribution, however, fails to provide even a rough date, as the Peripatetics, though declining in volume and quality of literary output in the third century B.C., were active throughout the Hellenistic period.[28] Internal evidence offers some insight. Rehm noted that two Pamphylian cities, Olbia and Magydos, are mentioned (§973a6), but not the larger and more prominent Attalea, which lies on the coast between the two smaller settlements.[29] Attalea (modern Antalya) was founded by Attalos II in the mid second century B.C., thus giving us a terminus ante quem of about 150 B.C. The upper date is more difficult to pin down. It is unclear from the fragments whether Timosthenes influenced *ΑΘ* or vice

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22 Arist. [*Mund.*] 394b19; Posidonius (Strab. 1.2.21); Varro (Sen. *Q. Nat.* 5.16.3–6); Suetonius (Isid. *De Rerum Natura* 37); Ptol. *Geog.* (Berggren and Jones 2000, 15); Favorinus (in Gell. *NA* 2.22); Veg. *Mil.* 4.38.

23 On the problems associated with this wind name, see Masselink 1956, 108–10.

24 One exception is Gohlke 1936, 327.

25 It fails to appear in Diogenes Laertius' extensive list of Aristotle's works (§5.22–7), which is probably in turn derived from a list from the second century B.C. (see Lynch 1972, 148–9).

26 Theophrastus: Kaibel 1885, 606 n. 2 and 608; Heeger 1889, 56–9; Steinmetz 1907, 41; Masselink 1956, 98–102; Posidonius: Nielsen 1945, 57.

27 Hett 1955, 451.

28 Lynch 1972, 135–46.

versa, or if both authors were drawing from a third. It may simply be the case that the rose of twelve winds was au courant in the maritime community in the Greek east beginning in the 3rd century B.C.

4. The Hellenistic and Roman Rose of Eight Winds

During the Hellenistic period, and contemporary with the wind roses of Timosthenes and *AΘ*, a wind rose composed of eight winds appears among so-called Egyptian parapegmatists of the 3rd century B.C. Others emerge in other scientific writings, such as Hipparchus's *parapegma*, [Hippocrates'] *De Hebdomadibus* and apparently Eratosthenes' major geographic work (Table 4.2).[30] The names are, with slight variations, *Aparktias*, *Boreas*, *Apeliotes*, *Euros*, *Notos*, *Lips*, *Zephyros* and *Argestes*. The Egyptian *parapegmata*, according to Rehm, reserve *Boreas* for both north and northeast.[31] Roman writers describe this eight-wind system and provide Latin equivalents. Aulus Gellius, Vitruvius, Pliny the Elder and Agathemerus describe it in their surveys of winds before turning to other systems, and the same Pliny recommended it for use in agriculture.[32]

The Tower of the Winds in Athens, known from inscriptions as the Horologion, or Waterclock, of Andronicus, is the most visible example of the Hellenistic eight-wind rose and deserves a more detailed discussion here. The small and elegant octagonal tower of Pentelic marble, 3.2 m to a side, was built at some point in the first century B.C. on the edge

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29 Rehm 1916, 102–3; cf. Masselink 1956, 102. On the foundation of Attalea, see Strab. 14.4.1.

30 On the Hellenistic eight-wind system in general, see Rehm 1916, 70–5; Masselink 1956, 85–97. On the 'Egyptian' parapegmatists,' see Rehm 1941, 103–4; Nielsen 1945, 48–9. On Hipparchus' parapegma, see Rehm 1916, 71; 1941, 103–4. On the Hellenistic date and details of [Hippocrates'] *De Hebdomadibus*, an eight-wind rose minus one wind, see Mansfeld 1971, 151–5. Vitruvius (*De arch.* 1.6.9) alludes to Eratosthenes' use of an eight-wind system. Von Freeden (1983, 65), repeating Thiersch's suggestion (1909, 80), points out that a *terminus ante quem* for the rose of eight winds may be ascertained if the upper story of the Pharos lighthouse (begun under Ptolemy II Philadelphus, 308–246 B.C.) were constructed as an octagon with each side depicting eight winds. The form of the octagonal upper story, whether or not it displayed personifications of winds, may have served as a model for Andronicus' Horologion in Athens.

31 Rehm 1916, 71 n. 1.

32 Gell. *NA* 2.22, Vitr. *De arch.* 1.6.4–5, Plin. *NH* 2.46.119 (on Pliny's use of an eight-wind rose for agricultural purposes, see *NH* 18.76.326–77.339 and below, pages 108–9) and Agathem. 2.7. It is difficult to find one original source behind the Roman eight-wind rose. Varro's name has been floated (see, e.g., Nielsen 1945, 72; Masselink 1956, 243), but Seneca (*Q Nat* 5.16.3–17.1) unequivocally attributes to him a rose of twelve winds.

of the Roman agora near the foot of the Acropolis (figs. 4.4 and 4.5).[33] It was designed externally as a monumental sundial and weathervane, its interior housing an elaborate clepsydra, or waterclock, and possibly a planetarium, neither of which have survived. At the top of each external side, just below the cornice, were sculpted in relief the winged personifications of each wind, along with their names: *Boreas*, *Kaikias*, *Apeliotes*, *Euros*, *Notos*, *Lips*, *Zephyros*, *Skirōn* and *Thrakias* (fig. 4.6). They fly counterclockwise around the tower as though imitating the veering of winds that takes place in those frequent roving winter depressions discussed in Chapter 2. According to Vitruvius, the peak of the roof was capped by a bronze weathervane in the form of a Triton who pointed his wand at whichever wind was blowing.[34] The building's namesake and architect, Andronicus Cyrrhestes, was a native of Macedonia and the astronomer responsible, it would appear, for building the sundial at the sanctuary of Poseidon and Amphitrite on the island of Tenos.[35] The Horologion's location within the marketplace of Athens was quite functional: a brief glimpse at Triton's pointer would tell merchants whether the winds were blowing fair or contrary, thereby offering some clue of their ship's departure and arrival.[36]

Vitruvius portrays Andronicus as a proponent of the eight-wind system, who, "as proof" of the accuracy of his system, designed and built the octagonal tower. The personifications more or less reinforce Aristotle's descriptions of winds and their respective signatures. *Boreas* is heavily cloaked and carries a triton shell (a common symbol of seafaring winds), probably to indicate his cool temperature, strength and dominance. *Kaikias* (not

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Posidonius, too, has been mentioned as a source, at least for Varro, but without evidence (see Kidd 1988, 2: 521).

33 First mentioned in Varro's *De Re Rustica* 3.5.17 (30s B.C.), and lauded in Vitr. *De Arch*. 1.6.4. Pausanias makes no mention of it. Several studies on the structure have appeared since Stuart and Revett recorded it in the eighteenth century (1762, ch. 3). Some of these, such as Noble and Price 1968 and Price 1967, deal with the clepsydra and sun-dials. Robinson (1943) discusses the placement of the building within the context of the Roman forum. Travlos (1980, 281–8) and Kienast (1997) provides a convenient overview of the architecture and sculptures, but von Freeden 1983 is considered the most definitive study of the building and its sculptural program.

34 Vitr. *De Arch*. 1.6.4.

35 On Andronicus' connection to the sanctuary of Poseidon and Amphitrite see *IG* I, XII/V, 891 and Etienne and Braun 1986.

36 As Graindor (1927, 198) suggests, "Aux exportateurs d'huile qui fréquentaient ce marché, il importait de connaître l'heure et surtout le vent. Et c'est sans doute parce qu'elle avait été élevée avant tout à l'intention des navigateurs que cette Tour était surmontée d'un Triton de bronze indiquant, avec sa baguette, le vent qui soufflait."

Boreas, as with other eight-wind roses) indicates his stormy nature by bearing hailstones. *Apeliotes*, the east wind, carries a sash of grains and fruits, the symbol of autumn. *Euros* protects his face with his sash, possibly from dust and sand from the Levant or North Africa. *Notos* holds a water jar upside-down, a reference to the oppressive (and evaporative) Sahara winds that at times make their way into the Aegean. *Lips* holds an *aphlaston*, the curving sternpost of a galley. *Zephyros*, the west wind, bears flowers, an indicator of his gentle nature and presence during springtime. Finally, *Skirōn* (perhaps a name favored in Athens as opposed to *Argestes* on other eight-wind roses) carries an inverted brazier.

Let us consider, briefly, the symbolism of *Lips* and the *aphlaston*. As the only wind depicted with a direct nautical association, *Lips*, like *Skirōn*, must have held some significance to Athenians. As early as the late eighteenth century, Stuart and Revett suggested that the personification symbolized either its role in aiding ships entering the Piraeus or as a destroyer of ships along Attica's lee shore.[37] The symbolism, however, is not so elusive. The entrance to the largest of the three harbors of Piraeus, the Grand Harbor (known in antiquity as the *Kantharos* or Goblet), faces southwest, in the direction of *Lips*. On the Horologion, the *aphlaston*, because it is a sternpost held forward, is oriented in the *opposite direction* of *Lips*' travel. In other words, it is not pushing the ship along but blows contrary to its forward movement. Therefore, it seems much more likely that *Lips* was associated with a baneful wind that hindered or prevented ships from departing the Grand Harbor. When the weathervane pointed to *Lips*, merchants in the Roman agora realized that their cargoes could not get underway until the wind changed. This interpretation finds reinforcement in the original etymology. It is generally accepted that the word derives from the Greek verb *leibō*, which means to pour, pour forth or let flow. Its appellation thus indicates an original association with wet and stormy weather.[38]

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37 Stuart and Revett 1762, 45; Schamp (1955, 125) considers Lips a favorable wind ("Der Lips ist als kräftiger Jüngling dargestellt; sein Attribut, ein auf dem Heck der griechischen Schiffe üblicherweise angebrachter Zierat, kennzeichnet vielleicht seine für die Schiffahrt günstige Richtung, die das Ansegeln des Piräus erleichterte"). Von Freeden (1983, 214) curiously avoids any commentary on the topic.

38 Herodotus (above n. 10), for example, states that these winds are "the most rainy," and Pausanias (2.34.2) reflected on the destructive nature of this wind on crops along the southern coasts of the Saronic Gulf. On the etymology of λίψ, see Nielsen 1945, 19. From the fifth century B.C. forward, the popular etymology equated λίψ with Libya (stated explicitly in Herodotus 2.25.10, Theophrastus, *De Ventis* 51, Pseudo-Aristotle, *ΑΘ* 12–13).

The general development of the wind rose, then, is relatively clear from literary and architectural evidence. What began as a four-wind *system* in Homer became a proper *rose* of ten winds in Aristotle. By the Hellenistic period and throughout the Roman era two wind roses were in use simultaneously, one of twelve winds, another of eight. Wind names were, for the most part, standardized, although some migrated or were substituted by others. The twelve-wind rose endured into the Middle Ages, at least until the twelfth century, when a wind rose of sixteen and thirty-two points, or 'rhumbs,' developed in concert with the advancement of the magnetic compass.

II. WHICH WIND ROSE?

Which rose, then, did Greek and Roman seafarers employ, and why? Both roses are, in fact, found among both Greek and Roman sources, and thus there appears to be no perceivable cultural preference. Nor is there any evidence of particular roses being used by particular sectors of the maritime sphere, e.g. war fleets one, merchant fleets another. The tendency in scholarship, however, has been to privilege one over the other for seemingly unsubstantiated reasons. Bunbury, for example, followed by numerous other scholars, generally credited the prevalence of the eight-wind rose over that of twelve.[39] They cite its general popularity, its persistence into late antiquity and its practicality as compared to the rose of twelve winds. This later view is informed by the comments of the Elder Pliny and

[39] Bunbury (1959, 1:610–11) believed that the twelve-wind system was known only to the more scientific writers, and "there can be no doubt that eight winds only were popularly known." Kaibel (1885, 609), apparently unaware of the extensive use and citation of the twelve-wind system throughout the Roman era and well into the Middle Ages, believed that Timosthenes' extended wind rose failed because the eight-wind system lived on. Semple (1971, 93–4) echoed Bunbury's conclusion. Taylor (1971, 55) considered the twelve-wind system the realm of a literate, educated minority, then, without any evidence mentioned, cited the persistence of the eight-wind system among sailors. Mansfeld (1971, 151) speculated that the eight-wind system was "apparently the most practical." Kreutz (1973, 367–83) favored the eight-wind rose among seafarers of antiquity because it harmonized with her (in my opinion implausible) view that the 16-/32-point system of the early mariner's compass was derived from it via further divisions of the horizon; she bases her speculations on certain peculiar features of Etruscan and apparently Samothracian ceramic vessels and highlights the well-known role Samothrace played as the seat of a mystery cult for seafarers (the so-called *Theoi Megaloi*) in Hellenistic and Roman times. Pomey (1997, 33) cited the practical prevalence of the eight-wind rose, as did Cronin (1992, 336), Morton (2001, 217–18, n. 120) and Arnaud (2005, 54–5).

Favorinus, both of whom considered the twelve-wind rose excessively precise.[40] Behind these reasons one can also sense the excessive weight given to the eight-wind rose displayed on the Horologion of Andronicus in Athens, as well as the direct nautical association provided by the portrayal of *Lips* with its *aphlaston*. Survival seems to have had its privileges.

Others insist that the twelve-wind rose was designed specifically with seafaring and Mediterranean weather in mind.[41] They list its expanded divisions as an asset rather than an encumbrance, and they cite its persistence into late antiquity and the Middle Ages.

A contextualization of four sources spanning a period from the third century B.C. to the end of the Roman era and dealing specifically with winds in a maritime context may help shed some light on the question.

1. Timosthenes

The origin of Timosthenes' twelve-wind rose appears neither in the fragments nor in ancient citations. Nevertheless, most scholars agree that his wind rose was designed for the maritime sphere and served to address at least some of the problems associated with Aristotle's. These problems include the latter's restricted frame of reference to the Aegean in terms of latitudinal relevance (solstitial benchmarks vary with latitude), the marked inconvenience of using solstitial/equinoctial points for simple orientation[42] and the limited vantage point of a local nomenclature. The result was a wind rose designed for the *oikoumenē*

[40] Plin. *NH* 2.45.119; Favorinus in Gell. *NA* 2.22.

[41] Cf. the comment of the third-century A.D. writer Faventinus (2): "But most men assert that there are twelve winds" (*sed plerique duodecim ventos esse adseverant*). Kaibel (1885, 609), although a proponent of the eight-wind rose, conceded (without citing any evidence) that Timosthenes' twelve-wind rose may have been used only by Rhodian and Alexandrian fleets. Tozer (1964, 194) believed that the twelve-wind rose endured for geographical and nautical purposes, but that the eight-wind rose was retained in use. Taylor (1937, 37) believed that the twelve-wind rose was practical for seafaring, although her 1957 monograph, republished in 1971, stated the opposite. Böker (1958b, 2351–2) considered the twelve-wind rose essential for Mediterranean seafaring; it rendered orientation at sea easier (without reliance on solstitial measurements) and more practical than the eight-wind rose.

[42] Solstice observation is not difficult. An estimated average of days when the gnomon's shadow stops advancing suffices to determine it. Seafarers, however, would have had to maintain a calendar (mental or otherwise) to estimate where the sun was along its northern and southern paths on either horizon, and to interpolate its position in relation to the solstitial and equinoctial points.

(although retaining some Aegean names), and one apparently using Dicaearchus' parallel through Rhodes as a new frame of reference.

Wagner suggests that another impetus behind Timosthenes' twelve-wind rose is to be found in the evolving practice of open-sea navigation among Greek merchant ships in the late fourth century B.C. and their need for a finer division of the horizon for course steerage away from land.[43] While it has been shown that Greek seafarers were already sailing the open sea for several centuries prior to this time, it is understandable to look for the origin of the twelve-wind rose in the context of the greater degree of far-flung maritime activity during the Hellenistic and subsequent Roman eras: expanded trade networks may have created a demand for a finer discrimination of the horizon for formulating navigational strategies. As Taylor has noted, a ship could not necessarily clear the harbor or round a headland with, for example, a northwest wind (an eight-wind system), but could with a north-northwest wind (a twelve-wind system).[44] The twelve-wind rose would have helped seafarers discriminate more closely between requisite winds.

Aside from Timosthenes' convenient cartographic associations, which offered additional cognitive references, the twelve-wind rose also would have offered a more convenient and discriminating standard for the incorporation of, and associations with, other regional and local wind names around the Mediterranean and Black Seas. This is especially evident in *AΘ* (see below), but is also manifest in the ease with which Roman authors assimilated Latin wind names in and after the first century B.C.

2. Acts of the Apostles *27*

The voyage narrative in chapter 27 of the *Acts of the Apostles* is as remarkable in its vividness and employment of realistic nautical terminology as it is to its adherence to stock literary conventions (see above, page 6 and below, Appenix A). Many of the technical words are taken directly from the language of seafarers, and among them are the names of winds.[45]

[43] Wagner 1888, 46–7.
[44] Taylor 1937, 37.
[45] Smith 1848, 5–17; Böker 1958b, 2338.

The author names four of them (vv. 12–14, in order): *Lips*, *Chōros, Eurakylōn* and *Notos*. *Lips* and *Notos*, as we have seen, appear in both eight- and twelve-wind roses. *Chōros* and *Eurakylōn* appear here for the first time. *Chōros* is certainly derived from the Latin wind *caurus* or *corus*.[46] Both versions are found (erroneously side by side) in Vitruvius' rose of twenty-four winds.[47] Seneca lists *corus* as a west-northwest wind, and Pliny the Elder lists it both as a northwest wind (in his eight-wind system) and as a west-northwest wind, with *argestes* (in his twelve-wind system).[48] *Eurakylōn*, however, points exclusively to a twelve-wind system. The word is clearly a combination of Greek *Euros* and Latin *Aquilo*.[49] It appears here as the only literary instance, but its position is confirmed by its inclusion as an east-northeast wind on the twelve-wind rose pavement inscription from Thugga (modern Dougga), dating to the second or third centuries A.D. (see Table 4.1).[50]

3. *Arrian,* Periplus Ponti Euxini

The *periplus* of the Black Sea written by Arrian of Nicomedia, the Roman governor of Cappadocia in A.D. 129 or 130, includes a brief description of the harbor at Athenai visited during his inspection of the Cappadocian coast (see below, pages 171–2). The ship haven, Arrian notes, provided shelter from the south wind (*Notos*), east wind (*Euros*) and winds from the north-northeast (*Borras*), but not those from due north (*Aparktias*) or from the northwest quarter (called *Thraskias* in the Black Sea, *Skirōn* in Hellas).[51] The inclusion of, and distinction between, *Aparktias* and *Borras* signal Arrian's use of a rose of twelve winds.

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[46] The word is found first in Lucretius, *De Rerum Natura* 6.135; on the etymology, see Nielsen 1945, 81–2.

[47] Vitruv. *De Arch.* 1.6.10.

[48] Plin. *NH* 18.77.333–9 (eight-wind system), 2.46.119–20 (twelve-wind system).

[49] *Εὐρακύλων* and *εὐρυκλύδων* are both attested from fourth-century A.D. papyri and manuscripts (see app. crit. in Aland et al. 1993, 511). The latter reading is unconvincingly argued by Coones (1986) who draws on irrelevant and unconvincing evidence. *Εὐρακύλων*, however, is shown by Metzger (1971, 497; see also Smith 1848, 119–25 and Nielsen 1945, 60) to have more secure manuscript authority.

[50] *CIL* 8.4, 26652; Gauckler 1905a, 280, pl. XVI. This wind appears again in the early medieval period in the writings of Peter on the *Miracula S. Phantini* (Halkin 1957, 1509, 72.1068–74.1108). The voyage between Sicily and Greece entailed an encounter with a *Euroclydon* wind reminiscent of Paul's journey. The deacon calmed the sea by appealing to their patron saint's power,—clearly drawing on the familiar scene of *Acts of the Apostles* 27.14.

[51] Arr. *Periplus Ponti Euxini* 4.2–5.1: The mooring [at Athenai] at the right time of year can receive a few ships and provides haven for them from the south wind and even the east wind; it may also save ships at anchor

4. ***Vegetius*** **De Re Militari**

Renatus Flavius Vegetius, whom we met briefly in Chapter 3 as a commentator on the ancient sailing season, was an administrator in the late Roman imperial bureaucracy. He addressed an epitome of military matters in four books to an unnamed emperor some time between A.D. 383 and 450.[52] The first book treats recruiting, the second army organization, the third strategy and tactics and the fourth fortifications and naval warfare. The section on naval warfare is divided into sixteen rather short sections (chapters 31–46) which treat various topics related to the overarching theme of proper preparation for conducting fleet operations.[53] These topics range from ship types and their construction (§33–7) to tidbits of navigational information (§38-42) to fleet tactics and strategies (§43–6). Chapter 38 is a treatment of winds and their importance in conducting fleet maneuvers. He first declares (1–3) the importance of knowing weather signs (*turbinum signa*) for those who are transported with the army in war fleets. *Liburnae* (a generic term applied to any warship), he states, have often perished more frequently by waves than by enemy action. Here navigational skill (*sollertia*), including a knowledge of winds, should be applied to prevent disaster. A paragraph on wind systems follows (4–6), explaining that a four-wind system of simple cardinals was replaced by one of twelve winds (*sed experimentum posterioris aetatis duodecim comprehendit*); nowhere is the eight-wind system mentioned.

He then proceeds to enumerate the twelve winds, treating each cardinal and its two adjacent winds (7–12). He provides Greek transliterations, followed by the Latin equivalent: *apheliotes-subsolanus* is flanked by *caecias-euroborus* and *eurus-vulturnus*; *notus-auster* by *leuconotus-*

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from the north wind, but not from *aparktias* at any rate, nor from the wind they call *thraskias* in Pontus and *skiron* in Hellas (*ὁ δὲ ὅρμος οἷος ὥρᾳ ἔτους δέχεσθαι οὐ πολλὰς ναῦς καὶ σκέπην ταύταις παρέχειν ἀπὸ νότου ἀνέμου καὶ αὐτοῦ τοῦ εὔρου· σῴζοιτο δ᾽ ἂν καὶ τοῦ βορρᾶ τὰ ὁρμοῦντα πλοῖα, ἀλλὰ οὐ τοῦ γε ἀπαρκίου οὐδὲ τοῦ θρασκίου μὲν ἐν τῷ Πόντῳ, σκίρωνος δὲ ἐν τῇ Ἑλλάδι καλουμένου*).

[52] The date of Vegetius' work ranges from 383 when the emperor Gratian died (mentioned as *divus* at 1.20.3) and a correction of a copy at Constantinople in 450 by Eutropius. The dedicatee may have been Theodosius the Great (A.D. 383–395), but some manuscripts that omit his name have descendants that include it. See Reeve 2004, v–lx for a comprehensive discussion of the author and work.

[53] Commentaries on the naval sections of Vegetius' epitome are few, but see Baatz and Bockius 1997 and Milner 2001, 140–51.

albus notus and *libonotus-corus*; *zephyrus-subvespertinus* by *lips-africus* and *iapyx-favonius*; and finally *septentrionales-aparcias* (sic) by *thrascias-circius* and *boreas-aquilo*.

Some of these wind names are unique in Vegetius and clearly present some problems. In the case of *euroborus*, for example, these two winds never neighbored each other on any other wind rose, before or after,[54] and the equation of *libonotus* (typically a south-southwest wind) with *corus* (typically a west-northwest wind) is unanimously agreed to be a mistake on Vegetius' part.[55] Precisely where Vegetius derived his wind rose is also problematic. Several scholars assign it to Varro on the assumption that he is drawing this specific material from that author's *libri navales*,[56] mentioned in the section on weather signs at 4.41.[57] Others suggest that it is informed by local knowledge.[58] I believe, with Masselink, that the exercise is pointless: the limited evidence does not allow us to construe the origin of Vegetius' material. The important point to grasp here is that while Vegetius was plainly not a fleet commander, his failure to mention or allude to an eight-wind system in this extensive nautical context is telling. For him, it would seem, the twelve-wind system was the rose used by the Roman fleet.

The ancient sources that deal with the maritime sphere privilege the rose of twelve winds from at least the first century B.C., if not earlier, to the end of antiquity. The finer segmentation of the horizon offered by the twelve-wind rose, along with its geometric arrangement, would have served to standardize orientation and directional references at sea, and thus provided more options for formulating and communicating navigational strategies. As we shall see below, the extended nomenclature and organization of the twelve-wind rose also aided with the assimilation and association of both wind-courses and local coastal winds.

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[54] Kaibel 1885, 620 n. 1; Masselink 1956, 157–8.

[55] Gilbert 1967 [1907], 555, n. 2; Nielsen 1945, 106; Masselink 1956, 158.

[56] Varro's so-called *libri navales* must have comprised the mostly lost *Ora Maritima* (cited and quoted by Servius (*Ad Aeneidos* 1.108, 112; 5.19; 8.710; see Detlefsen 1886), *Ephemeris Navalis* (see Schanz and Hosius 1935, 1:569) and the *Aestuariis*.

[57] Kaibel 1885, 597; Gilbert 1967 [1907], 555; Nielsen 1945, 107; Milner 2001, 144 n. 7. Masselink (1956, 159), however, states that the hypothesis that Varro lies behind Vegetius' wind rose is "waardeloos."

[58] Gilbert 1907, 555.

III. Evidence of Wind Roses and Telltales

Aside from the cognitive schemata of directions described in the literature, did wind roses assume a practical physical form? Mention has already been made of the earliest known monumental wind rose in the form of the Horologion of Andronicus in Athens, as well as the Roman pavement inscribed with twelve wind names from Thugga in North Africa. At least two other monumental civic structures with meteorological themes are known from inscriptions and literary sources. According to Marcus Cetius Faventinus, the third-century epitomizer of Vitruvius, a wind structure erected in Rome (no longer extant) was decorated with twelve winds and was topped with a statue of Triton, whose staff served as a vane.[59] Faventinus' brief description permits only speculation as to its date (post-Vitruvian), size, form and location. Another, the so-called *Anemodoulion*, was built in Constantinople near the Forum Tauri under Theodosius II in the latter half of the fourth century A.D. This lost structure is described by several Byzantine writers as a tetrapylon holding up a pyramidal roof with winged bronze figures.[60] It is unknown how many winds it displayed, as well as its location. What is important here is the recognition that cities both large and small, some near the coast, others far away, saw fit to commission and erect monuments of a meteorological nature. Winds, weather and weather prediction clearly fell within the ambit of everyday city and commercial life.[61]

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[59] Faventinus, *Liber Artis Architectonicae* 2 (= Plommer 1973, 42 and commentary 88–9): "But most men assert that there are twelve winds, just as in Rome there is a bronze Triton built with figures of winds similar to that on the temple of Andronicus Cyrrhestes. Holding the same rod above the head of the wind it shows that this is the one that is blowing" (*sed plerique duodecim ventos esse adseverant, ut est in urbe Roma Triton aeneus cum totidem thoracibus ventorum factus ad templi Andronici Cyrrestae similitudinem. Supra caput venti virgam tenens eundem esse flantem ostendit*). The date and location of this structure or statue remains unclear: it was not mentioned by Vitruvius, nor does it appear in the Severan marble plan of A.D. 203–11. It may have been contemporary with Faventinus himself. See also Masselink 1956, 96–7.

[60] On the *Anemodoulion*, see Constantine of Rhodes vv. 178–201 (= Legrand 1962, 41–2), Cedrenus I (= Bekker 1838–1839, 565, 20) and Nicetas Choniates, *Chron.* II, 6 (= van Dieten 1975, 332, lines 25ff. and 648, lines 31ff.). For a discussion of this enigmatic monument, see Janin 1950, 100–1 and Downey 1952.

[61] Propertius (4.3.37–41) makes reference to a map that shows the winds that bear ships to Italy: "And I am compelled to learn from a map the countries painted on it and what sort of arrangement is made by a wise god, what lands are listless with frost, what crumbling heat, what wind will bear sails safely back to Italy" (*Cogor et e tabula picots ediscere mundos, Quails et haec docti sit positura dei, Quae tellus sit lenta gelu, qua putris ab aestu, Ventus in*

But were there smaller versions of wind roses that could have been placed and utilized aboard ship? Are these to be included among the nautical instruments (*ναυτικοῖς ὀργάνοις*) of which Plato speaks[62]—the instruments that were "used for sailing and in meeting dangers…of winds and sea that pertain to the voyage"?

1. Anemoscopes and Sundials

Besides these few wind monuments there is from central Italy a group of smaller anemoscopes, or wind tables, with inscribed wind roses and central holes for some sort of wind-sock arrangement (Table 4.3). Of the three that have been published, two are bilingual and one is inscribed in Greek. All three display a rose of twelve winds with Timosthenic names. One of the bilingual anemoscopes was originally discovered at the Roman port city of Caiete, modern Gaete, but is now lost.[63] The other comes from an area between the Esquiline and the Colosseum.[64] The Greek anemoscope, on a flat slab of Luna marble, was found just outside the Porta Capena.[65] Its upper face was pointed south, down the Via Appia. Unfortunately the specific find context of these three anemoscopes was never recorded, and therefore we have no definitive means of assigning them to a public or private sphere.

Similar wind roses were incorporated into sundials, but these are very rare. Of the 256 Greek and Roman sundials catalogued by Gibbs,[66] just four (discounting the Horologion of Andronicus, discussed above) display some sort of wind diagram. Three come from Rome. Of these, two were inscribed with Greek letters and exhibit the twelve Timosthenic wind names.[67] They are without provenance. The third is a Latin rose of eight

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Italiam qui bene vela ferat). Could the reference here be to a non-extant civic map, such as that commissioned by Julius Caesar in 44 B.C., or that begun by Agrippa and finished by Augustus in 12 B.C.?

[62] Plat. *Plt.* 298d: *τοῖς ναυτικοῖς ὀργάνοις εἰς τὴν τῶν πλοίων χρείαν καὶ περὶ τοὺς κινδύνους τούς τε πρὸς αὐτὸν τὸν πλοῦν ἀνέμων καὶ θαλάττης*. The context of the passage clearly refers to the nautical equivalent of surgical instruments.

[63] *CIG* 14, 906; *CIL* 10, 6119.

[64] *CIG* 14, 13082; *CIL* 5, suppl. 204.

[65] Zicàri 1954, 69–75; Dilke 1998, 110–11, pl. 21, fig. 21; Taub 2003, 149, fig. 4.2 and 179, fig. 5.4.

[66] Gibbs 1976.

[67] *IG* XIV 1308 (Vatican); Museo Nazionale Romano, nos. 40621–42 (Rome).

winds found on marble fragments in the Mausoleum of Augustus.[68] The last, also a Latin rose of eight winds, was found next to a small temple of Jupiter in Aquileia, a coastal city at the head of the Adriatic.[69]

None of these anemoscopes should be considered *portable* in any meaning of the word, although they were certainly transportable together with their stone pedestals. If these stone anemoscopes or sundials with wind roses had traveled aboard ship, some, or one at least, would have been found among the hundreds of Roman wrecks that have been excavated.[70]

2. Portable Wind Roses

There were even smaller wind roses made of wood during the Roman era. Two small wood fragments found near Caesarea Maritima bear a zodiac with Sol Invictus on one side, and on the other an octagon of what must have been an eight-wind rose with wind lines fanning out beyond the border.[71] Unfortunately it is too small and fragmentary to show wind labels. Ovadiah and Mucznik interpret it as a personal horoscope or an apotropaic object, "possibly belonging to a seaman."[72] They date it very roughly to the Roman period, but the literary parallels they cite are relevant to the fourth and fifth centuries A.D.

The Elder Pliny digresses in his section on weather forecasting and the timing of agricultural and husbandry practices to offer practical advice on how to configure an eight-wind rose, either on the ground in a field or using a wooden model. From it one can identify the wind and all the relevant agricultural responses to it.

> We said that the umbilicus should be drawn at the middle of the line. Let another line run transversely through the middle of the umbilicus. This line will be from the equinoctial west and the equinoctial east, and a path that cuts the field in this way will be called the decumanus. Then two other oblique lines must stretch into the decumanus in such a way

[68] Gibbs 1976, 333, no. 4010.
[69] *ILS* 8643.
[70] Although anemoscopes have never been recovered from shipwrecks, a sundial "made to look like the sundial at Achradina" was apparently installed aboard the elaborate super-freighter built by Hieron of Syracuse (Ath. *Deip*. 5.207e–f). On the sundial at Achradina erected by Dionysius I (405–36 B.C.) see Plut. *Dio*. 29.2.
[71] Ovadiah and Mucznik 1996.
[72] Ovadiah and Mucznik 1996, 377.

that they run down from the north on the right and left to the south on the left and right. They should all run through the same umbilicus, and they must all be equal, as should the intervening spaces all around. This reckoning must apply in each field once, or, if you plan to use it often, a wooden version must be made composed of rods of equal length fitted into small drum.[73]

3. Other Telltales of Wind

In the iconography of Greek and Roman ships appear pennants, flags and standards waving in the wind from various parts of ships—the top of the mast, the ends of the yard, and such stern devices as the aphlaston, *stylis* and short pole.[74] To Casson these elements were used for identification and signaling, and indeed these purposes are so described in the literature.[75] But they may also have been used as telltales, or strips of light material designed to indicate the flow of wind near the sail and to show how to correct the sail's trim. This purpose is suggested by the two vanes on a ship on a third-century A.D. mosaic from the Quirinal (fig. 4.7).[76]

Other seafaring cultures employed such telltales. Arab sailors in the Indian Ocean, for example, employed cotton or silk strips to read wind direction.[77] A common feature of

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[73] Plin. *NH* 18.76.331–2: *Diximus ut in media linia designaretur umbilicus. Per hunc medium transversa currat alia: haec erit ab exortum aequinoctiali ad occasum aequinoctialem, et limes qui ita secabit agrum decumanus vocabitur. Ducantur deinde aliae duae liniae in decussem obliquae, ita ut ab septentrionis dextra laevaque ad austri laevam dextramque descendant. Omnes per eundem currant umbilicum, omnes inter se pares sint, omnium intervalla paria. Quae ratio semel in quoque agro ineunda erit vel, si saepius libeat uti, e ligno facienda, regulis paribus in tympanum exiguum sed circinatum adactis*. Cf. Appian's narrative above n. 2. Brizzi and Medas (1999, 13–6) posit a physical, but purely hypothetical, version for shipboard use.

[74] Basch 1987, figs. 579 (Ficoroni cista from the later fourth century B.C.), 802a (Roman-era bas-relief), 1030 (third-century mosaic from Rome), 883 (fourth-century B.C. hydria from Capua), 928 (second-century frieze in Capitoline Museum), 962 (first-century relief from Puteoli), 1051 (Pompeiian ship graffito), 1082 (third-century sarcophagus from Ostia), 1099 (third-century mosaic from Hadrumetum), 1105 (El Djem mosaic from the second century), 1106 (third-century mosaic in the Bardo Museum, Tunis); Casson 1995, fig. 145 (mosaic of a third-century cargo vessel), 149 (relief of a third-century cargo vessel); Shapiro 2003, 232, fig. 6 (*Dinos* painter's krater from Gela). Perhaps these are the leather strips (διφθερίδες) mentioned in a poem from the *Greek Anthology* (9.546: Antiphilus): "Once, in a way, let my portion be a mattress on the stern, the leather strips sounding with the blows of spray" (*Κὴν πρύμνῃ λαχέτω μέ ποτε στιβὰς αἵ θ' ὑπὲρ αὐτὴν | ἠχεῦσαι ψακάδων τύμματα διφθερίδες*). These telltales should not be confused with the wreaths with which the priests of Apollo in the Athenian *theoria* crowned the *aphlasta* of ships. These are seen in some vase paintings (see the example in Shapiro 2003, 232 fig. 6; cf. 238 fig. 14).

[75] Casson 1995, 246–7 and notes 86–9, 346.

[76] Casson 1995, fig. 154; cf. Ericsson 1984, 31–2, Rom. 19 (where "wine-vane" should be read as "wind-vane").

[77] As related by the fifteenth-century navigator Ahmad ibn Majid in his Eighth Fa'ida (Tibbets 1971, 192 and n. 1). Tibbets (1971, 50, 122, 294) also draws attention to the curious Arab practice of dividing the gunwales, decks and other topside timbers of the ship according to the 32 rhumbs of the compass rose. These projections

aboriginal vessels in the South Pacific were telltales or wind strips, made of bark strings or feathers and hung in the rigging to indicate the apparent wind and give clues to shifts in the wind. As Lewis has noted in his pioneering ethnographic study of Polynesian ships and navigation, the man responsible for observing them would instantly perceive the slightest wind shift and trim the sails appropriately.[78] At night, the telltales indicated simultaneously "the angle of the wind and the bearing of a steering star…Should the [steering] star become obscured by cloud, the angle between the staff and the pennant would be kept constant."[79]

Any elevated pennant or telltale indicating wind direction and intensity in port (whether aboard ship or atop some other prominence) would have been of great utility for planning departures.[80]

Despite these examples of transportable and portable wind roses in municipal, agricultural and personal contexts, evidence of wind roses used aboard ship is virtually nonexistent. Textual sources fail to allude to them, and the iconography of Greek and Roman ships offers no indications they were used. The only objects seemingly available for determining the direction and intensity of the wind were such wind telltales as pennants and flags.

On the other hand, absence of evidence is not necessarily evidence of absence. The lone attestation of a wooden version in Pliny's passage above is telling. If ships did carry wind roses in some manifestation, they would have likely been displayed at or near the helm station to aid steersmen in the mental recalibration of the navigational horizon at sunrise, noon and sunset by day and the northern constellations at night.[81] Roses carved in timbers on the upper aft deck, or those manufactured from such ephemeral materials as wood or papyrus or leather, understandably would never have survived on wrecks found in

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provided the steersman with a system of reference for maintaining course at certain angle from the ship's intended heading, apparently as a means of adjusting for leeward drift suffered as a result of winds and current. For the use of the ship and ship's rigging for celestial navigation, see below, pages 144–5.

[78] Lewis 1994, 133–4.

[79] Lewis 1994, 134.

[80] G. Bagnani, via Boyce (1958, 69 and pl. 10.1), has made the interesting suggestion that the "feather-like" object apparent on the roof of a quay structure on the so-called Antonine harbor coins from Pompeiopolis (Cilician Soli) is a signal or weather vane, a "guide to incoming and departing ships."

[81] On possible Byzantine examples carried aboard ship, see Brizzi and Medas 1999, 11–12.

Mediterranean waters.[82] The only environment capable of preserving such materials are the deeper, anoxic waters of the Black Sea, where organic materials have demonstrably survived for centuries in the absence of any wood-boring biota. Future excavations on shipwrecks here have the potential to reveal a trove of navigationally related materials.

IV. WIND-ROUTE ASSOCIATIONS

We are left, then, with numerous literary mentions of wind roses in navigational contexts, but neither physical evidence nor specific literary reference as to how, specifically, they would have been used aboard ship. One logical implication is that certain winds were simply associated with certain routes or legs of voyages, irrespective of the use of any sort of portable wind rose. In these cases knowledge and experience attained in sailing these routes, combined with a wind-referenced system mentally recalibrated at every sunrise, noon and sunset by day, and the stars by night, likely would have sufficed for determining orientation and maintaining courses during the hours of daylight.

1. Course Winds

Much of the navigational information that has been passed down in Greek and Roman literature treats distances between anchorages/harbors or prominent natural coastal features, some of which were used as jump-off points for certain traverses (see above, page 84). The numerous extant *periploi* and geographies, in particular, bristle with lists of distances expressed either in terms of stadia or a day's sail; as we shall see in Chapter 6, these works appear to have had the origins in the maritime sphere. More rare, however, are literary references to specific winds associated with specific traverses. In *Iapyx* and *Africus* we see an obvious influence of navigational nomenclature for common routes, and behind the Elder

[82] The names of owners, at any rate, were sometimes carved into the mast, as we read in the *Testament of Naphtali* (Sperber 1986, 86–7, 90–1).

Pliny's list of record runs there is a semblance of a such a system,[83] but most of the instances are found in just a handful of authors:

- Anon. *Periplus Maris Erythraei* 57.4–7: "In this area the winds we traditionally call the etesians blow seasonally from the direction of the ocean, and so *Libonotos* appears in the Indian Sea, but it is called after the one [Hippalos] who first discovered a way across."[84]
- Strab. 2.5.24: "The passage from Rhodes to Alexandria is, with *Boreas*, approximately four thousand stadia, while the coasting voyage is double the distance."[85]
- Strab. 14.1.35: "From Chios to Lesbos is 200 stadia with *Notus*."
- Strab. 17.3.21: "From Cyrene to Kriou Metopon (Crete) is 200 stadia with *Leukonotos*."[86]
- Plin. *NH* 2.46.121: "[*Circius*]…carries a vessel right across the Ligurian Sea to Ostia."
- Plin. *NH* 4.12.71: "From [Karpathos] to Rhodes 50 miles with *Africus*."
- Agathemerus 26.5: "From Paphos to Alexandria is 3800 stadia with *Boreas*."
- Anon. *Stadiasmus Maris Magni* 137: "From Balaneas (Syria) to Laodicea…200 stadia with *Leukonotos*."

83 See above, pages 80 n. 117 and 83 n. 124. Casson (1951, esp. 139–42) has compiled a list of references that record runs and other voyages made with "favorable winds" and from it was able to extract an average sailing speed of 4-6 kts for merchant ships.

84 *Periplus Maris Erythraei* 57.4–7 (= Casson 1989, 86): *ἀφ' οὗ καὶ τοπικῶς ἐκ τοῦ ὠκεανοῦ φυσώντων [τῶν] κατὰ καιρὸν τῶν παρ' ἡμῖν, ἐτησίων ἐν τῷ Ἰνδικῷ πελάγει ὁ λιβόνοτος φαίνεται (ἵππαλος) προσονομάζεσθαι δὲ ἀπὸ τῆς προσηγορίας τοῦ πρώτως ἐξευρηκότος τὸν διάπλουν*. To make the traverse from the Gulf of Aden to the west coast of India ships kept the wind on the starboard quarter the entire way. It is interesting to note, too, how the courses (*dromoi*) along the east African coast (between Mogadishu and Brax) were coupled with the personal names Sarapion and Nikion, named for the destinations at the end of each course (Sarapion's roadstead and the town of Niki farther south). They, together with five others, were termed the 'courses of Azania' (see Casson 1989, 137–9; Kirwan 1981, 84; repeated in Marcian, *Periplus Maris Externi* 1.13.6–7). So destinations, as well as winds, could be used for course appellations during the Roman era.

85 Rhodes was a major jump-off point for Alexandria, and its distance, in terms of both stadia and days at sea, were well known. See, e.g., Agatharchides, *De Mari Erythraeo* 5.67a–b and above, page 79.

86 Strabo purposely adheres to the solar/celestial horizon reference system throughout his work, so his inclusion here of a wind from a twelve-wind rose indicates that he was drawing specifically from another kind of work, perhaps a *periplus* vel sim.

- Anon. *Stadiasmus Maris Magni* 158–9: "From Myriandros to Aegeas toward the [north celestial] pole with *Notos*…from Rhosos to Serretillis toward the [north celestial] pole with *Notos*."[87]
- Anon. *Stadiasmus Maris Magni* 165: "From the River Pyramos by a straight course to Soloi (Cilicia)…with *Apeliotes* and a little *Notos*.
- Anon. *Stadiasmus Maris Magni* 273: "The voyage from Rhodes to Skyllaion [Promontory in the Argolid near the island of Hydra], made under fairest conditions, is (?) stades with *Apeliotes*."

From these few references Taylor concluded that Greek and Roman seafarers made it a common practice to associate winds with destinations.[88] Thus, for example, seafarers wishing to voyage from a port of Cyrene to southwest Crete by sailing north-northeast were compelled to wait for a favorable *Leukonotos* (south-southwest) to begin blowing. Similarly, seafarers making for Ostia from the Gulf of Lion awaited the onset of the *Circius* wind before setting out.

Böker, writing just a year after Taylor, reached similar conclusions but went one step further by creating charts of the Mediterranean crisscrossed by numerous wind-courses, or *Kurswinde*, on which ships would have sailed to reach their destination.[89] The courses took their names from predominant winds and salient promontories from which ships were known or suspected to have departed. His examples include the *Circeius-Kurs* between Monte Circello and the Strait of Messina; the *Zephyrus-Kurs* between the Zephyrium promontory in southern Calabria and the Ionian island of Zacynthus; and the *Chelidoniae-Kurs* between those isles and Alexandria.

[87] Cf. Anon. *Stadiasmus Maris Magni* 164 where, curiously, the course from the Rhosian crag to Antioch [*ad Pyramum*], which lies almost due west, is also made with *Notos*
[88] Taylor 1971, 37–8. The idea is echoed in Arnaud 2005, 17: "…alors qu'un vent d'orientation connue et bien établi conduit à destination aussi sûrement qu'une boussole."
[89] Böker 1958a, Karten I and II. Cf. Arnaud 2005, 58.

Despite the paucity of evidence, these ideas have much to commend them. As has been found in other, non-instrument, seafaring societies,[90] most Greek and Roman seafarers traveled the same or similar routes repeatedly in their careers and built up a store of local weather knowledge pertaining to each leg.[91] Over the course of time and accumulated experience particular winds would have been recognized as steady and favorable for certain traverses or certain legs of long-distance voyages—much in the same way that Greek and Roman seafarers timed their long, open-sea voyages between the Gulf of Aden and the western coast of India according to the onset and reversal of the monsoon.[92] Here, because the monsoon winds did not blow exactly from astern while traveling in either direction (southwesterly on the outward leg, northeasterly on the homeward leg), it was necessary to know even *the angle* at which to maintain a ship to the wind in order to reach one's destination.[93] Similar circumstances would have applied for nearly every favorable route in the Mediterranean. In the Eastern Mediterranean, for example, ships heading south and east from Crete, Rhodes or Cyprus used the prevailing etesians to speed them on their way, but knowing what angle to the wind to maintain the rigging, and the course, was crucial for making accurate landfall: a ship departing Crete for Alexandria would have had winds astern for most of the way; another heading there from Cyprus would have had to keep the wind on the starboard beam or quarter; still others heading there from Rhodes, such as the course described by Strabo above, and probably the very same one used by Caesar's squadron in 48 B.C., would have had to split the difference. To ignore these details was to suffer the possibility of making landfall downwind of one's destination and being forced to double

[90] Lewis (1994, 112–14) records numerous uses of wind roses in the South Pacific. Traditional navigators in the Carolinas of Micronesia, for example, reportedly used a wind compass device to sail wind-routes. Fr. Cantova, a Jesuit priest traveling among the islands in 1721, described one with twelve wind directions. Polynesian navigators reportedly used a hollow gourd with several lines on it representing the "highways of the Navigation stars." Others in the Cook islands reportedly had a compass with 32 winds or wind-holes perforating a calabash, or gourd, to represent the edge of the horizon. It is unclear whether any of these physical objects were taken aboard ship and used by the seafarers themselves, or simply used as teaching devices in navigation schools on land.

[91] This was certainly true of one Flavius Zeuxis, for example, whose tomb epitaph at Hierapolis in Asia Minor (*IGRR* 4.841) boasts that he rounded Cape Malea some seventy-two times on voyages to Italy (see the epigram to Chapter 6, page 157). Similar numbers would have been seen in the case of heavily-trafficked routes, such as between Rhodes and Alexandria, or between Carthage and Puteoli/Ostia.

[92] On the monsoons and their employment by Greek and Roman seafarers, see Tarn 1951, 366–70; Böker 1962; Raschke 1978, 660–3; Casson 1989, 224, 289–91.

back upwind using enormous expenditures of time, labor and wear on the ship and crew. This appears to be the background informing Seneca's well known quip: "If a man does not know to which port he is steering, no wind is favorable to him."[94]

Such *Kurswinde* are not always reliable, however, particularly while sailing near or during the margins of the seasons when winds often shift and pressure systems approach and pass or their centers wobble. Orientation on the open sea, if reliant on wind alone, can become easily confused in both strong winds and lulls. In many cases what begins as a voyage with favorable winds can, if the wind shifts are recognized, quickly develop into a struggle against headwinds or quickly developing storm winds which first veer (winds shift clockwise) as they approach, then back (shift counterclockwise) as they pass. In these cases, whatever course was established will alter drastically as crews formulate strategies for maneuvering and tacking the ship to maintain an overall effective course (see above, pages 59–61). Only the appearance of land by day or a clear sky at night would permit reliable reorientation.

2. Departure Winds in *ΑΘ*

The evidence for *Kurswinde* is in some degree more secure if included in a more general discussion of local departure winds, that is, winds required by ships to get underway and to clear the harbor. Warships under oars could put to sea in search of favorable winds offshore,[95] but oftentimes sailing ships were constrained by contrary local and seasonal winds to remain in harbor until more favorable winds appeared.[96] During the summer,

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[93] Messedaglia 1899, 86; cf. above n. 77.

[94] Sen. *Ep.* 71.3: *Ignoranti quem portum petat, nullus suus ventus est.*

[95] Xen. *Hell.* 2.3.31: "Just as [rowers] toil aboard ship, until they But just You must toil like seamen do [at the oar] until they get a fair wind" (*ὥσπερ ἐν νηὶ διαπονεῖσθαι, ἕως ἂν εἰς οὖρον καταστῶσιν*).

[96] During the Roman era, offerings to Priapus, the god of the harbor, for a fair departure were a common occurrence. See, e.g., *Gr. Anth.* 10.17: "Great god of the harbour, accompany with soft breeze the departing sails of Archelaus across the undisturbed water as far as the open sea, and you who rule over the far point of the beach, preserve him on his voyage as far as the Pythian shrine. From thence, if all we singers are dear to Phoebus, I will sail trusting in fair zephyrus" (*Ἀρχέλεω, λιμενῖτα, σὺ μέν, μάκαρ, ἠπίῳ αὔρῃ | πέμπε κατὰ σταθερῆς οἰχομένην ὀθόνην | ἄχρις ἐπὶ Τρίτωνα· σὺ δ' ἠόνος ἄκρα λελογχὼς | τὴν ἐπὶ Πυθείου ῥύεο ναυστολίην· | κεῖθεν δ', εἰ Φοίβῳ μεμελήμεθα πάντες ἀοιδοί, | πλεύσομαι εὐαεῖ θαρσαλέως ζεφύρῳ*). Cf. *Gr. Anth.* 10.1, 14 and 16.

onshore winds typically blew directly from the sea during the morning and early afternoon and made getting underway challenging in some circumstances and impossible in others, depending on local geography. Contrary seasonal winds, too, could keep ships in harbor for days, weeks and months at a time.[97]

Many regions, however, had their particular local winds which facilitated departures, and it is tempting to imagine Timosthenes' *On Harbors* or Varro's *Ora Maritima* filled with such crucial information. Never adduced or interpreted as evidence of departure winds is the short Aristotelian treatise *ΑΘ*, discussed above.

Under the heading of each of the eleven major winds are associated more than a score of local winds named after mountains, headlands, straits and regions—nearly all associated with coastal areas (Table 4.4). Of the twenty-five local winds, four derive from the Levantine littoral, six from the southern coast of Asia Minor (including Rhodes), six from the Aegean Sea (of which two are associated with Lesbos), two from Cyrenaica and two from Magna Graecia. One wind each is treated on the western Italic coast, on the Hellespont, in the interior of Asia Minor and on the coast of the Black Sea (*Hellespontias* is applied to two regions, the Aegean/Hellespont and Cyrenaica). Winds around Egypt are not included, nor are those in the Black Sea aside from the southern coast. Immediately noticeable is how many of them map precisely onto the main trunk route of the eastern and central Mediterranean (see fig. 3.4).

It is clear from the structure of the treatise that the author collected the names of singularly dominant winds from a variety of Mediterranean coastal regions, then associated and assimilated them with a Timosthenic rose of eleven named winds (the twelfth wind was in all probability *Aparktias*).[98] The treatise raises questions of purpose and readership. Was

[97] The *Stadiasmos Maris Magni* (39, 53, 60, 77) lists several harbors as suitable only in summer (*ὅρμος θερινός*) due to the predominant winds in those locales. See Rougé 1966, 113–14.

[98] There are several problems of interpretation of the winds in *ΑΘ*. In Pamphylian Olbia, for instance, *βορρᾶς* is equated with *Ἰδυρεύς*. But the site of *Ἰδυρεύς*, if we have its correct location, is located *south* of Olbia. At Aigai in Syria, the local wind *σκοπελεύς*, named after the Rhosian Skopelos, is considered a *εὖρος* (east-southeast) wind, although the crag is actually due *south* of the city. In Cyrene, *κάρβας* was classified as *εὖρος*. However, the Cypriot city of Karpasia, the putative origin of this wind name, lies east-northeast of Cyrene (Strab. 14.6.3). Similar problems exist for *Ἑλλησποντίας*, classified as *ἀπηλιώτης*. How can the inhabitants of Teos, Crete, Euboea and Cyrene, all of whom lie nearly due south of the Hellespont, possibly consider this wind an easterly? However, if we grant that the names and their associated locales are correct, and that these should be interpreted strictly as departure winds for ships, then these seeming contradictions can be explained: in order

the compilation and assimilation a scientific exercise by one of the authors of the Peripatetic school? Or was it purposely composed for and/or by seafarers, or perhaps for travelers who utilized shipping in these areas? The treatise does not address these details, unfortunately, but the information as compiled would have been useful to seafarers of differing nationalities sailing into and out of ports along the Eastern Mediterranean's main trunk route. Moreover, as we shall see in Chapter 6, this is the kind of information we would expect, but do not generally receive, in the numerous extant *periploi*.

Specific winds, then, were associated with specific routes at least from the first century B.C. The evidence, however, is too thin to consider the association of winds with routes (*Kurswinde*) a general practice for each and every route. It is possible that the more frequently traveled corridors, such as between Rhodes and Alexandria, or between Gaul and the ports of the Tiber mouth, were assigned wind associations because these winds (etesians and mistral respectively) were among the steadiest in the entire Mediterranean. We are on firmer conceptual ground with the recognition in antiquity of departure winds. The pseudo-Aristotelian treatise *ΑΘ* lists several of them, each unique to different locales in the Levant and Aegean and central Mediterranean. Although the treatise's precise raison d'être remains a mystery, the store of practical information it contains would have greatly aided seafarers plowing the trunk route of the Eastern Mediterranean. More importantly, the assimilation of these local winds into a Timosthenic wind rose demonstrates a concern to standardize the Mediterranean's multitude of wind names for ease of reference and understanding among seafarers.

for *Ἰδυρεύς* to be considered a northerly (*βορρᾶς*), a northerly wind from this area of Pamphylia must have been considered essential for ships departing from Olbia to round Cape Gelidonya, that is the Chelidonium promontory and its adjacent isles (after passing the mouth of the Idyros river and before turning westward toward Lycia and Rhodes). Similarly, ships departing Aigai for points west must have relied on an easterly wind, *σκοπελεύς*, blowing from the Skopelos crag (located south of the city) to push them westward under Cilicia. Seafarers from Teos, Crete, Euboea and Cyrene would have considered *Ἑλλησποντίας* an easterly if they were navigating in the northern Aegean area.

V. CONCLUSIONS

In an age without the magnetic compass winds provided a rough and often unreliable, but until the advent of the compass largely irreplaceable, means of orientation for ships' crews struggling to maintain an effective course over the open sea. By the fourth century B.C. the most well-known winds had become ordered into an individual-centered arrangement that we now call a wind rose: some writers described a rose of eight winds based on the Ionian model of a solar-reference horizon divided by solstitial and equinoctial points; others, particularly those describing the maritime sphere in and after the Hellenistic period, described a geometric rose of twelve winds. What physical form they took aboard ship, if any, remains unclear; the lack of material evidence of wind roses on the hundreds of ancient shipwrecks that have been documented all over the Mediterranean and Black Sea suggests that they were conceived primarily as mental constructs. As seafarers amassed a wealth of empirical data in their annual runs through familiar corridors it is reasonable to envisage them as having associated their paths of intended movement with the winds that facilitated their voyages. References to such wind-courses, though existent, are relatively rare in the literature, but it is likely a reference to this skill and competence that we read behind the epigram of the sailor's song heading this chapter. The ability to "command" and "order" the winds to suit a voyage's requirements entailed an intimate knowledge of their regional and seasonal patterns.

Winds, however, had their limitations and idiosyncrasies as indicators of direction. For Caesar's pilot as much as for any other pilot in antiquity and thereafter it was the night sky that could be relied upon for accurate orientation and course steerage.

Chapter 5: *Nautical Astronomy*

Lead on before me, daughter. You are like eyes for my blind feet, like a star to sailors.
—Euripides[1]

So the sailor in mid-sea, when he has left behind the sweet earth, and the lifeless sails on his indifferent mast find no winds, gazes upon the boundless waters, and, overcome by the deep expanse, wearily turns to the sky to refresh his eyes.
—Silius Italicus[2]

While Caesar was chasing Pompey across the Eastern Mediterranean to Egypt in the summer of 48 B.C., the vanquished general, according to Lucan in his epic work *Pharsalia*, took a moment to reflect on how his pilot was directing the ship across this broad sea at night. "[Pompey] consults the steersman about all the stars: In which quarter does he mark the land? What is his method of dividing the sea by the sky? By what constellation does he steer for Syria? Or which of the lights in the Wain correctly points to Libya?"[3] Behind Pompey's (or rather Lucan's) line of questioning (as well as Euripides' lines in the epigram above) lies the reasonable premise that the stars of the night sky were understood by Greeks and Romans to have been exploited somehow for navigational information. These and the scores of other references to stars and seafaring in Greek and Roman literature are indeed reflective of the physical requirements of navigation within many of the maritime corridors we explored in Chapter 3. The aim of this chapter is to determine *how* the stars and constellations were exploited and to offer some informed speculations about those aspects of celestial navigation on which the sources are largely silent. To place our subject within its wider intellectual and cultural milieu this chapter (I) reviews some of the popular, scientific and literary traditions of Greek and Roman astronomy, (II) outlines the structure and order of the night sky and (III) explores the attested and hypothetical methods to which the sources allude.

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[1] Eur. *Phoen*. 834–5: *ἡγοῦ πάροιθε, θύγατερ· ὡς τυφλῶι ποδὶ* | *ὀφθαλμὸς εἶ σύ, ναυβάταισιν ἄστρον ὥς.*

[2] Sil. It. *Pun*. 3.535: *medio sic navita ponto* | *cum dulces liquit terras, et inania nullos* | *inveniunt ventos securo carbasa malo,* | *immensas prospectat aquas, ac, victa profundis* | *aequoribus, fessus renovat sua lumina caelo.*

[3] Luc. 8.167–70: *rectoremque ratis de cunctis consulit astris:* | *unde notet terras; quae sit mensura secandi* | *aequoris in coelo; Syriam quo sidere servet:* | *aut quotus in Plaustro Libyam bene dirigat ignis*. The rest of this passage is discussed below, pages 142–3.

I. Astronomical Traditions

The stars and their complex but steady motions were objects of both wonder and utility in Greek and Roman society. Their formal study was the sphere of philosophers, scientists and to some extent geographers, but we may presume that a large segment of the population had at least some familiarity with those calendrical aspects that impinged on everyday life, such as religion, agriculture and seafaring. The astronomical knowledge we find so visibly and deeply embedded in ancient Mediterranean culture finds expression in three main traditions, all of which overlap to some extent. These include the practical astronomy of Homer and Hesiod; a scientific astronomy which flourished in the Classical and Hellenistic periods but which also looked back to archaic precedents established by Ionian scientists; and a strong literary tradition derived ultimately from Hesiod but heavily influenced by the astronomical poem of Aratus of Soloi in the Hellenistic period (fig. 5.1). Before we move on to more focused questions about the role of astronomy in ancient Greek and Roman navigation, let us briefly explore these traditions to place our subject in its relevant context.

1. The Archaic Tradition: Homer and Hesiod

Astronomical references in Homer and Hesiod reflect the state of knowledge of the night sky before the Classical period and establish the core themes that characterize many subsequent literary references on the topic. The Homeric poems employ celestial imagery for various literary effects. 'Starry' (*asteroeis*), for example, is used to describe a sky (*ouranos*) characterized as a solid object supported by pillars.[4] Day and night were divided by the course of the sun and stars—the day into morning, noon and afternoon, the night into three watches.[5] The shield of Achilles wrought by Hephaestus in *Iliad* Book 18 displays some of the more prominent heavenly bodies of the cosmos—the sun, the moon and the

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[4] On the 'starry' sky, see Hom. *Od.* 11.17; the solid sky: *Od.* 3.1–2, *Il.* 17.425; supported by pillars: *Od.* 1.52–4.

constellations Pleiades, Hyades, Orion and the Bear.[6] These and other constellations were employed as guides for Odysseus on his raft-borne voyage to Phaeacia:

> Gladly then did noble Odysseus spread his sail to the breeze; and he sat and guided his raft skillfully with a steering oar, nor did sleep fall upon his eyelids as he watched the Pleiades, and late-setting Boötes, and the Bear, which men also call the Wain and which ever circles where it is and watches Orion; it alone has no part in the baths of Ocean. For this star Calypso the beautiful goddess, had bidden him to keep on the left hand as he sailed over the sea, and on the eighteenth appeared the shadowy mountains of the land of the Phaeacians, where it lay nearest to him; and it looked like a shield in the misty sea.[7]

Several enduring themes spring from this passage, including the dutiful helmsman invested with a special knowledge of certain essential constellations and their cycles to accomplish safe, night-time voyages across the sea, and the first mention in Greek of the circumpolar constellation Arktos, the Bear, which neither rises nor sets in the latitudes of the Aegean, but circles the northern null point (see below, page 136). This first list of 'watch' stars—the Pleiades, Boötes, Bear and Orion—were associated with seafaring and tracking the transitions of the seasons. They would remain fixed in literature for more than a millennium.[8]

In Hesiod's *Works & Days* from the seventh century B.C. we find evidence of a rich tradition of solar and celestial observation employed primarily for the sort of calendrical maintenance we would expect of an agricultural society regulated by the solar year. Hesiod

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[5] Day-time divisions: Hom. *Il.* 21.111; *Od.* 7.288; on Homer's night-time division into three watches, see below, page 139.

[6] Hom. *Il.* 18.483–9; see Phillips 1980 and Hardie 1985.

[7] Hom. *Od.* 5.269–81: *γηθόσυνος δ' οὔρῳ πέτασ' ἱστία δῖος Ὀδυσσεύς. | αὐτὰρ ὁ πηδαλίῳ ἰθύνετο τεχνηέντως | ἥμενος· οὐδέ οἱ ὕπνος ἐπὶ βλεφάροισιν ἔπιπτε | Πληϊάδας τ' ἐσορῶντι καὶ ὀψὲ δύοντα Βοώτην |Ἄρκτον θ', ἣν καὶ ἄμαξαν ἐπίκλησιν καλέουσιν, | ἥ τ' αὐτοῦ στρέφεται καί τ' Ὠρίωνα δοκεύει, | οἴη δ' ἄμμορός ἐστι λοετρῶν Ὠκεανοῖο· | τὴν γὰρ δή μιν ἄνωγε Καλυψώ, δῖα θεάων, | ποντοπορευέμεναι ἐπ' ἀριστερὰ χειρὸς ἔχοντα. | ἑπτὰ δὲ καὶ δέκα μὲν πλέεν ἤματα ποντοπορεύων, | ὀκτωκαιδεκάτῃ δ' ἐφάνη ὄρεα σκιόεντα | γαίης Φαιήκων, ὅθι τ' ἄγχιστον πέλεν αὐτῷ | ἴσατο δ' ὡς ὅτε ῥινὸν ἐν ἠεροειδέϊ πόντῳ.*

[8] These same constellations, in addition to the Hyades (like the Pleiades, a cluster in Taurus), appear in *Il.* 18.483–9 (description of Achilles' shield). On the Dog of Orion (Sirius), see *Il.* 22.29. On the employment of these stars and constellations as important seasonal markers, see above, pages 65–7. Interesting in this regard is an astronomical graffito discovered on a Geometric krater sherd of ca. 700 B.C. from Pithekoussai (Coldstream and Huxley 1996). The fragmentary graffito is in the shape of a constellation with lines connecting what appear to be four stars. At the termination of one of these lines is the letter *Beta*. They suggest that the letter may have stood for Boötes (α Böotis), which happens to be the brightest star in the northern hemisphere. While it is tempting to speculate on a connection between Homer's Boötes and the Euboean seafarers at Pithekoussai in the eighth century B.C., the fragmentary state of the sherd precludes even tentative identification.

offers advice on when to conduct essential agricultural tasks (381–617), when to embark on the sea for trading (618–94) and on proper social and religious conduct (336–80, 695–764). Agricultural and seafaring activities are nearly all described within the context of heliacal risings and settings of key stars and star-groups, most of which appeared in Homer. We have already discussed Hesiod's advice on the sailing season in terms of the solar and celestial points of reference (see Chapter 3), but note here the use of the same seasonal benchmark stars and constellations as we saw above in the *Odyssey*:

> When the Pleiades, daughters of Atlas, are rising [early May], begin your harvest, and your plowing when they are going to set [early November]. Forty nights and days are they hidden and appear again as the year moves round, when first you sharpen your sickle.[9]

> Set your slaves to winnow Demeter's holy grain when strong Orion first appears [July], on a smooth threshing-floor in an airy place.[10]

> But when Orion and Sirius are come into midheaven, and rosy-fingered Dawn sees Arcturus [September], then cut off all the grape-clusters, Perses, and bring them home. Show them to the sun ten days and ten nights: then cover them over for five, and on the sixth day draw off into vessels the gifts of joyful Dionysus. But when the Pleiades and Hyades and strong Orion begin to set [end of October], then remember to plow in season.[11]

These and other passages in the *Works & Days* are a testament to the existence of a popular, pre-scientific astronomical tradition born of generations of simple observations and predictions for the regulation of seasonal tasks.[12] Hesiod is concerned with conveying practical knowledge to a general audience. Just as in the case of the Homeric epics, the audience would have been "fully familiar with the basic knowledge as well as the images in the text. The material is neither exotic nor esoteric…Reading these passages, one has the

[9] Hes. *Op.* 383–7: *Πληιάδων Ἀτλαγενέων ἐπιτελλομενάων | ἄρχεσθ' ἀμήτου, ἀρότοιο δὲ δυσομενάων. | αἳ δή τοι νύκτας τε καὶ ἤματα τεσσαράκοντα | κεκρύφαται, αὖτις δὲ περιπλομένου ἐνιαυτοῦ | φαίνονται τὰ πρῶτα χαρασσομένοιο σιδήρου.*

[10] Hes. *Op.* 597–8: *Δμωσὶ δ' ἐποτρύνειν Δημήτερος ἱερὸν ἀκτὴν | δινέμεν, εὖτ' ἂν πρῶτα φανῇ σθένος Ὠρίωνος.*

[11] Hes. *Op.* 609–17: *Εὖτ' ἂν δ' Ὠρίων καὶ Σείριος ἐς μέσον ἔλθῃ | οὐρανόν, Ἀρκτοῦρον δὲ ἴδῃ ῥοδοδάκτυλος Ἠώς, | ὦ Πέρση, τότε πάντας ἀποδρέπεν οἴκαδε βότρυς, | δεῖξαι δ' ἠελίῳ δέκα τ' ἤματα καὶ δέκα νύκτας, | πέντε δὲ συσκιάσαι, ἕκτῳ δ' εἰς ἄγγε' ἀφύσσαι | δῶρα Διωνύσου πολυγηθέος. αὐτὰρ ἐπὴν δὴ | Πληιάδες θ' Ὑάδες τε τό τε σθένος Ὠρίωνος | δύνωσιν, τότ' ἔπειτ' ἀρότου μεμνημένος εἶναι | ὡραίου.*

[12] Dicks 1970, 34–8.

sense that the Greek world at the time must have been saturated with a practical knowledge of astronomy."[13]

2. The Scientific Tradition

While the practical, time-focused astronomy of archaic times endured to the end of antiquity the classical period saw the development of a more mathematically based observational astronomy for the same and similar purposes. By the beginning of the fifth century B.C., if not a generation earlier, Cleostratus of Tenedos had delineated in verse the twelve signs of the zodiac,[14] and in 432 B.C. Meton and Euctemon observed the summer solstice at Athens in an attempt to gauge an accurate length of the year.[15] Meton also became associated with the discovery of the so-called Metonic or nineteen-year luni-solar cycle in which the sun and moon return to their first observed positions.[16]

In the same century appear the first literary *parapegmata*, or astrometeorological calendars, which correlated weather phenomena (e.g., the onset and abatement of the etesian winds) with the risings and settings of certain stars and constellations. The reason for the name, derived from the verb *parapegnumi* ("to fix something beside something else"), was unclear until the discovery of stone versions from the late second and first centuries B.C. in the theater at Miletus; others have been found in the Ceramicus district of Athens (possibly fourth century B.C.) and at Puteoli (date unknown). These had holes for pegs bored into them alongside the weather or astronomical entries. The pegs were moved each day from hole to hole to show the current astrometeorological condition.[17]

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[13] Aveni and Ammerman 2001, 85.

[14] Plin. *NH* 2.6.31; see Fotheringham 1919 and Dicks 1970, 87.

[15] Diod. Sic. 12.36.1–2; see also Evans 1998, 205; Bowen and Goldstein 1988; Dicks 1970, 87–8.

[16] Diod. Sic. 12.36.2; Censorinus, *De die natali* 18.8. See Neugebauer 1975, 2:622–4 and Bowen and Goldstein 1988.

[17] Geminus attributes *parapegmata* to Meton, Euctemon and Democritus, all late fifth-century B.C. scientists. On *parapegmata* in general, see Neugebauer 1975, 2:587–9; Evans 1998, 199–204 and Hannah 2001. The latest useful study on *parapegmata*, complete with analysis, catalogues and exhaustive bibliography, is Lehoux 2007. On the stone versions from Miletus see Diels and Rehm 1904 and Rehm 1904.

Parmenides of Elea (*fl.* 450 B.C.), probably an elder contemporary of Meton, was among the first to posit the sphericity of the earth,[18] but fourth-century B.C. philosophers such as Plato and Aristotle are credited with establishing a stationary spherical earth with a rotating spherical cosmos.[19]

Theoretical astronomy with mathematical underpinnings appeared in the fourth century B.C. when geometric and geocentric models of uniform circular motion were developed to explain the irregular motions of heavenly bodies. Some of the first theories were ascribed to Eudoxus of Cnidus (ca. 390–337 B.C.), a contemporary of Plato and Aristotle and the writer of at least two treatises on celestial motion, the *Phaenomena* and the *Enoptron*. The former work presented a description of the constellations and the circles of the celestial sphere; the latter work consisted mostly of a revision of the former. The oldest extant works on Greek mathematical astronomy, however, are *On the Moving Sphere* and *On Rising and Settings* by Autolycus of Pitane (late fourth century B.C.) in which the author attempted to remedy some of the observational problems presented by Eudoxus' homocentric spheres.

Some of the earliest systematic and careful observations of the declinations of stars, the moon and Venus were made by Timocharis and Aristyllus in Alexandria in the early third century B.C.[20] Aristarchus of Samos (ca. 280 B.C.) developed a heliocentric theory in which the earth rotated about its own axis around the sun and calculated the size of the sun and moon by rough geometrical methods, but these ideas had little impact among contemporary practicing astronomers.[21] About the same time Aratus of Soloi published his *Phaenomena*, a versified and extremely popular poetic version of Eudoxus' work by the same name (see below).

Over a century later Hipparchus (ca. 140 B.C.) made great strides in Greek astronomy by accessing a wealth of Babylonian observational records and adopting their mathematical procedures, including the sexagesimal system. He assigned numerical values to these and his own observations and developed trigonometric techniques in order to *predict* (as opposed to

[18] Diog. Laert. *Vit.* 8.48.
[19] Pl. *Phd.* 108e, *R.* 616b, *Ti.* 40b; Arist. *Cael.* 297a–298a.
[20] Their observations are used by Ptolemy (*Alm.* 7.3). See Maeyama 1984 and Goldstein and Bowen 1989.

observe) celestial positions for any given time. From his computations of star position and the length of the year he was also the first to discover the precession of the equinoxes (see below). Although he published copiously, only his *Commentary on the Phaenomena of Eudoxus and Aratus* survives. Most of our knowledge of his astronomical work comes from Ptolemy's *Almagest*, which eclipsed most of his and later writings.[22]

These advances in Hellenistic astronomy led to the creation of mechanical models designed to simulate solar, stellar and planetary motions. Here mention should be made of the Antikythera mechanism, a geared astronomical calculator found on a first-century-B.C. shipwreck off that island in 1900.[23] This complex system of gears, dating probably to the same century as the ship, was housed in a wooden casing with front and back doors. Its gearing and inscriptions relate to various cycles, including the sun and moon in the zodiac, a solar calendar adjustable to leap years, the Saros eclipse cycle, the 19-year Metonic cycle and the 76-year Callippic cycle. And some of the gearing has recently been found to calculate the irregular motion of the moon by methods developed by Hipparchus. Although there are mentions of such mechanized models in the works of Cicero and others, none had ever been found before or since the Antikythera mechanism.[24] And none would be seen again until the Byzantine period, albeit in simpler form.[25]

Although Greek astronomy continued to develop and draw from Babylonian resources after Hipparchus, the next three centuries are all but a blank. Nearly the only extant work is Geminus' *Isagogē*, or *Introduction to Astronomy* from the first century B.C., a text-book-like work which gives some of the basic concepts of astronomy as understood in his day.[26] To this was appended a *parapegma* which appears to be at least a century older, but contains references to *parapegma* writers as far back as Euctemon, with whom the genre may have originated.

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21 Archimedes, *Sand-reckoner* 4–5. On Aristarchus see Heath 1959; Neugebauer 1975, 2:634–43.
22 The essential study of Hipparchus is Neugebauer 1975, 1:274–343.
23 Price 1975; Edmunds and Morgan 2000; Freeth et al. 2006. The mechanism was first reported to be an astrolabe (P. Rediadis in Svoronos 1908, 43–53; cf. Arenson 1990, 96), then an ancient navigational instrument akin to a sextant (see, e.g., Köster 1923, 196–7; repeated by Rougé 1966, 82).
24 Textual references are compiled and discussed in Price 1975, 56–60.
25 See, e.g., Field and Wright 1985.
26 See Evans and Berggren 2006.

Scientific astronomy reaches its acme in Alexandria in the mid second century A.D. with Claudius Ptolemy's *Almagest*.[27] This grand mathematical treatise in thirteen books covers all the major astronomical subjects of his day: spherical astronomy (Book 1), solar and lunar theory (2–5), eclipses (6), a catalogue of stars visible from Alexandria (1, 7–8), longitude (9–11), planetary stations and retrograde orbits (12) and planetary latitudes (13). It overshadowed and surpassed all earlier works on the subject, thus causing the disappearance of works from which he quoted. It would become the canonical work for the next thirteen centuries.

Ptolemy, drawing on his astronomical knowledge, also wrote a *Geography* in which he laid out the methods and data required to make maps of the *oikoumenē*. As early as the fourth century B.C. Greek scientists recognized parallel lines of latitude. Pytheas of Massilia (ca. 330 B.C.), for instance, used the length of the solstitial day and the length of the gnomon's noontime shadow to determine the geographic relationship between localities in the western Mediterranean and northwest Europe.[28] And Aristotle's pupil Dicaearchus of Messana (ca. 326–296 B.C.) in his non-extant *Periodos gēs* used observations of the elevations of the pole (or the length of the solstitial day) to assign several locations to a latitude zero, a sort of Mediterranean-based equator that stretched through the Pillars of Heracles, Sardinia, Sicily, the Peloponnese, Caria, Lycia, the Taurus range and the "Imaos" (probably the Himalayas).[29] Eratosthenes built on this concept in his *Geography*,[30] but Ptolemy advanced the method further by developing a system of orthogonal coordinates of latitudes and longitudes, measured in degrees and minutes, to map the positions of some 8,000 localities on the earth's surface. Zero latitude was based on the equator, and longitudinal zero was located in the "Fortunate Islands" (the Canaries) because this island group was the westernmost part of

[27] Toomer 1984; Neugebauer 1975, 1:21–261.

[28] Roseman 1994, with fragments and commentary; Dicks 1960, 180–2, 185–7.

[29] Agathem. 1.5 (G*GM*, 2:472; see Keyser 2001, esp. 365–8): "Dicaearchus defines the earth not by waters but by a straight line from the Pillars through Sardinia, Sicily, Peloponnesus, Ionia, Caria, Lycia, Pamphylia, Cilicia and Taurus as far as Mt. Imaus, and he calls the several regions either northern or southern" (*Δικαίαρχος δ' ὁρίζει τὴν γῆν οὐχ ὕδασιν, ἀλλὰ τομῇ εὐθείᾳ ἀκράτῳ ἀπὸ Στηλῶν διὰ Σαρδοῦς, Σικελίας, Πελοποννήσου, Ἰωνίας, Καρίας, Λυκίας, Παμφυλίας, Κιλικίας, καὶ Ταύρου ἑξῆς ἕως Ἰμάου ὄρους. Τῶν τοίνυν τόπων τὸ μὲν βόρειον, τὸ δὲ νότιον ὀνομάζει*).

[30] Strab. 2.1.1; 2.4.2–3. Cic. *Att.* 6.2.3. see Bunbury 1959, 1:616–28.

the known world. Ptolemy's world map was constructed using the same system we use today, and would remain unaltered for the next fourteen centuries.

3. The Literary Tradition

The night sky, as we saw above, served as a theme for archaic poets before it became a scientific discipline. Homer established as important constellations and star groups the Pleiades, the Hyades, Orion, Bear, Boötes, the Dog and Hesperus, and in Hesiod are added Sirius, Arcturus and the solstices. The lyric and dramatic poets of the later Archaic and Classical periods expounded on these same star themes for a variety of reasons, from gauging the time of night (see below) and the season of the year,[31] to referring to one or two popular stars as a synecdoche for the entire night sky,[32] to inventing astronomical metaphors.[33] The Presocratic philosophers adopted Hesiod's hexameters as the formal verse for discussing astronomical theories.[34]

The literary tradition of astronomy was rejuvenated with the publication of Aratus' immensely popular *Phaenomena*, a didactic poem written in the first half of the third century B.C. and based on Eudoxus' astronomical work.[35] It reworked the literary tradition of astronomy while at the same time offering a spate of new material. Aratus' 1150 lines of hexameters merge literary tropes with current scientific understandings to describe all the constellations then known (lines 19–461), the relative times of their risings and settings (462–757) and the numerous astral and natural signs to be employed by farmers and sailors for predicting weather (758–1141). The *Phaenomena* was influential in its day and in subsequent Greek and Latin traditions. Callimachus drew some inspiration from it, as did Apollonius of Rhodes in his *Argonautica* and Theocritus in his bucolic poetry.[36] The *Phaenomena* itself was translated into Latin at least three times—by Cicero, Germanicus and

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[31] See, e.g., Campbell 1994, 130–1 (Sappho 104a) and 172–3 (Sappho 168b); Aesch. *Ag.* 4–6; Eur. *IA* 7–8, *Rhes.* 527–30.
[32] See Eur. *Ion* 1147–58.
[33] Alcm. 1.60–3 in Page 1962, 4; Pind. *Nem.* 2.10–12.
[34] See, e.g., Parmenides fragments 8–11 and Empedocles fragments 27–9, 41–2.
[35] For the latest edition of the text and a complete commentary see Kidd 1997.
[36] See Kidd 1997, 37–40.

Avienus—and some two dozen scholia and commentaries have survived entire, in fragments or in titles.[37] It endured well into the Middle Ages through the textual tradition of the *Aratus Latinus*.[38]

The literary tradition of astronomy in Hellenistic Greece and early imperial Rome was also concerned with the forecasting of weather by observing the appearances of sun, moon and stars alongside those signs given by clouds, winds, animals and vegetation. Some of these astrometeorological signs have already been seen in Hesiod (see above), but a genre of astrometeorology and weather lore flourished among the peripatetics, particularly Aristotle and Theophrastus. To the latter author is ascribed a treatise entitled *Peri Semeiōn*, now generally referred to as *De Signis* (see below, pages 210–11). In it are many of the same signs Aratus included in the *Phaenomena*. Certain characteristics of the constellation Crab, for example, appears as a sign of weather in both works:

> *De Signis*: In the constellation of the Crab are two stars which are called the Asses; in between them is a nebula called the Manger. If this becomes hazy it is a sign of rain…If the Manger of the Ass becomes condensed and hazy, it indicates a storm…Whenever the Manger of the Ass is clear and bright, it signifies fair weather.[39]

> Arat. *Phaen.*: Observe also the Manger: like a faint haze in the north it leads in company with the Crab. On either side of it move two faintly shining stars, not at all far apart nor very close, but as far as the approximate estimate of a short cubit; one comes on the north side, the other on the south. Now these are called the Asses, and between them lies the Manger. If suddenly it disappears completely when the sky becomes clear all around, and the stars that go on either side appear near to one another, then the fields are inundated with no small storm. If it [the Manger] should grow dark and the two stars be visible at the same time, they will be signaling rain. If the one to the north of the Manger shines faintly, appearing a little hazy, and the southern Ass is bright, expect wind from the south; and a northerly wind you must certainly expect if the hazy and the bright stars are the other way around.[40]

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[37] On the fragments of Cicero's *Phaen.*, see Soubiran 1972, 158–95; on Germanicus' version, Breysig 1899 and Gain 1976; on Avienus, Soubiran 1981. On the scholia and commentaries of Aratus' *Phaenomena*, see Kidd 1997, 43–8. The influence of the poem was felt at many social and cultural levels, as even the apostle Paul quoted lines from the proem (*Acts of the Apostles* 17.28).

[38] On the *Aratus Latinus* see Maass 1892, comm. 174–306; Kidd 1997, 52–5.

[39] [Theophr.] *De Signis* 23, 43 and 51: *Ἐν τῷ καρκίνῳ δύο ἀστέρες εἰσὶν, οἱ καλούμενοι ὄνοι, ὧν τὸ μεταξὺ τὸ νεφέλιον ἡ φάτνη καλουμένη. Τοῦτο ἐὰν ζοφῶδες γένηται ὑδατικόν…Ἡ τοῦ ὄνου φάτνη εἰ συνίσταται καὶ ζοφερὰ γίνεται χειμῶνα σημαίνει…Καὶ ἡ τοῦ ὄνου φάτνη ὅτε ἂν καθαρὰ καὶ λαμπρὰ φαίνηται εὐδιεινόν.*

[40] Arat. *Phaen.* 892–908: *Σκέπτεο καὶ Φάτνην. Ἡ μέν τ' ὀλίγῃ εἰκυῖα | ἀχλύϊ βορραίη ὑπὸ Καρκίνῳ ἡγηλάζει· | ἀμφὶ δέ μιν δύο λεπτὰ φαεινόμενοι φορέονται | ἀστέρες, οὔτε τι πολλὸν ἀπήοροι οὔτε μάλ' ἐγγύς, | ἀλλ' ὅσσον τε μάλιστα πυγούσιον ὠΐσασθαι, | εἷς μὲν πὰρ βορέαο· νότῳ δ' ἐπικέκλιται ἄλλος. | Καὶ τοὶ μὲν καλέονται Ὄνοι, μέσση δέ τε Φάτνη, ἥτε κεὶ ἐξαπίνης πάντη Διὸς εὐδιόωντος | γίνετ' ἄφαντος ὅλη, τοὶ δ' ἀμφοτέρωθεν ἰόντες | ἀστέρες ἀλλήλων αὐτοσχεδὸν ἰνδάλλονται, | οὐκ ὀλίγῳ χειμῶνι τότε κλύζονται ἄρουραι. | Εἰ δὲ μελαίνηται, τοὶ*

Vergil's *Georgics* and Ovid's *Fasti* imitated much of Aratus' material, but successive writers such as Columella, the Elder Pliny and Vegetius used prose as the medium of expressing astrometeorological signs, and predominantly in agricultural contexts.[41]

Manilius' *Astronomica* from the first century A.D., though versified and didactic like the works of Hesiod and Aratus, existed outside of all of these traditions in its treatment of purely astrological matters.[42]

4. A Textual Tradition of Nautical Astronomy?

So far we have covered the three main traditions of astronomy in antiquity. Did any of them include a component on nautical astronomy? Or was there a fourth tradition devoted specifically to navigation at night?

Our sources leave us in some doubt whether the formal study of astronomy had any effect on navigation. Despite the long-established practice of overnight voyaging from at least the early Archaic period, and despite the strong and enduring astronomical traditions and advances of Greek and Roman astronomers over the course of antiquity, there appears to have been little effort exerted on the part of the scientific community to detail any of the practices and techniques of nautical astronomy. The single exception is the supremely relevant though non-extant work entitled *Nautical Astronomy* (*nautikē astrologia*), which was attributed by Diogenes Laertius either to Thales of Miletus or to one Phocus of Samos.[43]

δ' αὐτίκ' ἐοικότες ὦσιν | ἀστέρες ἀμφότεροι, ἐπί χ' ὕδατι σημαίνοιεν. | Εἰ δ' ὁ μὲν ἐκ βορέω Φάτνης ἀμενηνὰ | φαείνοι λεπτὸν ἐπαχλύων, νότιος δ' Ὄνος ἀγλαὸς εἴη, | δειδέχθαι ἀνέμοιο νότου· βορέω δὲ μάλα χρὴ | ἔμπαλιν ἀχλυόεντι φαεινομένῳ τε δοκεύειν. The distance measurement *πυγούσιος* (from *πυγών*) is Homeric; it is a short cubit equivalent to 20 *δάκτυλοι* (see Kidd 1997, 481–2 and *LSJ* s.v.).

[41] Verg. *G.* 1.351–465; Ov. *Fast.* 1–6; Columella, *Rust.* 11.2.4–97; Pliny *NH*, Book 18; Veg. *Mil.* 4.40–1.

[42] See Goold 1997.

[43] Diog. Laert. *Vit.* 1.23: "According to some he [Thales] left behind no writings. For the book on *Nautical Astronomy* which is attributed to him is said to be the work of Phocus of Samos. But Callimachus knew him as the discoverer of the Lesser Bear, saying in his *Iambics* thus: 'And he is said to have computed the little stars of the Wain (*Ursa Major*) by which the Phoenicians sail their ships.'" (*καὶ κατά τινας μὲν σύγγραμμα κατέλιπεν οὐδέν· ἡ γὰρ εἰς αὐτὸν ἀναφερομένη ναυτικὴ ἀστρολογία Φώκου λέγεται εἶναι τοῦ Σαμίου. Καλλίμαχος δ' αὐτὸν οἶδεν εὑρέτην τῆς ἄρκτου τῆς μικρᾶς, λέγων ἐν τοῖς Ἰάμβοις οὕτως: καὶ τῆς Ἀμάξης ἐλέγετο σταθμήσασθαι τοὺς ἀστερίσκους, ᾗ πλέουσι Φοίνικες* [= Callim. Fr. 191.52–5]); here Diogenes appears to confuse *Ἄμαξα*, typically

That it was archaic in date is confirmed by Plutarch, who describes its composition as hexametric, a mode typical of the Ionian cosmographers.[44] Although Diogenes and Plutarch doubted Thales' authorship, both archaic figures are dubious candidates. Thales' name had already reached legendary status by the Classical period and served as a magnet for the attribution of numerous works by authors living centuries later; the Milesian sage has not one single title attributed to him on reliable authority.[45] The obscure Phocus of Samos, on the other hand, is nowhere else attested. We can only speculate on its contents: the title is highly evocative of a didactic work in the Hesiodic tradition, perhaps a catalogue of stars used in navigation or an exposition on the uses of the two Bears and other circumpolar constellations (discussed below).[46] Such didactic works in catalogue form found expression on similar topics toward the late Archaic period. These include the *Ges periodos* and *Astronomy* ascribed to Hesiod and the versified zodiacal poem by Cleostratus of Tenedos (see above, page 123).[47] On the other hand, it may have taken the form of a technical handbook of the sort that was in vogue during the Classical period.[48] Whatever its form, its impact appears to have been negligible. No other scientist is known to have addressed the issue, and Geminus' divisions of mathematical science (of which astronomy was part) make no room for it.[49]

Precisely why the topic was addressed in the first place but failed to engage others subsequently remains a puzzle. We may infer that the weather lore and astrometeorological references expressed in Hesiod, Aristotle, Theophrastus, Aratus and later authors, as well as

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used to describe *Ursa Major* (cf. Hom. *Il.* 18.487, *Od.* 5.273), with Cynosura, or *Ursa Minor*; see also below, n. 53. On later attestations of the *ναυτικὴ ἀστρολογία*, see Diels and Kranz 1956, 1:80 (11.1B).

[44] See Plut. *De Pythiae oraculis* 18.402e. Kirk and Raven (1963, 87–8) reasonably suggest that the unattributed (or falsely attributed) *Nautical Astronomy* was housed in the Alexandrian Library.

[45] Dicks 1959; Dicks 1970, 42–4. Hodges (1992, 183) cites no evidence in crediting Thales with devoting himself to a "study of navigation at sea."

[46] Thales appears to have attracted other notice as one interested in problems related to seafaring. Proclus, for example, credits him with the discovery of a geometrical method by which he could show the distances of ships at sea (*In primum Euclidis elementorum librum commentarii* 352, 14–18 in Friedlein 1873): "Eudemus in his 'History of Geometry' credits Thales with this theorem. For he says that Thales must have applied it for the method by which, they say, he showed the distance of ships at sea" (*Εὔδημος δὲ ἐν ταῖς γεωμετρικαῖς ἱστορίαις εἰς Θαλῆν τοῦτο ἀνάγει τὸ θεώρημα. τὴν γὰρ τῶν ἐν θαλάττῃ πλοίων ἀπόστασιν δι' οὗ τρόπου φασὶν αὐτὸν δεικνύναι τούτῳ προσχρῆσθαί φησιν ἀναγκαῖον*). Perhaps this theorem was derived from the lost *Nautical Astronomy*.

[47] See Kahn 2003, 148–9.

[48] Such technical manuals included Sophocles' *On Greek tragedy*, Ictinus' *On the Parthenon* and Hippodamus' *On Town Planning*, to name but a few (see Turner 1952, 18).

[49] Gem. *Philokalia*. For translation and commentary, see Evans and Berggren 2006, 243–9; Evans 1998, 83–4.

those derived from the *parapegma* tradition, were known to and utilized by seafarers and travelers to plan their voyages (see below, pages 208–9). Indeed, there are numerous references to weather lore that pertain explicitly to seafaring (see below, pages 209–13). But one can only speculate to what extent, if any, the scientific tradition of astronomy impacted on the various seafaring communities of Greece and Rome. This is because we are generally unaware of the nature of interaction between astronomers and seafarers during any century of antiquity, and whether there was any conceptual or quantitative borrowing of ideas and information such as that which no doubt took place between geographers and seafarers, particularly regarding the mapping of the *oikoumenē*. In other words, geographers were known to consult seafarers for distance information, but no astronomers are known to have consulted seafarers regarding the night sky. Similarly, no seafarers appear to have appealed to astronomers for astronomical information. Even Pytheas of Massalia, an astronomer and renowned explorer of the outer ocean, is silent on the subject of navigation, at least as far as can be discerned in the fragments.

It is possible, perhaps even probable, that the theoretical and geometric models of astronomy from the Classical and Hellenistic period were simply not conducive to exploitation by seafarers who applied practical (sc. non-arithmetical) techniques to solve their navigational problems. Put another way, arguments of planetary orbits, the minutiae of eclipses and notions of sphericity were not readily applicable to the more fundamental challenges of steering accurate courses by the stars. In any event, we may never know whether a single Greek or Roman seafarer (literacy issues aside) ever felt an incentive to read even such low-level, textbookish material as Leptines' *Celestial Teaching*, Geminus' *Isagoge* or Cleomedes' *Meteora*.[50] And if such works were read by seafarers, it is unclear what information would have proven helpful and applicable. To be sure, the nearly total the lack of references to nautical astronomy in the scientific tradition is strongly suggestive of a disconnect between the two communities throughout most of the period of this study.

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[50] On Leptines' *Ouranios Didascalea* (second century B.C.) see Blass 1887; Tannery 1893, 283–94; Evans and Berggren 2006, 10–12. On Geminus, see above, page 125 and 130 and below, page 135. On Cleomedes' work (ca. second century A.D.), see Todd 1990 and Bowen and Todd 2004.

Instead it is from the literary tradition of astronomy that the vast majority of references to stars and seafaring are derived. Like the seafaring *topoi* we encountered in Chapter 1, these, too, may be classified into two fixed themes—the *topos* of the dutiful helmsman, and the *topos* of the two Bears.

The *topos* of the dutiful helmsman seen time and again in Greek and Latin literature is modeled ultimately on Homer's *Odyssey*, Book 5, which we explored briefly above. The key elements include (1) a sitting helmsman who fights sleep to maintain a vigil watch, (2) his exceptional knowledge of a short list of seafaring stars and constellations (never more than the Pleiades, Arcturus/Boötes, Orion and the Great Bear) and, in some instances, (3) an exceptional ability to predict storms and (4) spot land from extraordinary distances. Notable examples include Tiphys, the expert pilot of Apollonius Rhodius' *Argonautica* (whose abilities are developed further in Flaccus' Latin version), Aeneas' pilot Palinurus, and Bato the Carthaginian pilot of Silius Italicus' *Punica*.[51] Other examples abound.[52]

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[51] On Tiphys see Ap. Rhod. *Argon.* 1.105–8: "Tiphy, son of Hagnias, quit the Thespian deme of Siphai; skilled was he at predicting a rising storm on the broad sea, and windy squalls, and at guiding the ship by sun and stars" (*Τῖφυς δ' Ἁγνιάδης Σιφαιέα κάλλιπε δῆμον Θεσπιέων, ἐσθλὸς μὲν ὀρινόμενον προδαῆναι κῦμ' ἁλὸς εὐρείης, ἐσθλὸς δ' ἀνέμοιο θυέλλας, καὶ πλόον ἠελίῳ τε καὶ ἀστέρι τεκμήρασθαι*); cf. 3.744–6 and Tiphys' characterization in Val. Flacc. *Argon.* 5.44–52: "Where is Tiphys?…Will I not see you watching from the high poop the throng of the Pleiades and the nightly guides, the Bears…Is this the reward, for eyes so often cheated of sweet sleep?" (*ubi Tiphys?…nec summa speculantem puppe videbo | Pleiadumque globos et agentes noctibus Arctos?…hoc labor, hoc dulci totiens fraudata sopore | lumina*); cf. 1.481–3: "The ever watchful Tiphys, Hagnius' son, was gazing intently upon the Arcadian star [the Great Bear], a favored one who found use for the slow moving stars and gave [to men the ability to hold] their watery courses with the sky as their guide" (*pervigil Arcadio Tiphys pendebat ab astro | Hagniades, felix stellis qui segnibus usum | et dedit aequoreos caelo duce tendere cursus*); Verg. *Aen.* 3.513–17: "Hardly idle did Palinurus rise up from his bed and ascertain all the winds, with his ears espy the air and note the stars gliding silently across the sky, Arcturus, the watery Hyades and the twin Bears, and surveyed Orion armed with gold" (*haud segnis strato surgit Palinurus et omnis | explorat uentos atque auribus aera captat; | sidera cuncta notat tacito labentia caelo, | Arcturum pluuiasque Hyadas geminosque Triones, | armatumque auro circumspicit Oriona*); Sil. It. *Pun.* 14.453–7: "skilled was he [Bato] at contending with the fierce sea and outsailing storm winds…nor could Cynosura [Lesser Bear], no matter how obscured its course, escape his faithful watch" (*bonus ille per artem | crudo luctari pelago atque exire procellas…nec peruigilem tu fallere uultum | obscuro quamuis cursu, Cynosura, ualeres*).

[52] Petr. *Sat.* 102: "…the pilot who watches all night long and guards even the motion of the stars" (…*gubernator, qui pervigil nocte siderum quoque motus custodit*); Numenius (a second-century philosopher from Apamea) in Euseb. *Praep. evang.* 11.18: "A pilot driven along in mid-sea sits high enthroned above the rudders and steers the ship by the tillers, his eyes and thoughts intent on the sky and the things above. His path takes him upward through the heavens above as he sails the sea below" (*Κυβερνήτης μέν που ἐν μέσῳ πελάγει φορούμενος ὑπὲρ πηδαλίων ὑψίζυγος τοῖς οἴαξι διιθύνει τὴν ναῦν ἐφεζόμενος, ὄμματα δ' αὐτοῦ καὶ νοῦς εὐθὺ τοῦ αἰθέρος ξυντέταται πρὸς τὰ μετάρσια καὶ ἡ ὁδὸς αὐτῷ ἄνω δι' οὐρανοῦ ἄπεισι, πλέοντι κάτω κατὰ τὴν θάλασσαν*); Libanius, *Progymnasmata* 4.1.13: "Observe, dear one, the pilot. It seems to me that one makes no mistake in calling him the king of the ship. When night comes, does he not sit down at the rudders, keeping his eyes fixed keenly toward the stars and not contentious with the sailors with regard to rest; they lie sleeping with much ease, some on the decks, others in the hold" (*Ὁρᾷς, ὦ 'γαθέ, τὸν κυβερνήτην, ὃν οὐκ ἂν μοι δοκεῖ τις ἁμαρτεῖν εἰπὼν βασιλέα τῆς νεώς; οὐ*

The *topos* of the two Bears (Ursa Major, Ursa Minor) appears to have originated as an archaic tradition. A scholium on Aratus credits the mythical Nauplius with discovering the Great Bear, and Thales the Lesser Bear.[53] If Thales did write on the topic in the sixth century B.C. it appears to have passed subsequently without mention for over two centuries until finally reappearing in the *Phaenomena* of Aratus:

> One of the Bears men also call Cynosura, the other Helice. In order to steer their ships the Achaeans on the sea take their mark by Helice, whereas the Phoenicians cross the sea trusting in the other. Helice, appearing clear at earliest night, is easily recognized; but the other is small, yet better for sailors; for all of her stars wheel in a smaller orbit; by her, then, the Sidonians sail their ships.[54]

It is difficult to determine whether Aratus derived the description directly from Eudoxus' *Phaenomena* or culled it from an older source.[55] In any event, the popularity of the poem stretched well into the Roman era (long after the disappearance of the Phoenicians as a preeminent seafaring culture) and neatly ensured the propagation of these seeming cultural preferences with very little variation, particularly among Latin poets of the late Republic and

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τῆς νυκτὸς ἐπελθούσης ἐπὶ τῶν οἰάκων κάθηται τὰ ὄμματα στήσας ἀκριβῶς πρὸς τὰ ἄστρα καὶ οὐ φιλονεικεῖ τοῖς ναύταις περὶ τῆς ἀναπαύλης; καὶ οἱ μὲν κεῖνται καθεύδοντες μετὰ πολλῆς τῆς ῥᾳστώνης, οἱ μὲν ἐπὶ τῶν καταστρωμάτων, οἱ δὲ ἐν κοίλῃ τῇ νηί). Cf. Soph. fr. 432 and *Anth. Pal.* 7.498, 9.242. Amarantus, the helmsmen in Synesius' voyage, served as a foil to this popular literary model (see Appendix C).

The folk theme of the insomnial pilot is ubiquitous in time and place. Such reference range from Late Bronze Age Egypt (the tomb of the vizier Rekhmira from the fifteenth century B.C.: Fabre 2004–2005, 150) to first-century India (the Jatakamala of Arya Sura: Speyer 1895, 124–5 = Tibbets 1971, 1–2). The latter is worth quoting in full: "He possessed every quality desired in such a one. Knowing the course of the celestial luminaries, he was never at a loss with respect to the regions of the ship, being perfectly acquainted with the different prognostics, the permanent, the occasional and the miraculous ones, he was skilled in the establishment of a given time as proper or improper, by means of manifold marks, observing the fishes, the colour of the water, the species of the ground, birds, rocks etc. he knew how to ascertain rightly the parts of the sea, further he was vigilant, not subject to drowsiness and sleep, capable of enduring the fatigue of cold, heat, rain and the like, careful and patient."

[53] *Scholia in Aratum* 27: "For there are two bears, the greater of which Nauplios found, and the lesser the wise man Thales found" (*διτταὶ γάρ εἰσιν, ὧν τὴν μὲν μείζονα Ναύπλιος εὗρε, τὴν δ' ἐλάττονα Θαλῆς ὁ σοφός).*

[54] Arat. *Phaen.* 36–43: *Καὶ τὴν μὲν Κυνόσουραν ἐπίκλησιν καλέουσιν, | τὴν δ' ἑτέρην Ἑλίκην. Ἑλίκῃ γε μὲν ἄνδρες Ἀχαιοὶ | εἰν ἁλὶ τεκμαίρονται ἵνα χρὴ νῆας ἀγινεῖν· | τῇ δ' ἄρα Φοίνικες πίσυνοι περόωσι θάλασσαν. | Ἀλλ' ἡ μὲν καθαρὴ καὶ ἐπιφράσσασθαι ἑτοίμη | πολλὴ φαινομένη Ἑλίκη πρώτης ἀπὸ νυκτός· | ἡ δ' ἑτέρη ὀλίγη μέν, ἀτὰρ ναύτῃσιν ἀρείων· | μειοτέρῃ γὰρ πᾶσα περιστρέφεται στροφάλιγγι· | τῇ καὶ Σιδόνιοι ἰθύντατα ναυτίλλονται.* Although Callimachus (above n. 43) claims that Thales discovered the Lesser Bear, Cynosura must have been the original Greek name for this constellation before appearing in Eudoxus (see fr. 15; see Kidd 1997, 37, 188).

[55] Hipparchus (1.2.1–16) demonstrated that Aratus derived his astronomical material from Eudoxus by citing parallel passages. As Arat. *Phaen.* 36–43 is not among those parallels cited, we may suspect that Aratus, like Callimachus (above n. 43), adopted and poetically embellished the older theme for his version.

early Empire.[56] Like the seafaring *topoi* we encountered in Chapter 1, this, too, spilled over into prose with very little variation or elaboration.[57]

In sum, then, we derive nearly all of our knowledge of ancient practices and techniques of celestial navigation from literary works that embrace and perpetuate these two *topoi*.

To advance the ideas suggested by the *topoi* and offhand references, and to achieve any deeper understanding of ancient techniques of celestial navigation, will require some cautious speculation. Before embarking, however, we must take a moment to examine the mechanics of the night sky.

II. THE NIGHT SKY[58]

Greek astronomers and their successors to the time of Copernicus almost invariably conceived of a stationary earth fixed in the center of the cosmos.[59] Various celestial bodies

[56] Ov. *Tr.* 4.3.1–7: "You two beasts, great and small and both dry, one the leader of Grecian, the other of Sidonian ships" (*Magna minorque ferae, quarum regis altera Graias,* | *altera Sidonias, utraque sicca, rates*); *Fasti* 3.107–8: "Who knew the Hyades or Pleiades…that there are two Bears, the Sidonians steering by Cynosura, the Greek sailor noting Helice" (*quis tunc aut Hyadas aut Pliadas Atlanteas* | *senserat, … esse duas Arctos, quarum Cynosura petatur* | *Sidoniis, Helicen Graia carina notet*); Luc. 3.214–19: "the nations of Syria came: deserted Orontes and Ninos so wealthy, windy Damascus and Gaza and Idumaea rich in palm groves, and unstable Tyre and Sidon precious with its purple. These ships did Cynosura lead to the war by no winding path of the sea, more certain for no other ships" (*accedunt Syriae populi; desertus Orontes* | *et felix, sic fama, Ninos, uentosa Damascos* | *Gazaque et arbusto palmarum diues Idume* | *et Tyros in stabilis pretiosaque murice Sidon.* | *has ad bella rates non flexo limite ponti* | *certior haud ullis duxit Cynosura carinis*). Cf. Tib. 1.7.19–20 and Luc. 8.167–84 (below, n. 78).

[57] Eratosth. [*Cat.*] 1.2: "The small [stars] of the Bear. This is the so-called Lesser [Bear], but Phoinike is added by most people" (*Ἄρκτου μικρᾶς. Αὕτη ἐστὶν ἡ μικρὰ καλουμένη· προσηγορεύθη δὲ ὑπὸ τῶν πλείστων Φοινίκη*); Cic. *Nat. D.* 2.106: "In this [Cynosura] the Phoenicians trust as a guide by night upon the deep. But Helice shines with stars more clearly marked, and at once after nightfall is seen far and wide, whereas the Cynosura is small, and yet of service to sailors, for it revolves in a narrow circle with its course nearer to the pole" (*Hac fidunt duce nocturna Phoenices in alto.* | *Sed prior illa magis stellis distincta refulgent* | *et late prima confestim a nocte videtur.* | *Haec vero parva est, sed nautis usus in hac est;* | *nam cursu interiore brevi convertitur orbe*); Strab. 1.1.6: "…for it is likely that [in Homer's time] the other Bear [Ursa Minor] had not yet been marked out as a constellation, but when the Phoenicians designated and employed it for their voyages this grouping arrived also among the Greeks" (*οὐδὲ γὰρ εἰκὸς ἦν πω τὴν ἑτέραν ἠστροθετῆσθαι, ἀλλ' ἀφ' οὗ οἱ Φοίνικες ἐσημειώσαντο καὶ ἐχρῶντο πρὸς τὸν πλοῦν παρελθεῖν καὶ εἰς τοὺς Ἕλληνας τὴν διάταξιν ταύτην*); Arr. *Anab.* 6.26: "…making journeys by the stars at night or by the sun in the daytime, as sailors do by the constellations of the Bears—the Phoenicians by the Little Bear, and others by the Greater Bear" (…*πρὸς τὰ ἄστρα ἐν νυκτὶ μεθ' ἡμέραν πρὸς τὸν ἥλιον μεμελετῆσθαί σφισι τὰς πορείας, καθάπερ τοῖς ναύταις πρὸς τῶν ἄρκτων τὴν μὲν Φοίνιξι, τὴν ὀλίγην, τὴν δὲ τοῖς ἄλλοις ἀνθρώποις, τὴν μείζονα*); cf. Achill. Tat. 1.

[58] How ancient astronomers viewed the night sky has passed, as Newton (1974, 19) says, "from the realm of research into the realm of standard knowledge." This section draws from his summary, as well as that of several

trace their movements across the celestial sphere and are recognized by their distinct movements—the sun and a thousand or so 'fixed' stars, *ta aplanē astra*, rotate around the earth every twenty-four hours, the moon follows a complex orbital path, and the five planets, *planetes* (Mercury, Venus, Mars, Jupiter and Saturn), follow their own 'wandering' trajectories according to their respective periods.

The fixed stars move in uniform circles across the night sky, rising in the east and setting in the west. Geminus divided them into three groups of constellations—the zodiac with its twelve signs (and including well-known groups like the Pleiades and Hyades in Taurus), the northern constellations (including a circumpolar group which does not rise and set but revolves around the north celestial pole), and the southern constellations which in Mediterranean latitudes exhibit shorter transits.[60] The south celestial pole is not visible from Mediterranean latitudes (fig. 5.2).

The fixed stars do not rise and set at the same time every night of the year, but rather do so four minutes earlier each night. This is because the sidereal day (i.e., the time required for the heavens to complete one revolution) is approximately four minutes shorter than the solar day of twenty-four hours. The stars therefore appear and disappear with the seasons, but always reappear in the same place (at a particular latitude) at the same time the next year, year after year. Early observations of these regular phenomena developed into a popular astronomy (as we see so vividly in Hesiod's *Works & Days*) that utilized the stars as a seasonal clock, with the appearances or disappearances (or occultations) of certain stars serving as harbingers of seasonal changes (see Chapter 3). These were typically expressed as a heliacal rising (first visible before sunrise), acronycal rising (last visible in the evening just after sunset), cosmical setting (first visible just before sunrise) and heliacal setting (last visible just after sunset).[61]

Today's night sky appears somewhat different from that observed by Greek and Roman astronomers. As Hipparchus discovered by comparing his tabulations with those of

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others (see, e.g., Dicks 1970, Evans 1998), in pointing out some of the most fundamental aspects of the night sky as it would have impinged on navigation.

59 Gem. *Isag.* 6.24; Cleom. *De motu*.

60 Gem. *Isag.* 3.1–14.

61 Autolycus, *De ortibus et occasibus*.

older works, the positions of the stars gradually shift westward over a long arc of time due to the precession of the equinoxes. The phenomenon is the result of a slow wobble of the earth's axis caused by the gravitational pull of the sun and moon. This causes those equinoctial and solstitial points where the ecliptic (see below) intersects the equator to slide westward each year by nearly 50" of arc. The axis itself circumscribes an arc of some 47° (2 x 23½°) every 25,800 years. Today our pole star, Polaris (α *Ursae Minoris*), is less than 1° from the north celestial pole, but in Hipparchus' time it lay nearly 12½° away.[62] The star that was located closest to the north celestial pole was Kochab (β *Ursae Minoris*, but even it was some 7° removed (fig. 5.3).[63]

The sun follows an apparent path with respect to the horizon over the course of the year. As we saw in Chapter 4 in our discussion of wind roses, the sun rises and sets on the eastern and western horizon respectively. But its rising and setting positions change daily as it travels north and south of due east and west: in winter it reaches its southernmost extent at the winter solstice (shortest day of the year); in summer it reaches its northernmost extent at the summer solstice (longest day of the year). It intersects with the celestial equator at the autumnal and vernal equinoxes, when days and nights are accorded equal time. Long-term observations will show that it returns to the same exact starting point after a full solar year of 365¼ days. It was these extreme points on the horizon that helped determine the location of quarter winds beginning possibly with Aristotle (see above, pages 92–3).

The sun also moves relative to the fixed stars, tracing out a mathematical line in the field of stars called the ecliptic. This imaginary line became the standard line of reference in astronomy during the Hellenistic period, and along it is arranged a belt (never more than 8° on either side of the line) containing the twelve signs of the zodiac. The sun 'occupies' one zodiacal sign each month, moving 1° each day west to east. The plane of the ecliptic is

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62 Hipparchus in Ptol. *Geog.* 1.7.4.

63 In reality, as Hipparchus (*In Arat.* 1.4.1) pointed out, there was no real candidate for the pole star in antiquity: "Eudoxus is ignorant about the North Pole when he states: 'There is a star which remains ever motionless. This star is the pole of the world.' In fact there lies no star at the pole, but an empty space, near to which are three stars which taken together with the point of the pole make a near quadrangle, just as Pytheas of Massilia tells us" (*Περὶ μὲν οὖν τοῦ βορείου πόλου Εὔδοξος ἀγνοεῖ λέγων οὕτως· 'ἔστι δέ τις ἀστὴρ μένων ἀεὶ κατὰ τὸν αὐτὸν τόπον· οὗτος δὲ ὁ ἀστὴρ πόλος ἐστὶ τοῦ κόσμου.' ἐπὶ γὰρ τοῦ πόλου οὐδὲ εἷς ἀστὴρ κεῖται, ἀλλὰ κενός ἐστι τόπος, ᾧ παράκεινται τρεῖς ἀστέρες, μεθ' ὧν τὸ σημεῖον τὸ κατὰ τὸν πόλον τετράγωνον ἔγγιστα σχῆμα περιέχει, καθάπερ καὶ Πυθέας φησὶν ὁ Μασσαλιώτης*).

inclined in relation to the plane of the celestial equator (itself a projection of earth's equator), which explains the sun's changing positions on the horizon each morning and evening. The ecliptic plane and the celestial equator meet at two points each year, the vernal and autumnal equinoxes. At any one time, six of the twelve zodiacal signs are visible in the night sky, each taking about two hours to rise (fig. 5.4). They thus served as a convenient clock for those who are aware of the order of the signs.[64]

The moon follows a quite different and complex orbital path. Despite the regular phases of the moon on which most civic calendars in antiquity were based, its actual movement through the sky is much more irregular than the sun. This is because its elliptical orbit is inclined at an angle of up to 5° to the plane of the ecliptic and takes it sometimes north of it, sometimes south. The moon also oscillates according to its position vis-à-vis the earth and sun, thus often returning discrepancies between predicted and observed positions. It was for these reasons that the moon, as a navigation aid, did not come into its own until the development and production of accurate lunar tables in the eighteenth century.[65]

The orbital periods and motions of the planets are also complex; they were never harnessed as navigational aids either in antiquity or in modern times. However, their paths along the ecliptic aided in pointing out the band of zodiacal constellations.

III. Techniques of Nautical Astronomy

Having reviewed the various traditions and literary *topoi*, and having delineated the mechanics of the night sky, we may now move on to the issues associated with sailing at night and the techniques that were (and may have been) developed to minimize its risks and dangers.

As we saw in Chapters 2 and 3, some of the maritime spaces of the Mediterranean and Black Seas were simply too broad to cross in the space of a day or week, even in the most favorable weather. This simple fact of geography had the consequence of mandating overnight and multi-day voyages during which seafarers were not only out of sight of land,

[64] See references in Homer, above n. 5 and below, pages 140–1.
[65] See, e.g., Cotter 1968, 28–9.

but were, by reason of darkness or heavy weather, also out of sight of the sea itself for significant periods of time. These were naturally times of heightened risk, not least of collision with land or with other ships, but also of overshooting one's destination. To judge from epic and other literary works, and the *topoi* they generated, from Homer onward seafarers looked to the sky to provide some assistance to minimize these dangers. And indeed prose writers from the fourth century B.C. onward verify that pilots concerned themselves with learning the night sky in order to navigate safely and effectively.[66] Even so, we are left with just bare bones in the way of detail, and thus there is room for much speculation on both the degree to which ancient seafarers used the stars to navigate and the techniques they actually employed.

The balance of scholarship until about fifty years ago sought to severely minimize the overall navigational abilities of Greek and Roman seafarers, including competence in celestial navigation (see Chapter 1). Taylor's study of early Mediterranean navigation helped swing the pendulum the other way (see above, pages 11–12 and below, page 148), and here it has remained fixed by subsequent studies, with only a few dissenting views.[67] Taylor and her followers, however, have had to construct their understandings primarily on a corpus of literary evidence heavily burdened with thematic baggage. Rarely, however, are these themes mentioned in any analyses.[68]

With these literary considerations in mind, then, let us examine the various roles the stars played in nighttime navigation as suggested by the sources and as posited in modern scholarship.

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[66] See, e.g., Pl. *Resp.* 488d: "he [the pilot] must pay attention to the time of the year, the seasons, the sky, the stars, the winds and all that pertains to his art if he is to be a true ruler of the ship" (*ἀνάγκη αὐτῷ τὴν ἐπιμέλειαν ποιεῖσθαι ἐνιαυτοῦ καὶ ὡρῶν καὶ οὐρανοῦ καὶ ἄστρων καὶ πνευμάτων καὶ πάντων τῶν τῇ τέχνῃ προσηκόντων, εἰ μέλλει τῷ ὄντι νεὼς ἀρχικὸς ἔσεσθαι*); Cic. *Rep.* 5.5: "without it there can be no justice, not ignorance of law, but just as a pilot is [knowledgeable] of the stars, a doctor of physics…" (*sine quo iustus esse nemo potest, civilis non inperitus, sed ita ut astrorum gubernator, physicorum medicus*…). Cf. Man. *Astron.* 4.279–89.

[67] See, e.g., Severin 1987, 15; Janni 1996, 67; Medas 1998, 147–51.

[68] Refreshing exceptions include Rougé 1981, 4–5, 14, 23 and Medas 1998, 161.

1. Telling time

A natural extension of the preoccupation of Greek and Roman astronomy with timekeeping was the breakdown of time into smaller divisions of day and night. At night, these divisions, or 'watches' (*phylakē*, *vigilia*), were routinely assigned to people for guarding cities and military camps.[69] Aboard ship, as on land, these watches were regulated by the passages of stars and constellations. Although the helmsmen in the *topoi* seemingly stand watch all night, Homer, perhaps alluding to an archaic practice, thrice refers to a system of three night watches and stars passing their zenith position.[70] By the Greek and Roman era, however, a system of four night watches, numbered with ordinals (with *hē heōthinē phylakē* used as a variant for the fourth) became customary.[71] We can only assume that the four-watch system extended to the maritime sphere, where it would have been practical and safe to rotate helm watches on both merchant and naval ships for longer voyages.[72]

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[69] Perhaps the most well-known *phylax* in classical literature being the night watchman in Aeschylus' *Agamemnon* 4–7: "I know the assemblage of star groups, and those that bear winter and summer to mortals, bright dynasts, conspicuous in the aether, stars when they wither and when they rise" (*ἄστρων κάτοιδα νυκτέρων ὁμήγυριν | καὶ τοὺς φέροντας χεῖμα καὶ θέρος βροτοῖς | λαμπροὺς δυνάστας, ἐμπρέποντας αἰθέρι | ἀστέρας, ὅταν φθίνωσιν ἀντολαῖς τε τῶν*).

[70] Hom. *Il.* 10.251–3: "But let us go, for truly the night is waning and dawn is near; the stars have moved onward, the night has passed more than two watches, and the third watch still remains (sic)." (*ἀλλ' ἴομεν· μάλα γὰρ νὺξ ἄνεται, ἐγγύθι δ' ἠώς, | ἄστρα δὲ δὴ προβέβηκε, παροίχωκεν δὲ πλέων νὺξ | τῶν δύο μοιράων, τριτάτη δ' ἔτι μοῖρα λέλειπται*); *Od.* 12.312–15: "But when it was the third watch of the night, and the stars had completed their course, Zeus, the cloud-gatherer, roused against us a strong wind with an incredible tempest, and hid with clouds the land and sea alike" (*ἦμος δὲ τρίχα νυκτὸς ἔην, μετὰ δ' ἄστρα βεβήκει, | ὦρσεν ἔπι ζαὴν ἄνεμον νεφεληγερέτα Ζεὺς | λαίλαπι θεσπεσίῃ, σὺν δὲ νεφέεσσι κάλυψε | γαῖαν ὁμοῦ καὶ πόντον*); *Od.* 14.483–4: "But when it was the third watch of the night, and the stars had turned their course, then I spoke to Odysseus who was near to me" (*ἀλλ' ὅτε δὴ τρίχα νυκτὸς ἔην, μετὰ δ' ἄστρα βεβήκει, | καὶ τότ' ἐγὼν Ὀδυσῆα προσηύδων ἐγγὺς ἐόντα*). For the problems associated with the Iliadic reference (Zenodotus' athetization, the strange dual form and the time contradiction), see Hainsworth 1993, 3:177–8. On similar concepts of time at night and the use of stars to marks its divisions in other early cultures, see Nilsson 1920, 38–41.

[71] Early on the Romans divided day (*dies*) and night (*nox*) into twelve hours (*horae*) each. Daybreak began the first day hour, nightfall the first night hour. Noon (*meridies*) was designated as the sixth hour of day, midnight (*media nox*) the sixth hour of night. Obviously the length of the hour varied not only by day and night, but also by geographic locale. The first night watch at the autumnal and vernal equinoxes, therefore, corresponded with 6-9 pm. On examples of watches used in a maritime context, see Agatharchides, *De Mari Erythraeo* 106a–b (below, n. 76) and Heliodorus, *Aethiopia* 5.17.5 (below, n. 74). For other examples, see those listed in Greek and Latin respectively in *LSJ*, s.v. (4) and *OLD* s.v. (2). For a more extended discussion of watches in Greek, Roman and contemporary Jewish traditions, see Martin 2001 and references in notes 22–3.

[72] As Philostratus (*Vita Ap.* 3.35) indicates in his description of a merchant ship used in the monsoon trade with India, there could be numerous *κυβερνῆται* aboard merchantmen, presumably in order to relieve each other at the helm on a regular watch rotation: "there were many helmsmen aboard this ship under the command of the eldest and the ablest" (*πολλοὶ μὲν κυβερνῆται τῆς νεὼς ταύτης ὑπὸ τῷ πρεσβυτάτῳ τε καὶ σοφωτάτῳ πλέουσι*). Cf. Ael. *VH* 9.40, where Carthaginian ships are described as embarking two *κυβερνῆται*

Of more relevance to navigation itself is the relationship of time, or at least some conception of its duration, with *distance*.[73] Certain voyages required less than a full night's sailing, and others were measured in terms of a certain number of days and nights (see Chapter 6). Seafarers thus had a vested interest in recognizing how much of a night had passed to ensure they avoided closing sufficient distance to make landfall (and the chance of grounding) until daybreak when they could recognize land more easily and employ landmarks to make their way safely.[74] And indeed in Aratus we find a description of a method which employs zodiacal constellations for determining the time at night, even when all the constellations are not visible.[75] The problem inherent in this method, however, is that the stars gain four minutes on the sun each day, and so the stars, constellations *and their positions at specific times of the year* must be known precisely to gain any ability to estimate time. It is only speculation to assume that the popular astronomy known since Hesiod invested seafarers with a sufficient fund of astronomical knowledge to use the zodiac in this fashion.

(but see Rougé 1966, 223–4). Taylor (1971, 48) suggests that Greek and Roman seafarers adopted the Egyptian practice of dividing the night sky into decans, that is into 36 ten-degree segments of the zodiac (see, e.g., Parker 1974, 53–6), for telling time at night. As there is no evidence in Greek or Roman sources, or in Egyptian sources for that matter, it must remain mere speculation.

[73] According to Tibbets (1971, 62–3, 299), Arab navigators employed a three-hour *zām*, or 'watch', as a unit of both time and distance; e.g., 8 *zām* was a distance sailed in the space of one day. In tropical latitudes the darkness lasts about twelve hours, so there were four watches in all, each defined by the positions of the seven stars of the Plough (*Ursa Major*).

[74] See, e.g., Heliodorus, *Aethiopia* 5.17.4–5.18.1: "Having lost sight of the heights of Zacynthus we thought we espied it running like some dark cloud before our eyes, and the captain ordered us to take in some sheet. We when we asked him why he was interrupting the running of the ship in a fair breeze he said, 'because if we maintained at full sail, we should arrive at the island during the first watch, and there is a danger that in the dark we run aground on those sharp rocks that lie everywhere under the sea. It is therefore best to lie to on the sea and to take the wind in lighter measure, timing it sufficiently so as to make landfall at first light'" (*ἀποκρύψαντες τὴν Ζακυνθίων ἄκραν προσκοπεῖν ἀμφεβάλμεν ὥσπερ ἀμυδρόν τι νέφος τὰς ὄψεις ἡμῖν ὑποδραμοῦσαν, καὶ ὁ κυβερνήτης τῶν ἱστίων παραστέλλειν ἐπέταττεν. Ἡμῶν δὲ πυνθανομένων διότι παραλύει τὸ ῥόθιον τῆς νεὼς οὐριοδραμούσης "Ὅτι' ἔφη 'πλησιστίῳ χρώμενοι τῷ πνεύματι περὶ πρώτην ἂν φυλακὴν τῇ νήσῳ προσορμίσαιμεν καὶ δέος προσοκεῖλαι σκοταίους τόποις ὑφάλοις τὰπολλὰ καὶ κρημνώδεσι· καλὸν οὖν ἐννυκτερεῦσαι τῷ πελάγει καὶ τὸ πνεῦμα ὑφειμένως δέχεσθαι, συμμετρουμένους ὅσον ἂν γένοιτο αὔταρκες ἑῴους ἡμᾶς τῇ γῇ προσπελάσαι*).

[75] Arat. *Phaen*. 559–62: "Not useless were it for one seeking for daybreak to observe when each of the signs of the zodiac rises, for always with one of them at least does the sun himself rise; look especially to identifying the actual stars, but if they are darkened with clouds or rise hidden by a mountain you must make markers for them as they rise. The ocean itself can give you on both its horns the many constellations with which it crowns itself, whenever it raises up each twelfth of the Zodiac from below" (*Οὔ κεν ἀπόβλητον δεδοκημένῳ ἤματος εἴη | μοιράων σκέπτεσθαι ὅτ' ἀντέλλησιν ἑκάστη | αἰεὶ γὰρ τάων γε μιῇ συνανέρχεται αὐτὸς | ἠέλιος. Τὰς δ' ἄν κε περισκέψαιο μάλιστα | εἰς αὐτὰς ὁρόων· ἀτὰρ εἰ νεφέεσσι μέλαιναι | γίνοιντ' ἢ ὄρεος κεκρυμμέναι ἀντέλλοιεν, | σήματ' ἐπερχομένῃσιν ἀρηρότα ποιήσασθαι. | Αὐτὸς δ' ἂν μάλα τοι κεράων ἑκάτερθε διδοίη | ὠκεανὸς τά τε πολλὰ περιστέφεται ἑοῖ αὐτῷ | νειόθεν ὁππῆμος κείνων φορέησιν ἑκάστην*).

Instead, since each zodiacal sign was essentially of a uniform size of approximately 30°, and in the night sky there are six signs above the horizon at all times, seafarers may have simply counted the number of their risings and settings *each night* to measure an *approximate* passage of time and their respective watches.

2. Orientation and Relative Position: The Bears

The vast majority of references to sailing by the stars in antiquity involve the two Bears, *Ursa Major* (the Great Bear, also called Arktos, Helice, Septentriones, the Wain, the Plough) and *Ursa Minor* (the Lesser Bear, also called Cynosura and Phoenice). The *topos*, as we saw above, portrays the Great Bear as the constellation employed by Greek sailors and the Lesser Bear by Sidonian (sc. Phoenician) sailors to sail their ships at night. In Mediterranean latitudes (the latitude of a place is its angular distance north or south of the equator; in this case the Mediterranean's latitudes are 30° 15' S to 45° 45' N), neither constellation dips into the sea, and therefore both provided seafarers with a prominent and reliable reference point under the typically clear summer skies of the Mediterranean. From it, seafarers could establish the other three cardinal directions, and likewise could recalibrate their wind roses and maintain them accurately between the hours of sunset and sunrise.

The sources make it clear that the circumpolar constellations also fulfilled more of a role than just simple orientation. Their altitudes above the horizon were measured to determine the approximate *geographical position of the observer* north or south of an arbitrary reference point. As a rule of thumb, the altitude of the north celestial pole (mathematically abbreviated as φ) equals the latitude of the observer on the face of the earth (see fig. 5.1). For example, a Mediterranean seafarer off Malta (approximately 36° north latitude) would observe the north celestial pole (if there were a star occupying that position) nearly 36° above the horizon. As the ship travels north (thereby increasing its latitude), the pole and its adjacent constellations ascend higher and higher in the sky until upon (theoretically) reaching the geographic north pole they are positioned directly overhead and all the visible stars become circumpolar; and as the ship heads south (decreasing its latitude) they descend, disappearing below the horizon near the equator. Either of the two Bears, however, when coursing above the polar hub, can with a clear horizon provide a proximate indication of the pole's position even a few degrees south of the equator.[76] In the Mediterranean and Black Seas, there is a noticeable difference of ca. 20° in the altitude of the null point between the northernmost point (Gulf of Karkinitis) and southernmost point (Gulf of Sydra). This difference would have been quite noticeable to seafarers gazing at the night sky night after night over the years and centuries.

The correlation of the height of the north celestial pole with relative geographic position was widely recognized among Greek writers, and there are mentions of it in Roman-era sources,[77] but by far the best narrative derives from Lucan's *Pharsalia*, Book 8, in which Pompey's seaborne flight from the battlefield at Pharsalus across the Eastern Mediterranean to Egypt is described. We repeat the line of questioning that opened this chapter, then continue with the helmsman's response:

> [Pompey] consults the steersman about all the stars: In which quarter does he mark the land? What is his method of dividing the sea by the sky? By what constellation does he steer for Syria? Or which of the lights in the Wain correctly points to Libya? The skilled watcher of the silent heavens made this reply: "The constellations which follow their course in the star-bearing sky, deceiving poor sailors, the heavens never standing still, we do not follow; but that northern quarter which never sets or sinks, brightest with the two Bears, guides the ships. Here, always when the Lesser Bear rises up before me and stands over the tops of the ropes of the mainmast, then do we look on the Bosporus and the Black Sea which bends the shores of Scythia. But whenever Arctophylax (Boötes) descends from the mast top and Cynosura moves nearer to the sea, the ship is making for the ports of Syria. Next comes

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[76] This is implied in Agatharchides' *De Mari Erythraeo* 106b in Burstein 1989 (=Diod. Sic. 3.48.1; repeated in Plin. *NH* 2.71.178), where the circumpolar constellations coursing *below* the north celestial pole in winter caused considerable concern (*πλείστη ἀπορία*) for sailors operating at the southern end of the Red Sea (ca. 15° north latitude) in the second century B.C.: "But we must not pass over the unusual things seen in the sky in these regions. Most remarkable is what has been recorded about the Bear and which causes the utmost perplexity to sailors. For people say that from the month which the Athenians call Maemacterion [November] not one of the seven stars in the Bear can be seen until the first watch, and in Poseideon [December] until the second and as the months succeed in order after this one they gradually become invisible to sailors." (*Περὶ δὲ τῶν κατὰ τὸν οὐρανὸν ὁρωμένων παραδόξων ἐν τοῖς τόποις οὐ παραλειπτέον. θαυμασιώτατον μέν ἐστι τὸ περὶ τὴν ἄρκτον ἱστορούμενον καὶ πλείστην ἀπορίαν παρεχόμενον τοῖς πλοϊζομένοις· ἀπὸ γὰρ μηνὸς ὃν καλοῦσιν Ἀθηναῖοι μαιμακτηριῶνα τῶν ἑπτὰ τῶν κατὰ τὴν ἄρκτον ἀστέρων οὐδένα φασὶν ὁρᾶσθαι μέχρι τῆς πρώτης φυλακῆς, τῷ δὲ ποσειδεῶνι μέχρι δευτέρας, καὶ κατὰ τοὺς ἑξῆς ἐκ τοῦ κατ' ὀλίγον [πλοϊζομένοις] ἀθεωρήτους ὑπάρχειν*. A parallel passage is Photius' epitome of Agatharchides in 106a Burstein 1989 [= *Cod.* 250.104, 459b]. Cf. Mela 3.61, Plin. *NH* 2.75.184–5 and Ptol. *Geog.* 1.7. The stellar positions are described accurately, but Agatharchides' observation that they became increasingly invisible in succeeding months is without merit: the constellation rises four minutes earlier each night, so that more stars become visible as the month wears on.

[77] See, e.g., Gem. *Isag.* 5.58; Strab. 1.1.21, 10.2.12 (discussed in Aujac 1966, 122–5); Plin. *NH* 2.71.178; Cleom. *De motu* (= Ziegler 1891, 64).

> Canopus, a star content to wander the southern sky, dreading Boreas; if you keep it on your left as you speed past Pharos, your ship will touch Syrtis [Maior] in mid sea.[78]

At first glance this passage appears to offer a number of unparalleled insights, and indeed several studies rely on it as a peg on which to hang nearly all we know of ancient night-time navigation.[79] Lucan has seemingly created for himself an opportunity to expand on those overused seafaring *topoi* he readily employed elsewhere in his work (see the seafaring topoi in Chapter 1). The details, however, were not culled from maritime contexts, but rather from the literary and scientific traditions of astronomy and geography. The association of the Bears with the north, for example, was a commonplace several centuries prior to Lucan—Arktos had been a northerly wind and a direction as early as the sixth century B.C. (see above, pages 91–2), and the association of both Bears with the frigid north had been recently highlighted in Ovid's *Tristia*.[80] Greek geographers from as early as the fourth century B.C. had already expressed the northing and southing aspects of the pole 'star' by using its altitude to determine parallels of latitude (see above, page 126). Canopus (α Carinae), the southerly navigational equivalent of a pole star, was already associated with seafaring by virtue of its namesake (Menelaus' helmsman) and its position within the constellation *Argo*—itself represented only by the poop and mast.[81] The star had been an object of scientific inquiry at least since Posidonius, who used its relative altitudes at Rhodes and Alexandria to compute the size of the earth.[82] The fact that it could be easily seen at sea only near the latitudes of Alexandria made it an amenable antithesis to Lucan's northern

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[78] Luc. 8.167–84: *rectoremque ratis de cunctis consulit astris: | unde notet terras; quae sit mensura secandi | aequoris in coelo; Syriam quo sidere servet: | aut quotus in Plaustro Libyam bene dirigat ignis. | doctus ad haec fatur taciti servator Olympi: | "signifero quaecumque fluunt labentia coelo, | numquam stante polo, miseros fallentia nautas | sidera non sequimur: sed, qui non mergitur undis | axis inocciduus, gemina clarissimus Arcto, | ille regit puppes. hic cum mihi semper in altum | surget et instabit summis minor Ursa ceruchis; | Bosporon et Scythiae curvantem litora pontum | spectamus. quidquid descendit ab arbore summa | Arctophylax, propiorque mari Cynosura feretur, | in Syriae portus tendit ratis. inde Canopos | excipit, australi coelo contenta vagari | stella timens Borean: illa quoque perge sinistra, | trans Pharon, in medio tanget ratis aequore Syrtim.*" On the translation of *axis* as 'northern quarter,' rather than the more common 'pole,' see justification in Mayer 1981, 109–10 (but cf. p. 39 where he actually translates it as 'pole'). It will be recalled that there was no star occupying the pole position in antiquity, so *axis* must be used vaguely here.

[79] Taylor 1971, 46–8; Medas 1998, 154; Medas 2004, 159–61. Cf. McGrail 1998, 276.

[80] Ov. *Tr.* 2.190, 3.10.11, 4.3.1–4.

[81] On Canopus the mythical helmsman, see Hec. *FGrHist* 308 and Strab. 17.1.17. On the constellation *Argo*, see Arat. *Phaen.* 342–52. The Greek name of the constellation is first attested in Eudox. fragments 73 and 74. See commentary in Kidd 1997, 311–14.

circumpolar constellations, the Bears, although it was visible only during the winter months.[83] And finally, Odysseus also kept the stars *on his left* on his departure from Calypso's island (see above, page 121). Thus, there is little that is original, or without literary allusion at any rate, in this passage.

The single but significant exception is Lucan's concise description of the pilot who measures the height of circumpolar constellations and stars against the mast and rigging to determine northing and southing.[84] How effectively this method would have worked is difficult to determine: neither Lucan nor any other source describes at what point, precisely, these constellations were or should be so marked—upon culmination, or when horizontal to the east or west of the celestial pole.[85] No tabulations of such correlations or references thereof in maritime contexts have come down to us. And furthermore, in practical terms, the mast as a measuring rod of the altitude of polar constellations could be used from the vantage point of the stern or prow only on north and south voyages (such as between Rhodes and Egypt, or up or down the axis of the Adriatic or Aegean);[86] it would have

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[82] Cleom. *De motu* 1.10.50–2 (= Ziegler 1891, 92–4); see also Evans 1998, 66 and n. 101.

[83] Plin. *NH* 6.24.87: Pliny relates how the envoys to Rome from India "marveled at the Great Bear and the Pleiades, as if it were to them a new sky…and they told us that in their own region…Canopus, a large and luminous star, shines on them at night" (*septentriones vergiliasque apud nos veluti in novo caelo mirabantur…Canopum lucere noctibus, sidus ingens et clarum*).

[84] The only near parallel I could find is Ptol. *Geog.* 1.7.6, although it does not relate to latitude sailing. Here Ptolemy quotes the obscure Diodoros of Samos (perhaps the Diodoros who wrote a *periegesis* in the fourth or third century B.C.: *FGrHist* 372) who says that "The people from India who sail to Limyrike [in India]…hold Taurus in mid-heaven and the Pleiades along the middle of the yard" (*οἱ μὲν τῆς Ἰνδικῆς εἰς τὴν Λιμυρικὴν πλέοντες…ἔχουσι τὸν Ταῦρον μεσουρανοῦντα καὶ τὴν Πλειάδα κατὰ μέσην τὴν κεραίαν*).

[85] A common practice among Portuguese navigators from the fifteenth century was to observe, at their place of departure, the altitude of the Pole Star when it was in a certain position relative to the bright star Kochab (one of the so-called 'Guards' in Ursa Minor). Heading southward, they would then measure the Pole Star in the same relationship, measure off the degrees (using a quadrant on shore), and convert that value to leagues to reckon their present position. As they explored down the west African coast in the fifteenth century, they discovered the latitudes of the Azores and Madeira islands, and on subsequent voyages to these areas simply 'ran down the latitude', that is, measured their progress southward by the Pole Star until they reached the correct latitude, then altered course onto the parallel and ran due west until they encountered the islands. Eventually, these procedures were simplified, standardized and published in a treatise entitled *Regiment of the North Star* which made a simple translation of altitude into latitude and aided in correcting the position of Kochab in relation the Pole Star (Waters 1958, 45–6; Cotter 1968, 130–2).

[86] In this regard it is interesting to note Ptolemy's comments (*Geog.* 1.4) that "Hipparchus alone has transmitted to us [observed] elevations of the [celestial] north pole for a few cities…and [lists of] the [localities] that are situated on the same parallels. And a few of those who came after him [have transmitted] some of the localities that are oppositely situated, (not [meaning] those that are equidistant from the equator, but simply those that are on a single meridian, based on the fact that one sails from one to another of them by *Aparktias* or *Notos*

proved nearly useless when traveling east, west or on any oblique course (such as Roman grain ships did between the Strait of Messina and Alexandria) unless the sails were temporarily struck to come about and measure it. This is to say nothing of the difficulty of using a nodding and dipping mast (especially if the ship was tacking or wearing its way to its destination) to measure something so precise as the height of a star or constellation on anything except perfectly calm seas.

To be sure, Lucan's 'method,' condensed as it is within a highly literary poem, has the feel of a loose set of correlations to rough latitudinal references, rather than a nod to the more precise measurements of preceding geographers and astronomers, such as Pytheas, Dichaearchus and Hipparchus. These scientists measured—from shore—pole-star altitudes and gnomon shadows of the equinoctial sun to determine latitudinal parallels and derive the geographic positions of prominent cities.[87] In this sense, Lucan's description is more comparable to simple Norse methods of pole-star navigation in the North Sea and North Atlantic,[88] rather than the sophisticated techniques of Arab seafarers in the Indian Ocean who developed hand-held sighting instruments (such as a *dhubbān* or *kamāl*) to measure the altitude of the pole at sea, then correlated those altitudes with specific destinations.[89] Such instruments had earlier analogs in the Mediterranean sphere in the form of the plane astrolabe, developed apparently as early as Ptolemy, but there is no evidence of their use aboard ships at sea in antiquity, and in any event a rolling ship was an inadequate platform for taking accurate stellar measurements.[90]

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winds)" (translation by Berggren and Jones 2000, 62–3). Did Hipparchus' successors derive their information from seafarers treading north-south routes using the pole star as a guide?

87 On Pytheas' measurements, see above, page 126 and Roseman 1994; on Dicaearchus, see above, page 126; on Hipparchus, see above, pages 124–5, 135–6; Dicks 1960, 193; Berggren and Jones 2000, 9, 28.

88 Taylor 1971, 80–1; Marcus 1981, 108–13.

89 Ferrand 1928, 235; Cotter 1968, 69–70; Tibbets 1971, 331–9; Medas 2004, 177.

90 The plane astrolabe (as opposed to the armillary sphere) was known in Ptolemy's time and described in a non-extant work by Theon of Alexandria in the late fourth century (see Neugebauer 1949, 240–3, reproduced in Neugebauer 1983, 278–81; Evans 1998, 156). It was a mechanical instrument that on one side reproduced the celestial sphere with solstitial and zodiacal circles, the ecliptic and several notable fixed stars, and on the other contains a sighting apparatus (*diopter*) which when pointed at the sun or toward a star gave the altitude. From a complete lack of physical or literary evidence we may dismiss Hyde's view (1947, 319) that the astrolabe "was of immense aid to the Greek mariner and must have been the most prized object on every ship." Likewise the view of Neuburger (1969, 502) that the *gnomon* was taken aboard ship to measure latitude.

In the absence (or apparent absence) of more proper sighting instruments aboard ships Greek and Roman seafarers likely adopted a rudimentary method for measuring stellar altitude using dactyls (finger widths) and hand spans, as is attested among both Babylonian and later Greek astronomers, as well as later Arab navigators.[91] The method, in which a typical finger width is roughly equated with 2°, was more amenable than a mast as a means for taking measurements at sea on a heaving ship, and could easily have been transmitted from the astronomical to the maritime sphere, or vice versa. And even if seafarers consulted or memorized the latitudes of their destinations by these means, such crude measurements taken at sea, as Medas reminds us, could easily have resulted in terrific errors: just 1° of error (or half a finger width) is equivalent to 60 nautical miles.[92]

With such simple and imprecise means of measuring the altitudes of circumpolar stars, is it reasonable to suggest, as several scholars do,[93] that latitude sailing was practiced in antiquity? First, let us define what latitude, or parallel, sailing is. Let us say that a destination is known by its latitude (e.g., Strait of Bonifacio = 41° 18' N; Strait of Messina = 38° N; Rhodes = 36° 25' N), and that a point of departure lies somewhere north or south of that latitude, in addition to being displaced some distance east or west. The ship would depart and immediately sail north or south until the pole reaches an altitude associated with the destination's latitude. It would then turn onto that parallel of latitude and follow it east or west until the destination appeared on the horizon. The key to successful latitude sailing was to maintain the north celestial pole at a consistent altitude while sailing east or west. This was the method, as we saw above, adopted and perfected by later Arab and Portuguese seafarers for use on an oceanic scale using more sophisticated sighting instruments and methods—

[91] Neugebauer 1975, 2:591–3; Tibbets 1971, 314–15; Taylor 1971, 49; McGrail 1996, 315; Evans 1998, 248–9. See Aratus' mention of the cubit above, pages 128–9 and n. 40.

[92] Adam 1966, 95–7; Medas 2004, 175. Cf. Waters 1958, 52, in which he states that even the most skilled navigators in the fifteenth century (when sight observations were still practiced with the unaided eye) "were rarely more accurate than to within half a degree…"

[93] Fresa (1964, 67–8, 72–4; 1969, 255–6), for example, believes that the thirty-eighth parallel probably served as a common navigational meridian for Greek shipping on the Ionian Sea, cutting as it does through Ephesus, Corinth, Zacynthus and the Strait of Messina—the skies above which would have been the same in all places. He may be basing his idea on Strab. 2.1.11, where Strabo criticizes Hipparchus for trusting sailors "for the whole line from the Pillars on to the Strait [of Messina]." Strabo, however, was likely referring to Hipparchus' reliance on sailors for estimated distances, for which they were a common source for all ancient geographers,

relying not only on the height of the pole star by night, but also the sun's noon altitude by day.[94] But Greek and Roman seafarers, to our knowledge, did not develop such instruments or techniques. And the winds with which seafarers would have had to contend on longer east-west or west-east crossings were predominantly northerly throughout the year, thus destabilizing any attempt to steer a straight eastward or westward course. Tacking, wearing or steering courses farther upwind of one's destination are more logical strategies than guessing by eye the height of polar stars. There is no reason to infer otherwise. Thus, as attractive as the idea is, there is no reason to believe, nor is there any evidence to support the idea, that Greek and Roman seafarers utilized such a technique. And in any event, the vast open areas of the Atlantic and Indian Oceans proved far more appropriate for this technique than the narrow, east-west trend of the Mediterranean basin.

This is not to say, of course, that certain simple but correct associations were not made between a celestial phenomenon and a position on the earth's surface. Indeed, we may credit Lucan (contradicting his own warning) with conveying what may have been a common connection—that of Canopus with Syrtis: "If you keep it on your left as you speed past Pharos [i.e. sail west], your ship will touch Syrtis in mid sea." At Alexandria, Canopus culminates just 7° (a little less than four dactyls) above the southern horizon. Seafarers who found themselves west of Alexandria and Cyrene, in this proverbially dangerous area (see above, pages 5, 19–20), may have used this stellar height as a warning: if Canopus rose any higher than this (that is, if the ship was within Syrtis Maior at a latitude south of Alexandria), then the ship was caught within a dangerous ship trap and its crew had to take emergency action to extricate the ship. Aside from such a simple association, however, it is difficult to imagine how Greek and Roman seafarers would have practiced latitude sailing effectively in any form in the Mediterranean and Black Seas.

This brings us to the question of why, in the face of seemingly rudimentary means for measuring polar altitude, Greek and Roman seafarers are described as heavily reliant on the Great Bear, the Phoenicians on the Lesser Bear. The distinction does indeed have the

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including Strabo himself. On similar claims of latitude sailing in antiquity, see Adam 1966, 97–8, McGrail 1996, 315 (with qualifications), Medas 1998, 167 (also with qualifications), Medas 2004, 175–9, and Bilić 2005.

[94] Tibbets 1971 (above n. 89); Waters 1958, 47, 76, 221–2.

appearance of practical application. Accordingly, Taylor and Fresa explained the Phoenician interest in polar altitudes, and using the Lesser Bear to gauge them, by way of their wide-ranging, north-south voyages in the Atlantic and Red Sea.[95] In this reading, the greater latitudinal differences outside the Mediterranean would offer more of an incentive to rely on circumpolar stars to gauge northing and southing, much in the same way Portuguese sailors utilized them in their explorations down the west African coast beginning in the fifteenth century. The scope of Phoenician seafaring in the Atlantic, however, is imperfectly known. The current understanding is that Phoenician colonizing and commercial efforts were focused in the eighth to sixth centuries B.C. primarily around southern Spain (particularly Gadir, later Gades and now modern Cadiz), with colonies and trading posts established along the Atlantic coasts of what are today Portugal and Morocco. It appears from archaeological evidence that they ranged *regularly* no farther north than Portugal's Rio Mondego (ca. 240 nm north of Cadiz) and no farther south than Morocco's Mogador (modern Essaouira, ca. 300 nm south of Cadiz).[96] These 540 nm amount to an angular distance of just 9°. By comparison, the Levantine seaboard from the Nile Delta to the Bay of Iskenderun (ancient Issicus Sinus)—the commercial homeland of the Phoenicians—stretches nearly 460 nm, or an angular distance of about 8°. The difference between these seafaring areas in terms of the night sky is therefore negligible.[97]

The Red Sea is a different story. Its north-south axis stretches some 1,200 nm (or 20° of latitude) from the Gulf of Suez to the Bab-el Mandeb. But here, too, the extent of Phoenician seafaring is largely unknown. The literary tradition offers only two significant, but suspicious, examples: Solomon's reported commission of Hiram of Tyre to sail to Ophir via the Red Sea in the tenth century B.C.;[98] and the purported circumnavigation of Africa (a

[95] Cotter 1968, 129; Taylor 1971, 48–9; Fresa 1964, 67–8; Fresa 1969, 244–7; cf. Medas 1998, 163; Medas 2004, 166.
[96] Aubet 1993, 243, 247–9; Markoe 2000, 184. The Phoenicians reportedly traded with the Cassiterites or Oestrymnides ('Tin') islands (Strab. 3.5.11; Avienus, *O.M.* 114–19), but they have yet to be identified; they are generally considered to lie farther north, perhaps along the coast of Brittany or perhaps the British isles. The more extended explorations of Hanno down the African coast belong not to the Phoenicians, but to the Carthaginian phase in the west (see below, pages 163–8).
[97] Interestingly, the northern shore of the Nile Delta lies precisely on the same parallel as Mogador (31°30' N).
[98] See 1 *Kings* 9.26–8 = 2 *Chronicles* 8.17–18. Cf. 1 *Kings* 10.11, 22.49, 2 *Chronicles* 20.36–7, *Jeremiah* 10.9, *Ezekiel* 27.12, 38.13. On the problems associated with Phoenician involvement in the Red Sea, as well as the problem of locating Ophir, see Lipiński 2004, 189–223, especially 196.

three-year voyage starting in the Red Sea) by Phoenicians commissioned by Pharaoh Necho II (610–595 B.C.) and recorded by Herodotus.[99] After these the sources become silent, and archaeology has done little to fill in any gaps.[100] From the late fourth century B.C. to Augustus the story of foreign merchants working Red Sea trade was largely a Ptolemaic one.[101] So much, then, for using explanations of widespread Phoenician voyaging as a motivating factor behind the use of the Lesser Bear.

Is it possible that the Great Bear/Lesser Bear *topos* is more a literary construct than a reflection of practice grounded in navigational circumstances? It is difficult to ignore the practical aspects of the distinction in terms of navigational usage. The Lesser Bear simply served as a more accurate indicator of the elevation of the north celestial pole than its larger sibling, and therefore offered seafarers a better indication of their northing or southing in relation to some arbitrary reference. But it is difficult to explain why the Greeks, and then the Romans, sailed by the Great Bear for all those centuries during which this fact was widely known among the *literati*. Why would Greek and Roman seafarers have avoided making the switch to the Lesser Bear, as the Phoenicians had done long before?[102]

It will be recalled that the literary association of Greeks with the Great Bear and the Phoenicians with the Lesser Bear is essentially a Hellenistic one, beginning effectively with

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[99] Hdt. 4.42. For comprehensive reviews of the literature, scholarship and arguments, see Lloyd 1977.

[100] Lemaire (1987), working from a weak premise, can adduce little pertinent evidence from any century to advance her theory that the Phoenicians were active on the Red Sea. Although Red Sea archaeology remains in its early stages, the sheer lack of identified pre-Ptolemaic coastal settlements here stands in glaring contrast to the hundreds of known and identified Phoenician stations in the Mediterranean and along the Atlantic seaboard. This fact, in itself, is worthy of additional study to place modern claims of Phoenician involvement in the Red Sea into proper focus.

[101] Fraser 1972, 1:173–84; Burstein 1989, 1–12.

[102] Hyginus (*Poet. astr.* 2.2) referred to those who asked this same question in his own time, but he failed to answer the question satisfactorily: "There is still an error among many as to why the Lesser Bear is called Phoenice, and why those who observe her are said to navigate more truly and carefully, and why, if it is more reliable than the Great Bear, do all not observe her. They fail to understand the reason behind her appellation as Phoenice. For Thales of Miletus, who inquired quite carefully about these matters and was the first to call her Bear, was by birth a Phoenician, as Herodotus says. Therefore, all who inhabit the Peloponnese use the Great Bear. The Phoenicians, however, observe the one they received by her discoverer, and by watching her carefully are thought to navigate more accurately. They correctly call her Phoenice from the race of her discoverer" (*Incidit etiam compluribus erratio, quibus de causis minor Arctos Phoenice appelletur, et illi qui hanc observant, verius et diligentius navigare dicantur; quare, si haec sit certior quam maior, non omnes hanc observent. Qui non intelligere videntur, de qua historia sit profecta ratio, ut Phoenice appelletur. Thales enim Milesius, qui diligenter de his rebus exquisivit et hanc primus Arctum appellavit, natione fuit Phoenix, ut Herodotus dicit. Igitur omnes qui Peloponnesum incolunt, priore utuntur*

Aratus. An earlier tradition, however, credits Thales with the discover of the Lesser Bear. I suggested above (page 130) that the *Nautical Astronomy* ascribed to Thales may have contained some material dealing with the use of these two constellations in navigation. While we are on very unsure ground here using tertiary sources, it may have been in reference to this publication that Callimachus stated that "Thales computed the little stars of [Lesser Bear] by which the Phoenicians sail their ships."[103] If so, then it appears that Aratus was looking back to archaic works in meter to illustrate and give authority to his descriptions of stars and seafaring, to Homer for the Great Bear (see above, pages 121–2) and to Thales the purported author of the *Nautical Astronomy* for the Lesser Bear (see above, pages 129–30). That there was an independent tradition that gave Thales a Phoenician ancestry[104] and a historical tradition that painted Phoenicians as intrepid seafarers and star-gazers[105] would only have served to ensure the propagation of Aratus' description of the Bears among subsequent Hellenistic and Roman writers. Thus, in this reading, what may have begun as an interesting and factual observation on nautical astronomy made in the Archaic period—a time of intense contacts between Greeks and Phoenicians—appears to have become fixed over the centuries into a rigid literary theme which maintained its form long after the decline of the Phoenicians as a maritime culture.[106]

Arcto. Phoenices autem quam a suo inventore acceperunt, observant, et hanc studiosius perspiciendo diligentius navigare existimantur, et vere eam ab inventoris genere Phoenicen appellant). On Herodotus' claim, see below, n. 104.

103 Above n. 49.

104 Hdt. 1.170. Cf. Plutarch (*De Mal. Herod.* 857 F9) who disputes Herodotus' statement. Herodotus probably only meant that Thales was related to the Thelidae, the original settlers of Miletus who were descendant from the Phoenician Cadmus (see How and Wells 1957, 1:130).

105 In Greek eyes, the wisdom of Phoenician seafarers must have been reinforced by Tyrian and Sidonian claims of colonial ties to nearly identically named cities on the Persian Gulf (cf. Hdt. 1.1), a locale thought to be very close to the Chaldean heartland which was also a well-known hub of Babylonian astronomy (on the literary tradition, see Bowersock 1986). In fact *Ursa Minor* had been known to Babylonian astronomers from time immemorial. The constellation appears as the 'Wagon of Heaven' or 'Damkianna' in the MUL.APIN, a Babylonian compendium of astronomy dating from the middle of the seventh century B.C. but with much more ancient antecedents (see Hunger and Pingree 1989, 24, 137, 139). Cf. Strab. 16.2.24: "The Sidonians are…philosophers in the sciences of astronomy and arithmetic, having begun their studies with practical calculations and with night-sailings; for each of these branches of knowledge concerns the merchant and ship-owner" (*Σιδώνιοι…φιλόσοφοι περί τε ἀστρονομίαν καὶ ἀριθμητικήν, ἀπὸ τῆς λογιστικῆς ἀρξάμενοι καὶ τῆς νυκτιπλοίας· ἐμπορικὸν γὰρ καὶ ναυκληρικὸν ἑκάτερον*).

106 See, e.g., Avienus, *Aratus* 131: "Indeed Cynosura [Ursa Minor] is the guide for Sidonian ships" (*denique Sidoniis dux est Cynosura carinis*).

3. East/West Courses and Stellar Paths

The prevalence of the Bears in Greek and Roman seafaring themes now raises an important question regarding the rest of the night sky: What use, besides time reckoning, was made of zodiacal stars of the ecliptic and those in the southern sky?

For those unfamiliar with the mechanics of the night sky, it would seem a small leap to associate one's destination with the rising or setting azimuth of one of these stars. This naivety is seen in both Euripides' and Lucan's passages heading this chapter. In fact, a system of navigation utilizing most prominent stars in the night sky was developed by the early seafarers of Oceania centuries before the modern era. As several anthropologists, ethnographers and historians have documented, Polynesian navigators followed pre-established 'star-paths' by steering toward a series of stars that rise or set over a destination.[107] As a guide star rose high in the sky and became too distant from the horizon to serve as an accurate indicator, the navigator simply switched the steering mark to the next star that rose on the same azimuth, and so on. Similarly with setting stars: as one star set, the navigator steered by the next star that would set on that same bearing. These procedures were repeated over the course of the night, night after night, until the vessel hove into view of the target island. As many as ten stars could be used over the course of a journey, all memorized in order by name by illiterate navigators. By these means, and with an uncanny sense of wind and swell, Polynesian navigators were able to memorize hundreds of star-courses and navigate precisely from island to island over enormous distances of hundreds, sometimes thousands, of nautical miles.

Was such a system beyond the reach of Greek and Roman seafarers voyaging in ships much more technically advanced than their Polynesian counterparts? This is difficult to answer. There appear to be two main reasons that argue against the notion. The first is distance. Even with combined areas the Mediterranean and Black Seas compare in no way to the vast distances separating the various archipelagos of the equatorial and southern areas of the Pacific. Historically documented voyages by Polynesians tell of routine routes in the 50- to 200-nm range within island groups, but inferred voyages between archipelagos often

[107] The literature on Polynesian star-paths is voluminous. The *locus classicus* remains Lewis 1994 (first published in 1972), but see also Gladwin 1970, Finney 1976, 1994 and Irwin 1992.

ranged upwards of 500 nautical miles, and those to Hawaii or New Zealand are measured at just under 2,000 nautical miles. The longest voyages in the Mediterranean, then, were comparable only to the routine, shorter voyages of Oceania. Thus, the vast distances faced by Polynesian seafarers, in addition to the lack of outer landmasses to ameliorate the effects of missing targets, offered an incentive to develop highly effective systems of wayfinding.

The second and perhaps more relevant reason is latitude. The seafaring arenas of Oceania straddled the equator and just a few degrees south of it. The limits include the Hawaiian islands in the north (20° N) and (excluding New Zealand) Easter Island in the south (27° S), but the majority of the archipelagos (southern Micronesia, Melanesia and Polynesia) lie between the equator and ca. 23° south. The sun and many of the main guide stars in these climes rise and set nearly perpendicular to the horizon on either side of due east and west, night after night, year after year. Destinations were thus easily connected with the rising and setting azimuths of a vertical string of stars. The Mediterranean and Black Seas, by comparison, are situated in more northerly climes (between about 30° and 46° N) where the stars rise and set at more oblique angles with respect to the horizon, the angle of obliquity increasing with higher latitude. With stars rising and setting at severe angles it becomes very difficult to reference a steady azimuth point on the horizon, and consequently connecting a destination with a series of rising or setting stars is quite difficult. It is for these reasons that Lucan's pilot addresses Pompey's naïve questions: "The constellations which follow their course in the star-bearing sky, deceiving poor sailors, the heavens never standing still, we do not follow."[108]

However, to suggest that Greek and Roman seafarers *never* utilized these stars, at least to some degree, is largely an argument *ex silentio*. Indeed, the positive statement of Pompey's pilot may raise some suspicion, placed as it is among various highly literary themes. There are certain, heavily trafficked maritime corridors that probably encouraged the

[108] The passage appears to look back to Aratus, *Phaen.* 141–2: "Striking is the Bear, and striking are the stars near to her. Sighting them, you need perceive no other" (*δεινὴ γὰρ κείνη, δεινοὶ δέ οἱ ἐγγύθεν εἰσὶν | ἀστέρες· οὐκ ἂν τούς γε ἰδὼν ἐπιτεκμήραιο*).

use of horizon stars and constellations for course maintenance, particularly when repetitive voyages were linked to a seasonal calendar.[109]

As an example, let us examine the route traveled by the Alexandrian grain ships. We saw in Chapter 3 that the grain fleet departed Rome between April and June, depending on whether they had wintered in Rome (thus departing in April) or had arrived after a spring voyage from Alexandria (thus departing in May-June). The first leg of the voyage was to the Strait of Messina, thence across the broad Ionian Sea and through waters between Crete and Cyrene to Alexandria. The voyage from Messina to Alexandria, keeping to the open sea nearly the entire way, could take as little as six days and as many as three weeks, depending on the intensity of the northwest trades.[110] Out of Messina the desired course in modern terms would be between 120° and 130°, and in terms of the wind course, *Corus*. Figures 5.5 and 5.6 show what stars would be visible on the eastern horizon at the end of the first watch (ca. 9 pm) on the first day of April, May, June and July. It just so happens that our course is aimed directly at the ecliptic on the eastern horizon, and so the pilot could easily have employed Libra, then Scorpio, Sagittarius and Capricorn as horizon guides, switching to the stars of the next constellation as they appeared on the horizon.

Those grain ships wintering in Alexandria set out for Rome in April, arriving in Ostia in May-June (see Chapter 7). In some cases ships in Alexandria tried to squeeze in two runs per year, leaving on the second in September-October, as we saw in Paul's voyage to Rome. In both cases they would have headed to Cyprus first using the circumpolar constellations, after which it was a case of making for the shelter of southern Crete. Jumping from Crete to the east coast of Sicily entailed a course of about 300°, a *Vulturnus* course, over a distance of about 400 nm. In late April, May and June, the same watch would witness a number of zodiacal settings straight ahead: Taurus (whose heliacal setting is in May), Gemini (with Castor and Pollux), Cancer, Leo (with Regulus) and nearby the exceptionally bright star

[109] As suggested by Davis, 2002, 299–301; Medas 2004, 161. To my knowledge, the only possible associations of zodiacal stars with course steering are found in the *Stadiasmus Maris Magni*, a geographical work of the first or second century A.D. (explored more fully below, pages 174–6). Corrections and emendations of Müller's text by Cuntz (1905, 264–6) have produced references to the constellation Cancer (*GGM*, 1:484, §185.4) and the Ram (*GGM*, 1:491, §233.12 and 496, §272.20), but these appear to have gone too far and in any event fail to make accurate correspondences with real courses. A separate article is planned on the topic.
[110] Casson 1995, 283, 298.

Procyon in Canis Minor. Seafarers could not help but notice some of brightest heavenly bodies in this series—the Pleiades in Taurus, Castor and Pollux in Gemini and Regulus in Leo (fig. 5.7). For long tacks using winds blowing obliquely to a planned course, these stars would have given the helm a directional axis by which to judge a course offset. And the northern mark of the Bears would have provided a convenient reference to help define the quarter of the sky associated with the destination.

Although there is little evidence of the employment of horizon stars other than those associated with the circumpolar group, it is reasonable at least to suggest that seafarers struggling to find a means of course reference on a dark sea would not have completely ignored the majority of the blazing stars of the night sky. On the contrary, those seafarers who regularly plied certain more lengthy corridors in the central and eastern basins would easily have noticed certain constellation patterns associated with both direction and season. Indeed, as modern sailors can attest, the oblique risings and settings of stars on the eastern and western horizon would have been quite easily noticeable and accounted for when referenced against the set of the sails along certain wind courses.

IV. Conclusions

In Chapter 3 we saw how the Mediterranean's maritime space presented ancient seafarers with the challenge of crossing large, open spaces that necessitated voyages lasting several days and even weeks on the open sea out of sight of land. In these conditions seafarers were compelled to search the horizon for reliable marks of orientation and references for course maintenance. By day the sun and winds provided adequate information, but it was the stars and constellations of the night sky—visible from a third to half of any twenty-four-hour period depending on the season—that gave a complete and ever-visible structure to the navigational horizon. With the stars the wind-referenced system that so dominated nearly every aspect of navigation found a reliable yardstick.

The answer to our opening question of how the stars were employed by Greek and Roman seafarers, however, is not so straightforward. That the stars were used in navigation from the Archaic period, is manifest in Homer's description of Odysseus' voyage and the survival of a title to a work directly pertaining to the subject, the *Nautical Astronomy* ascribed to Thales. But nearly every subsequent reference to the pairing of stars with navigation is painted in clear Homeric, and later Aratean, hues, with little or no additional details to be discerned. From Homer and Aratus descend those two *topoi* that were repeated again and again to the end of antiquity, the dutiful helmsman and the Bears. The former *topos* tells us of the responsibilities of helmsmen to learn the stars and to navigate safely by them. Though the language and presentation are largely thematic there is little reason to doubt, and indeed there is some prose writing that helps to verify, that most pilots had some degree of familiarity with the night sky. The latter *topos*, that of the two Bears, allows glimpses into the uses of the two primary northern circumpolar constellations. One certain application was orientation, for by the invisible null point around which they rotated seafarers obtained a constant reference on the horizon by which to determine the other three cardinal points and finer divisions of the horizon. And by it the wind-rose could be updated constantly during nighttime sailing. That Greek and Roman seafarers were ignorant of true latitude sailing is largely an argument *ex silentio*, but the silence is deafening. Despite the existence of (late) treatises on astronomical sighting instruments, there are no descriptions or remains of any made for use aboard ship. The large corpus of Greek and Roman geographic writings, despite the formulation of latitudes and meridians seemingly suited for geo-positioning, fails to mention measurements taken at sea or tabulations of observations made for areas at sea. Nor does the literary record make any specific mention of or allusion to the practice. Instead, what few sources there are support only the notion that the height of the two Bears above the horizon was associated with a rough geographic position north or south of an arbitrary reference point. Altitudes may have been roughly gauged by employing dactyls or some other practice to achieve approximations, but the refinement of the technique appears to have reached no further stage than the recognition that the Lesser Bear offered a closer reference to the north celestial pole than its larger cousin. The notion that only the Phoenicians employed it as such is testament more to the strength of the literary tradition descending from Aratus (or earlier) than a reflection of actual practice. After all, while the original source may have been Phoenician, the literary tradition is clearly Hellenic. There is no reason to believe that the Greeks, and later the Romans, would have ignored the greater utility of the Lesser Bear throughout antiquity.

Completely missing are textual references to steering by non-circumpolar horizon stars. Silence here indicates either its complete absence among the techniques of nautical astronomy, or perhaps a secondary importance due to the complications of reading obliquely rising and setting stars. Despite the difficulties of their use, and despite Lucan's claim to the contrary, those seafarers who voyaged frequently on the same route or routes at the same time of year, year after year, would likely have associated at least some of their courses with prominent stars and constellations that rose and set ahead of the ship or off either bow. It is quite improbable, despite the lack of textual evidence, that Greek and Roman seafarers actively ignored such essential referential clues.

Bound up with these notions of *direction* and *direction*-finding, whether by wind, sun or stars, is the culmination of that string of navigational decisions made at sea—landfall. Here, near shore, notions of the other two imperatives of navigation, the determinations of *position* and *distance*, come directly into play. In the chapter that follows we will explore the navigational dimensions of those genres of geographic writing generally credited with expressing these two critical pieces of information, *periploi*, *stadiasmoi* and *limenai*.

Chapter 6: ***So-Called Written Aids to Navigation***

Flavius Zeuxis, a merchant mariner, sailed past Cape Malea
to Italy on seventy-two voyages.
—Funerary inscription from Hierapolis[1]

A voyage to Italy is being prepared for me; to friends
I shall set out, from whom I have been absent a long time.
I am searching for a *periplus* that will lead me as a guide
To the Cycladic islands, as well as to ancient Scheria.
But, Menippus, my friend, give me some help; you who have
written a circular account, you who know all geography.
—Crinagoras of Mytilene[2]

The boastful epitaph of Flavius Zeuxis and the epigram by Crinagoras of Mytilene present a dilemma in our attempt to identify the techniques seafarers used to determine those two other imperatives of navigation—position and distance. Did seafarers rely on memory built up from experience as the sole font of navigational knowledge, as may be implied in Zeuxis' epitaph? Or did there exist written materials designed to provide seafarers with this crucial information? Could both modes of information storage (one cognitive, the other text-based) have existed simultaneously?

The textual evidence that bears on these questions is subject to some degree of interpretation. On the one hand, the *topoi* and the few voyage narratives that have survived characterize pilots as drawing from the fund of their experiences when faced with navigational difficulties, or at least they are never described as consulting written or graphic aids.[3] On the other hand, while there was no tradition of navigational charts for plotting courses at sea,[4] there existed several subgenres of ancient geography that almost invariably

[1] *CIG* 3920; *IGRR* 4.841: *Φλάοθιος Ζεῦξις ἐργαστὴς, | πλεύσας ὑπὲρ Μαλέαν εἰς Ἰ|ταλίαν πλόας ἑβδομήκοντα | δύο.*

[2] *Anth. Gr.* 9.559: *Πλοῦς μοι ἐπ' Ἰταλίην ἐντύνεται· ἐς γὰρ ἑταίρους | στέλλομαι, ὧν ἤδη δηρὸν ἄπειμι χρόνον. | διφέω δ' ἡγητῆρα περίπλοον, ὅς μ' ἐπὶ νήσους | Κυκλάδας ἀρχαίην τ' ἄξει ἐπὶ Σχερίην· | σύν τί μοι ἀλλά, Μένιππε, λάβευ, φίλος, ἵστορα κύκλον | γράψας, ὦ πάσης ἴδρι γεωγραφίης.* Crinagoras and his epigram are discussed further below, pages 185–6.

[3] The 'scroll' (*βιβλίον*) from which Amarantus reads on the aft deck in Syn. *Ep.* 4.107 (Appendix C) is presumably the Torah. On books carried aboard ship, see below, pages 190–1.

[4] Cf. Uggeri 1998, who makes a bold but completely unsubstantiated case for the existence of nautical charts.

employed coastlines and distances between coastal features as an organizing principle for describing the *oikoumenē* at various resolutions.[5] These include such general, comprehensive works as Strabo's and Ptolemy's *Geographica*, as well as those specialized treatises to which Strabo refers—*Harbors* (*Limenai*), *Coasting Voyages* (*Periploi*) and *Descriptions of the Earth* (*Periodoi ges*).[6] To these may be added *Stadiasmoi* (registry of stades or distances), *Periegeseis* and *Chorographiai*. Greek remained the language of choice for these genres throughout the Greek and Roman periods.

Periploi, *limenai* and *stadiasmoi* seem particularly suited for use by seafarers in terms of the information they contained on coastal locales listed in paratactic order and the distances between them. And indeed for over a century the *communis opinio* is that all three subgenres served as navigational guides or seafaring manuals. Such was the conclusion reached by Nordenskiöld in his 1898 publication *Periplus* (he also believed without any foundation that they accompanied ancient nautical charts),[7] by Victor Bérard, who believed that Homer drew on Phoenician *periploi* for the *Odyssey*,[8] by Taylor in her *Haven-Finding Art*,[9] and by numerous others.[10]

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[5] As Strabo (9.2.21) himself states: "It is difficult to avoid mistakes of order in naming so many places, most of them insignificant and located in the interior. But the coastline has a certain advantage with regard to this: the places there are better known, and the sea better dictates the order of places. Therefore, I also treat the topic systematically from there" (*καὶ χαλεπὸν ἐν τοσούτοις καὶ ἀσήμοις τοῖς πλείστοις καὶ ἐν μεσογαίᾳ μηδαμοῦ τῇ τάξει διαπεσεῖν· ἡ παραλία δ' ἔχει τι πλεονέκτημα πρὸς τοῦτο· καὶ γνωριμώτεροι οἱ τόποι, καὶ ἡ θάλαττα τό γε ἑξῆς ὑπαγορεύει βέλτιον· διόπερ καὶ ἡμεῖς ἐκεῖθεν πειρώμ[εθα περιοδεύειν]*).

[6] Strab. 8.1.1: "Homer first treated these topics [western Europe and Greece]; then several others came after him, some of whom have written special treatises entitled *Harbors*, or *Coasting Voyages*, or *General Descriptions of the Earth*, or other such things" (*ἅπερ Ὅμηρος μὲν πρῶτος, ἔπειτα καὶ ἄλλοι πλείους ἐπραγματεύσαντο, οἱ μὲν ἰδίᾳ λιμένας ἢ περίπλους ἢ περιόδους γῆς ἤ τι τοιοῦτον ἄλλο ἐπιγράψαντες*).

[7] Nordenskiöld 1967 [1898], 3: "But if charts of the time here in question are absolutely wanting, nevertheless there are extant several so called *peripli* or descriptions of the coasts, dating from this period, of which some at least have served as guides for seafarers; and which, as regards both contents and form, correspond to the written portolanos…of the Middle Ages." On a critique of Nordenskiöld's view, see Janni 1984, 35–6.

[8] See Bérard 1927, 1:54–8, 2:52–7; 1931, 139–40. See also Güngerich 1950, 7; Janni 1984, 120.

[9] Taylor (1971, 51) described *periploi* as "sailing directions" and speculated that they were compiled by masters and pilots of trading ships and naval vessels.

[10] On *periploi* as "sailing directions," see Myres 1896, 610; Cary and Warmington 1963, 30. As "nautical instructions," see Rougé 1966, 110; Arnaud 2005, 48. As "manuals for seafarers," see Blomqvist 1979, 55; Janni 1984, 121; Flensted-Jensen and Hermans Hansen 1996, 140; Meyer 1998, 200. As "sailing handbooks," see Berggren and Jones 2000, 27. As "log-books," see Rostropowicz 1990, 113; Burian 2008, s.v. *Periplous*. As "coast pilot," see Casson 1991, 114–15. On the suggestion that *periploi* may have served as mnemonics of itineraries, see Vella 2005, 49. Cf. also Bérard (1931, 139) list of "analogous" modern navigation literature.

Pietro Janni in his *La mappa e il periplo* (1984) interpreted the widespread use of coastal description in ancient geographical writing as reflective of how the ancients conceived of geographic space, that is, as a sequence of locales located on a uni-directional string or route, rather than a locus viewed in two dimensions. To Janni, the language of *periploi* and other geographic writing conveyed the idea of space as "experienced," or "hodological." The implication of this "mentalità odologica"[11] was that it hindered the ability of ancient seafarers to navigate effectively in two-dimensional space, i.e. on the open sea; only with the invention of the compass, nautical charts and portolans in the Middle Ages, he argues, was it possible to navigate the global oceans.[12] Janni's findings, however, rest on two premises: first, that Greek and Roman seafarers confined themselves to coastal routes because their lack of geospatial awareness prevented them from sailing the open sea; and second, that *periploi* were written by seafarers as navigational aids for other seafarers. The former premise has been shown in this study, and numerous others, to be patently incorrect: coasting may have been the most common mode of navigation in antiquity, at least for cabotage and local shipping, but there is substantial empirical evidence attesting to the practice of open sea sailing (see above, pages 76–88). Moreover, the variable conditions of visibility in coastal areas and archipelagos could complicate even the most routine crossings (see above, pages 45–50).

The latter premise has remained unchallenged until relatively recently. F. Prontera has argued that the entire corpus of *periploi* may be classified as simply a subgenre of geography, as treatises on geography written by geographers.[13] And B. Salway singled out just two of the works within the genre—the *Periplus Maris Interni* by Menippus of Pergamum and the anonymous *Stadiasmus Maris Magni*—as having anything to do specifically with navigation (see below, pages 169–70, 174–6).[14] Both of these works eschew the cultural material that occupies much of the rest of *periplus* literature and instead confine themselves to location and distance information, with occasional mentions of freshwater or a type of

[11] Janni 1984, 130.
[12] Janni 1984, 58.
[13] Prontera 1992, 36–8; cf. Arnaud 2005, 66.
[14] Salway 2004, 67, 95–6.

harbor, among other things. But even these two works, as Salway himself observes, are noteworthy for their absence of wind and directional information.[15]

These contrasting perspectives on the role and function of *periploi* and related literature bring us full circle to the epigrams and questions that opened this chapter: Did seafarers rely on memory and experience to build up a mental geography to aid in their navigation? Or did they rely on written materials to make navigational decisions regarding position and distance? In order to address these questions in a productive way it is necessary first to determine the function of these three subgenres by exploring their form, content, authorship and readership. To aid those readers unfamiliar with these works and to draw out some of the evidence, I begin in section I with a survey of the extant works, using excerpts from each to exemplify their form and content. I then turn in section II to an analysis of the roles these works played in Greek and Roman geography and (to anticipate the conclusion) show that most of them had little to do with navigation proper but were likely used as guides for a public that traveled routinely by sea. Section III investigates some of the evident and likely (but nearly completely non-extant) sources that informed these three subgenres.

I. EXTANT 'NAVIGATIONAL' TEXTS

1. Periploi

The *periplus*, from περὶ + πλόος, "sailing around," "coasting voyage" or "circum-navigation," is among the earliest forms of prose and geographic writing. Its roots begin in the Archaic period and stretch all the way through antiquity to the sixth century of the Byzantine era. In the course of Greek and Roman antiquity nearly forty writers are known to have penned (or collated) a *periplus*. Nearly half of these date to the Hellenistic period, a time when Greek scientific geography and geographic knowledge in the wake of Alexander the Great's conquests had reached new heights (table 6.1). The periplographers typically modeled their works on an actual or hypothetical coasting voyage. Each consists of a register of coastal features in paratactic order (cities, harbors, river mouths, headlands, etc), distances

[15] Salway 2004, 67.

between them (in terms of a day's sail or stadia) and specific information related to certain localities (such as prominent land- and sea-marks, areas to obtain freshwater, and, on rare occasions, wind information); the formula may be generally rendered *place A to place B, distance C, additional information D*. Nearly all of the extant versions are prose works devoid of literary pretensions, although many go beyond the formula and insert historical, mythological or paradoxographical vignettes. Some extend their descriptions inland to include interesting features.

The precise inspiration or combination of factors behind the creation of the genre is difficult to discern. Seaborne colonization likely played a role, at least in the beginning. The oldest *periplus* to survive, that of Hanno the Carthaginian, describes in first-person fashion a Punic exploratory voyage for the purposes of founding colonies in the late sixth century B.C. Indeed, colonists and traders would have hungered for information on distant shores in order to make sense of their new environs and expanding horizons.[16] But with the appearance in the fourth century B.C. of the *periplus* of Pseudo-Scylax, and the subsequent development of the genre in and after the third century B.C., what may have been a genre of sailing directions appears to have metamorphosed into one intended for travelers and geographers. As we shall see, any utility *periploi* may have once had for the purposes of navigation appears either to have vanished or to have been subsumed into a largely lost and even more-specialized genre of navigational lists or texts.

Of the forty or so *periploi* known from antiquity there are just eleven that have survived whole or nearly complete. In the scholarly tradition this corpus of texts is known as the minor Greek geographers. The most comprehensive edition of extant *periploi*, complete with critical commentary, is Karl Müller's *Geographi Graeci Minores* (abbreviated henceforth *GGM*), published in 1855–1861 and updated in 1885–1888.[17] *Periplus* writers, or periplographers, make up a substantial portion of his monumental work.

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[16] Myres 1896, 610; Gisinger 1938, 842; Blomqvist 1979, 55; Prontera 1992, 27–8. It is interesting to note that Miletus, which founded most of the colonies in the Black Sea in the seventh and sixth centuries B.C., produced no known *periploi* of that or any other region. This despite the wealth and reputation of its learned men.

[17] A facsimile edition of Müller's *Geographi Graeci Minores* 1855–1861 was published in 1990 by Georg Olms Verlag (Hildesheim, Zürich and New York); updates to the original editions are found in *FHG* V. Studies of individual *periploi* are referenced below.

A majority of the *periploi* are derived from two codices: codex Palatinus Graecus 398 (ninth century) in the Universitätsbibliothek at Heidelberg; and codex Parisinus Graecus supplementi 443 (late thirteenth century) in the Bibliothèque Nationale in Paris.

The geographical texts of codex Palatinus Graecus 398 include the following:[18]

- Arrian's *Periplus of the Euxine Pontos* (Pseudo-Arrian)
  Ἀρριανοῦ περίπλους Εὐξείνου Πόντου
- Arrian's *Letter to Hadrian, in Which There Is a Periplus of the Euxine Pontos*
  Ἀρριανοῦ ἐπιστολὴ πρὸς Τραιανόν, ἐν ᾗ καὶ περίπλους Εὐξείνοθ Πόντου
- Arrian's *Periplus of the Erythran Sea* (Anonymous)
  Ἀρριανοῦ περίπλους τῆς Ἐρυθρᾶς θαλάσσης
- *The Periplus* of Hanno, King of the Carthaginians
  Ἄννωνος Καρχηδονίων βασιλέως περίπλους

Codex Parisinus Graecus supplementi 443 includes:

- *Epitome of the Geography in 11 Books of Artemidorus of Ephesos*, by Marcian of Heraclea
  Μαρκιανοῦ Ἡρακλεώτου ἐπιτομὴ τῶν ια βιβλίων Ἀρτεμιδώρου τοῦ Ἐφεσίου γεωγράφου
- *Periplus of the Outer Sea* by Marcian of Heraclea
  Μαρκιανοῦ Ἡρακλεώτου περίπλους τῆς ἔξω θαλάσσης
- Marcian's *Edition in 3 Books of the Periplus of the Inner Sea by Menippos of Pergamum*
  Μαρκιανοῦ Ἡρακλεώτου ἔκδοσις τῶν τριῶν βιβλίων Μενίππου τοῦ Περγαμηνοῦ τῆς ἐντὸς θαλάσσης περίπλου
- *Periplus of the Oikoumenē* by Scylax of Caryanda (Pseudo-Scylax)
  Σκύλακος Καρυανδέως περίπλους τῆς οἰκουμένης
- Anonymous *Periegesis* or *Periodos* of the Mediterranean Sea addressed to Nicomedes, King of Bithynia (Pseudo-Scymnus)
  (author and title not preserved)

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[18] It should be noted that the short Aristotelian treatise *ἀνὲμων θέσεις καὶ προσηγορίαι* which we explored in Chapter 4 (see above, pages 95–7) is appropriately included in this codex between the works of Agathemerus and Dionysius of Byzantium.

Nearly all the geographic writing of codex Parisinus bears the heavy authorial or editorial mark of one Marcian of Heraclea Pontica, including signs of his influence in Pseudo-Scylax and Pseudo-Scymnus.[19] As Marcian lists the names of over a dozen writers of *periploi* in his epitome of Menippus' *periplus*, at least one of which, Hanno, is included in Palatinus 398, it is clear that writings from both *corpora* passed through his hands at some point between the third and fifth century A.D. (the precise decades of Marcian's *floruit* remain conjectural).[20] This suggests either that Marcian had access to rare documents collected in major libraries (presumably either at Constantinople or Pergamum, considering their proximities to Heraclea), or that copies of *periploi* were in general circulation in Late Roman times. The antiquity of Hanno's and Pseudo-Scylax's *periploi* by Marcian's time suggests the latter, but we will return to these considerations below.

The ten extant *periploi* in chronological order are as follows:

a. *Hanno the Carthaginian*

The *periplus* of Hanno the Carthaginian is the earliest to have survived nearly complete.[21] Scholars generally agree that the one-hundred line prose text is a Hellenistic copy of a much earlier Punic inscription consecrated (*anathēken*) to the temple of Cronos at Carthage probably around 520 or 480 B.C.; the date of the voyage depends on whether Hanno was the father or son of the Hamilcar who led the Carthaginian expedition against Sicily in 480 B.C.[22] Although Pliny considered Hanno an explorer who circumnavigated Africa counterclockwise, the text is actually, as the opening statement makes clear, a report

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[19] Diller 1952, 45–6.

[20] Marcian's date is problematic. Müller (*GGM*, 1:cxxix) cites a possible early fifth century A.D. date for his writing, but all we know is that he wrote after Claudius Ptolemy (on which his work is based) and before (or possibly at the same time as) Stephanus of Byzantium (sixth century) who cites him extensively. Diller (1952, 45–6) argues for a date closer to Stephanus but this remains conjectural.

[21] *GGM*, 1:xviii–xxxiii, 1–14. Fischer 1893 also remains a fundamental edition. For critical commentary see Aly 1927; Schoff 1913; Bunbury 1959, 1:318–35; Blomqvist 1979; Oikonomides and Miller 1995. It has been argued that the *periplus* of western Europe contained in Avienus' *Ora maritima*, a work of about A.D. 400, belonged to either Euthymenes (ca. 520 B.C.) or Pytheas (fourth century B.C.), both of Massilia (see Murphy 1977, v–ix). Its extensive reworking and lacunose state prevent its inclusion in this study.

[22] On the date of the text, see especially *GGM*, 1:xxi–xxiv; Aly 1927, 324–8; Bunbury 1959, 1:332–3.

of a dedicated colonizing voyage of a purported 30,000 Punic settlers along the northwest African coast.[23] In the voyage narrative that follows the introduction the fleet is described as making its way through the Pillars, then heading south along the North African coast. They found cities along the way and encounter more and more exotic features.

> There, having founded a shrine to Poseidon, we embarked again and sailed toward the rising sun for half a day, until we came to a lake not far from the sea, filled up with numerous tall reeds; and in [the lake] were elephants and many other beasts using it. Departing from the lake as much as a day's sail we founded cities on the edge of the sea…And having hired interpreters from there we sailed along a desert coast southward for two days; and from there again our course took us for one day toward the rising sun. There we discovered in the recess of some bay a small island five stades around; this we named Kerne. We reckoned from our coasting voyage that it lay on a straight line with Carthage, for the voyage from Carthage to the Pillars was the same as from there to Kerne. From this place we arrived at a lake by sailing up a great river called Chretes…[24]

Although the narrative thread appears somewhat tangled at times, the hallmark formula of the genre is easily recognizable in the listing of cities and features on the coast, the number and increments of a day's sail, directions (in terms of the rising, culminating and setting sun) and descriptions of notable coastal features such as headlands, bays, desert shores, river mouths and mountainous hinterlands. Colorful descriptions of the interior, its wild animals and native inhabitants break up banal descriptions of the coast and doubtlessly ensured the work's perpetuation.

[23] Plin. *NH* 2.67.169: "When the power of Carthage had reached its acme, Hanno published an account of a voyage which he made from Gades to the extremity of Arabia; just as Himilco was sent at about the same time to investigate the extreme parts of Europe" (*Hanno Carthaginis potentia florente circumvectus a Gadibus ad finem Arabiae navigationem eam prodidit scripto, sicut ad exterea Europae noscenda missus eodem tempore Himilco*).

[24] Hanno, *Periplus* 4–5, 8–9: *Ἔνθα Ποσειδῶνος ἱερὸν ἱδρυσάμενοι πάλιν ἐπέβημεν πρὸς ἥλιον ἀνίσχοντα ἡμέρας ἥμισυ, ἄχρι ἐκομίσθημεν εἰς λίμνην οὐ πόρρω τῆς θαλάττης κειμένην, καλάμου μεστὴν πολλοῦ καὶ μεγάλου· ἐνῆσαν δὲ καὶ ἐλέφαντες καὶ τἆλλα θηρία νεμόμενα πάμπολλα. Τήν τε λίμνην παραλλάξαντες ὅσον ἡμέρας πλοῦν, κατῳκίσαμεν πόλεις πρὸς τῇ θαλάττῃ…Λαβόντες δὲ παρ' αὐτῶν ἑρμηνέας, παρεπλέομεν τὴν ἐρήμην πρὸς μεσημβρίαν δύο ἡμέρας· ἐκεῖθεν δὲ πάλιν πρὸς ἥλιον ἀνίσχοντα ἡμέρας δρόμον. Ἔνθα εὕρομεν ἐν μυχῷ τινος κόλπου νῆσον μικρὰν, κύκλον ἔχουσαν σταδίων πέντε· ἣν κατῳκίσαμεν, Κέρνην ὀνομάσαντες. Ἐτεκμαιρόμεθα δ' αὐτὴν ἐκ τοῦ περίπλου κατ' εὐθὺ κεῖσθαι Καρχηδόνος· ἐῴκει γὰρ ὁ πλοῦς ἔκ τε Καρχηδόνος ἐπὶ Στήλας κἀκεῖθεν ἐπὶ Κέρνην. Τοὐντεῦθεν εἰς λίμνην ἀφικόμεθα, διά τινος ποταμοῦ μεγάλου διαπλεύσαντες, [ᾧ ὄνομα] Χρετης.*

b. ***Pseudo-Scylax***

After Hanno the next surviving *periplus* is attributed to Scylax of Caryanda. This writer flourished in the late sixth century B.C. under Persian service in the east and published a (now lost) geographic work on the Red Sea and the Arabian and Persian Gulfs.[25] The *periplus* to which his name is attached, however, has been shown on internal evidence to date to the latter half of the fourth century B.C.—hence its modern appellation as Pseudo-Scylax.[26] It is possible, however, that Scylax wrote a lost *periplus* of the Mediterranean region, and that the surviving work drew information and the author's name from it. The extant work, widely cited in antiquity, compasses both seas in clockwise fashion beginning at the Pillars, then continues for some distance down the Atlantic coast of Africa;[27] lacunae occur between the Levantine coast and the Nile Delta. It is clearly a compilation of disparate sources and contains numerous confusing passages and inconsistencies. The artless text shows a paramount concern to identify coastal cities, harbors, peoples and natural features, as well as the distances in terms of either a day's (or often a half-day's) sail or in stadia. Sprinkled throughout the text are several short mythological or historical vignettes on certain regions and peoples.

> …Near the Canopic mouth there is a deserted island named Canopus, on which there are markers of Menelaus and memorials of his helmsman, Canopus, on the voyage home from Troy. The Egyptians and the locals in these places say that Pelousius came to Casion and that Canopus came to the island where the monument of the helmsman is.
>
> LIBYA. Libya begins beyond the Canopic mouth of the Nile. The Adyrmachidai: The Adyrmachidai are a tribe of Libyans. The voyage from Thonis to Pharos, a deserted island of good harborage but lacking in drinking water, is 150 stadia. At Pharos there are also many harbors. Water is drawn from Lake Mareia, for it is potable. The voyage upstream from Pharos to the lake is short, and there is a peninsula and harbor. There are 200 stadia to the coasting voyage. Beyond the peninsula is the Plinthine Gulf. The mouth of the Plinthine Gulf opens to the coast of Leuke and is a voyage of a day and a night, but through the innermost recess of the Plinthine Gulf the voyage is twice as much. It is inhabited all around. From the coast of Leuke to the harbor of Laodomanteion there is a half-day's voyage. From the harbor of Laodomanteion to the harbor of Paraitonion is a half-day's voyage. Next is the city of Apis. The Egyptians hold sway up to this point.[28]

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[25] Hdt. 4.44.
[26] *GGM*, 1:xxxiii–li, 15–95. Fabricius' 1878 Teubner edition is much less emendated. For text, translation in Italian and critical commentary, Peretti 1979 is fundamental. On the date of the text, see Fabre 1965, 354–5.
[27] On the testimonia, see *GGM*, 1:xxxiii–xxxviii; Peretti 1979, 55–83.
[28] Pseudo-Scylax 106–7: *Ἐπὶ δὲ τῷ στόματι τῷ Κανωπικῷ ἐστι νῆσος ἐρήμη, ᾗ ὄνομα Κάνωπος· καὶ σημεῖά ἐστιν ἐν αὐτῇ τοῦ Μενέλεω, τοῦ κυβερνήτου τοῦ ἀπὸ Τροίας, ᾧ ὄνομα Κάνωπος, τὸ μνῆμα. Λέγουσι δὲ Αἰγύπτιοί τε καὶ*

Of interest here and throughout the text is the general scarcity of explicitly practical navigational information. Aside from distance data and a concern to identify harborage we read in only one instance each of safe anchorages (108) and of availability of drinking water therein (107). Meteorological information is completely absent. And nearly all of the references to winds are confined to the passages on Crete (47) where they are used only to indicate direction, not their utility for approaches or departures. The rare exception is the description of one river, the Naron (the Neretva in modern Croatia), which can bear both triremes and cargo vessels to an emporion far upstream (24).

c. ***Arrian's*** **Anabasis**

Alexander the Great, according to Arrian, commissioned Nearchus around 326/5 B.C. to discover and document a sea route for the fleet between the Indus and the head of the Persian Gulf. Arrian faithfully transmitted Nearchus' detailed report of the voyage under the rubric *Indica* in the eighth book of his *Anabasis*.[29] The text combines aspects of both Hanno's and Pseudo-Scylax's *periploi*, so it is likely that Nearchus' original report was also organized as a *periplus*; indeed Arrian at one point (8.18.4) calls it by the more logical name *paraplus*, a "sailing along." The account is replete with the logistical details of moving a large fleet of galleys along unknown and hostile coasts—distances (consistently in stadia) between anchorages, locations of large quantities of fresh water to hydrate the crews, information on dangerous shallows and tidal flows, and characteristics of local populaces.

οἱ προσχώριοι οἱ τοῖς τόποις Πηλούσιον ἥκειν ἐπὶ τὸ Κάσιον, καὶ Κάνωπον ἥκειν ἐπὶ τὴν νῆσον, οὗ τὸ μνῆμα τοῦ κυβερνήτου. ΛΙΒΥΗ. Ἄρχεται ἡ Λιβύη ἀπὸ τοῦ Κανωπικοῦ στόματος τοῦ Νείλου. ἈΔΥΡΜΑΧΙΔΑΙ. Ἔθνος Λιβύων Ἀδυρμαχίδαι. Ἐκ Θώνιδος δὲ πλοῦς εἰς Φάρον νῆσον ἔρημον εὐλίμενος δὲ καὶ ἄνυδρος στάδια ρν΄. Ἐν δὲ Φάρῳ λιμένες πολλοί. Ὕδωρ δὲ ἐκ τῆς Μαρείας λίμνης ὑδρεύονται· ἔστι γὰρ πότιμος. Ὁ δὲ ἀνάπλους εἰς τὴν λίμνην βραχὺς ἐκ Φάρου. Ἔστι δὲ καὶ Χερρόνησος καὶ λιμήν· ἔστι δὲ τοῦ παράπλου στάδια σ΄. Ἀπὸ Χερρονήσου δὲ Πλίνθινός ἐστι κόλπος. Τὸ δὲ στόμα ἐστὶ τοῦ Πλινθίνου κόλπου εἰς Λευκὴν ἀκτὴν πλοῦς ἡμέρας καὶ νυκτός· τὸ δὲ εἰς τὸν μυχὸν τοῦ Πλινθίνου κόλπου δὶς τοσοῦτον. Περιοικεῖται δὲ κύκλῳ. Ἀπὸ δὲ Λευκῆς ἀκτῆς εἰς Λαοδαμάντειον λιμένα πλοῦς ἥμισυ ἡμέρας. Ἀπὸ δὲ Λαοδαμαντείου λιμένος εἰς Παραιτόνιον λιμένα πλοῦς ἥμισυ ἡμέρας. Ἔχεται Ἆπις πόλις. Μέχρις οὖν ἐνταῦθα Αἰγύπτιοι ἄρχουσιν.

[29] On the *Indica's* manuscript history, see Marcotte 2000, xlviii–xlix. On Arrian's reproduction of Nearchus' report, see Bunbury 1959, 1:525–41.

> Then after traversing 500 stades they dropped anchor in the mouth of a lake full of fish, called Cataderbis: at the mouth was a small island called Margastana. Thence about daybreak they sailed out and traversed the shallows in a single column of ships; the shallows were marked on either side by stakes driven down, just as in the strait between the island Leucas and Acarnania markers have been set up for seafarers so that the ships should not run aground on the shallows…Thus then they sailed out with great difficulty and traversed 600 stades…During the night, however, they began to sail in deep waters, and the next day also, up to the evening; they sailed 900 stades and anchored in the mouth of the Euphrates near a village of Babylonia called Didotis; here the merchants gather together frankincense from the neighboring country and all other sweet-smelling spices which the land of Arabia produces. From the mouth of the Euphrates to Babylon Nearchus says it is a voyage of 3,300 stades.[30]

These navigational details, as in Hanno's *periplus*, provide a framework for a chronological narrative largely concerned with the ethnography of the peoples and the nature of the lands along which they coasted during the five-month journey. The reunion with Alexander and his army along the banks of the river Pasitigris (modern Karun) concludes the narrative.

d. *Artemidorus*

Artemidorus, a prominent citizen of Ephesus, flourished around 100 B.C. and wrote a general work on geography in eleven books.[31] It survives in fragments and as an epitome by Marcian.[32] These are supplemented by a recently discovered papyrus containing the first five columns of Book II (on Iberia).[33] While Marcian considered the work a *periplus*,[34] the papyrus includes much more information, especially on geographic and ethnographical matters, than any previous *periplus*. It appears to have focused on lands touching on the

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[30] Arr. *Anab.* 8.41: *σταδίους δὲ πεντακοσίους κομισθέντες ὁρμίζονται ἐπὶ στόματι λίμνης ἰχθυώδεος, ᾗ οὔνομα Κατάδερβις· καὶ νησὶς ἐπῆν τῷ στόματι· Μαργάστανα τῇ νησῖδι οὔνομα. ἐνθένδε ὑπὸ τὴν ἕω ἐκπλώσαντες κατὰ βράχεα ἐκομίζοντο ἐπὶ μιᾶς νεώς· πασσάλοις δὲ ἔνθεν καὶ ἔνθεν πεπηγόσιν ἀπεδηλοῦτο τὰ βράχεα, κατάπερ ἐν τῷ μεσσηγὺς Λευκάδος τε νήσου ἰσθμῷ καὶ Ἀκαρνανίης ἀποδέδεικται σημεῖα τοῖσι ναυτιλλομένοισι τοῦ μὴ ἐποκέλλειν ἐν τοῖσι βράχεσι τὰς νέας…οὕτω δὴ χαλεπῶς διεκπλώσαντες σταδίους ἑξακοσίους κατὰ ναῦν ἕκαστοι ὁρμισθέντες ἐνταῦθα…τὴν νύκτα δὲ ἤδη κατὰ βάθεα ἔπλεον καὶ τὴν ἐφεξῆς ἡμέρην ἔστε ἐπὶ βουλυτόν· καὶ ἦλθον σταδίους ἐνακοσίους, καὶ καθωρμίσθησαν ἐπὶ τοῦ στόματος τοῦ Εὐφράτου πρὸς κώμῃ τινὶ τῆς Βαβυλωνίης χώρης—ὄνομα δὲ αὐτῇ Διρίδωτις—ἵνα λιβανωτόν τε ἀπὸ τῆς Γερραίης γῆς οἱ ἔμποροι ἀγινέουσι καὶ τὰ ἄλλα ὅσα θυμιήματα ἡ Ἀράβων γῆ φέρει. ἀπὸ δὲ τοῦ στόματος τοῦ Εὐφράτου ἔστε Βαβυλῶνα πλοῦν λέγει Νέαρχος σταδίους εἶναι ἐς τρισχιλίους καὶ τριακοσίους.*

[31] Strab. 14.1.26; Stiehle 1856; Bunbury 1959, 2:61–9.

[32] *GGM*, 1:cxxix–cxlv, 574–6.

[33] See Gallazi and Kramer 1998–1999; Kramer and Kramer 2000.

Mediterranean and Black Sea, but also ranged as far afield as Gades in the west and the Red Sea and India in the east. Strabo's extensive use of his work bespeaks its wide scope and popularity, if not its accuracy. A fragment on the Phoenician coast:

> Doros, a Phoenician city. Hecataeus [says] in [his] *Asia* [section]: "a city follows which was once called Doros, but is now called Dora."…And Artemidorus knew the city as Dora in his *Epitome*, Book 11: "The tower of Strato follows, then Dora, a little town sitting on a peninsula at the foot of Mt. Carmel." He says the same thing in Book 9 of his *Geography*.[35]

e. ***Pseudo-Scymnus***

A *periegesis* or *periodos* has been erroneously attributed to one Scymnus of Chios.[36] Some 743 lines, all in iambic trimeters, have been preserved. The work appears to have served as a compendium of geographic knowledge, its metrical structure meant, as the text explicitly states at vv. 19–35, to aid in its memorization. The text opens with a hundred-line proem, including a salutation to King Nicomedes III Euergetes of Bithynia. This places its composition in the first quarter of the first century B.C. or just before.[37] The error-laced description then begins at the Pillars of Heracles and proceeds clockwise around the Mediterranean in *periplus* fashion. The section on the Black Sea is fragmentary, that on Libya is completely missing. Distance information is rarely mentioned. Lines 646–654 on the northern Aegean furnish a flavor of the work.

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[34] Marcian (*Epitome Peripli Menippei* 3.1–4) lumped Artemidorus in with periplographers.

[35] Marcianus, *Epitome Geographiae Artemidori* 18 (*GGM*, 1:576): *Δῶρος, πόλις Φοινίκης. Ἑκαταῖος Ἀσίᾳ· "Μετὰ δὲ ἡ πάλαι Δῶρος· νῦν δὲ Δῶρα καλεῖται."… Καὶ Ἀρτεμίδωρος Δῶρα τὴν πόλιν οἶδεν ἐν Ἐπιτομῇ τῶν ια´· "Συνεχῶς δ' ἐστὶ Στράτωνος πύργος, εἶτα ἔνι Δῶρα, ἐπὶ χερσονησοειδοῦς τόπου κείμενον πολισμάτιον, ἀρχομένου τοῦ ὄρους τοῦ Καρμήλου." Καὶ ἐν θ´ Γεωγραφουμένων τὸ αὐτό.*

[36] *GGM*, 1:lxxiv–lxxix, cxli, 196–237; additional fragments have been compiled in Diller 1952, 165–76. Marcotte 2000 and Korenjak 2003 are the latest writers to provide a background and critical analysis for this interesting work. The determination of authorship has been very problematic. Early scholars assigned the work to Marcian based on a reference atop one apograph. Later scholars used references in later grammarians to assign it to Scymnus of Chios, who was known to have written a *periegesis*. It was Meineke (1846, z227) who demonstrated that Scymnus wrote in prose, not in meter, and so the unknown author has become stuck with the moniker Pseudo-Scymnus. Cf., however, Diller's suggestion (1952, 177) of an author in Pausanias of Damascus.

[37] On the date see Marcotte 2000, 7–8.

> One sailing along Athos [the Akte peninsula] comes to the coastal city of Acanthus, a colony of the Andrians, near to which is the canal cut for seven stades; Xerxes is reported to have cut it. Then comes Amphipolis. Alongside it flows the great river Strymon as far the sea, down to the so-called Choruses of the Nereids. On the river, in the country of Antiphanes, lies Berga.[38]

f. *Menippus of Pergamum*

Menippus of Pergamum, a geographical writer from the time of Augustus, wrote a *periplus* of the Mediterranean and Black Sea in three books.[39] An epitome of the work by Marcian of Heraclea is all that survives.[40] According to the epitome's proem, the first book treated the Black Sea, the second the Mediterranean shore of Europe from the Hellespont to Cadiz, and the third the Libyan/Asian coasts from the Pillars to the Hellespont. Each book was further divided into several smaller *periploi* which treated specific stretches of coastlines, along with summaries of total distances between salient locales. The extant portion, however, comprises only the Asiatic portions of the Black Sea from the sanctuary of Zeus Urius at the mouth of the Thracian Bosphorus to the southeast corner of the sea near Colchis. The rest, as Diller has shown, is partially preserved in the anonymous *periplus* of the Black Sea from the sixth century A.D. (see below, pages 173–4).[41] The framework sticks closely to the *periplus* formula we saw in Pseudo-Scylax, especially with regard to distances. But where Pseudo-Scylax inserted ethnographic vignettes Menippus chose instead to confine his additional comments to a running list of distances and toponyms, with some details inserted where appropriate. Thus, on the approaches to Sinope:

> From the territory of Potamoi to the small promontory of Syrias [modern Inceburun] is 120 stadia. From the Syrias promontory one meets with a gulf. The distance for one sailing into the village of Armene itself and its large harbor is 50 stadia. Next to the harbor is the river called the Ochosbanes. From Armene to the city of Sinope is 50 stadia. At the headlands is

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[38] Pseudo-Scymnus 646–54: *Τὸν Ἄθω δὲ παραπλεύσαντι παράλιος πόλις | Ἄκανθός ἐστιν, Ἀνδρίων ἀποικία, | παρ' ἣν διῶρυξ δείκνυται τετμημένη | ἑπταστάδιος· Ξέρξην δὲ λέγετ' αὐτὴν τεμεῖν· | εἶτ' Ἀμφίπολις. Στρυμὼν δὲ παρὰ ταύτην μέγας | ποταμὸς παραρρεῖ μέχρι θαλάττης φερόμενος | κατὰ τοὺς λεγομένους κεῖσε Νερήδων χορούς· | ἐφ' οὗ κατὰ μεσόγειον Ἀντιφάνους πατρίς | κεῖται λεγομένη Βέργα.*

[39] The date is anchored to an epigram composed by the Augustan poet Crinagoras of Mytilene and included as an epigram to this chapter. In it he asks Menippus for a *periplus* to serve as a guide to the Cyclades (see above, page 157, and below, pages 185–6).

[40] *GGM*, 1:cxxix–cxlv, 563–73; Diller 1952, 102 and 147–64.

[41] Diller 1952, 148, 155–6.

> an islet called Skopelos. It has a passage for smaller ships to put in at the city, but the larger ones must sail around; for them another 40 stadia is involved. From the promontory of Karambis [Krempe Burnu] it is a straight shot of 700 stadia to Sinope. Altogether there are 1450 stadia from Amastris to Sinope, and from Heraclea to Sinope, 2040 stadia.[42]

As Salway has pointed out, Menippus' work is largely a *stadiasmus*, a list of distances, as distinct from periegetic and geographical literature which loosely borrows the *periplus* structure and adorns each entry with various ethnographies and myths.[43] In this regard Menippus' text has much more in common with just one other work from the Roman era, the anonymous *Stadiasmus Maris Magni*, to which we shall return below.

g. *The Anonymous* Periplus of the Erythraean Sea

At some point between A.D. 40 and 70 an anonymous author, likely an Egyptian Greek merchant, penned a *Periplus of the Erythraean Sea* based on his personal experiences.[44] The Erythraean Sea includes not only what we call the Red Sea, but also the Persian Gulf, Arabian Sea and the northern reaches of the Indian Ocean. The *periplus* begins at the coastal emporion of Myos Hormos on the western coast at the northern end of the Red Sea, then continues down the African coast as far as Rhapta (probably in modern Somalia). He then switches to the Arabian side and describes a similar southward journey down the Arabian coast, through the Bab-el Mandeb, along the southern coasts of Arabia and into the Persian Gulf. The description proceeds along the western coast of India to its southern tip at Cape Comorin, then up the east coast to the mouth of the Ganges. Using unembellished prose the author follows the *periplus* formula throughout the work. Although most of the additional

[42] Marc. *Epitome Peripli Menippei* 9 (= *GGM*, 1:571): Ἀπὸ Ποταμῶν χωρίου εἰς Συριάδα ἄκραν λεπτὴν στάδιοι ρκ´. Ἀπὸ Συριάδος ἄκρας κόλπος ἐνδέχεται. Εἰσπλεύσαντι δὲ εἰς αὐτὸν εἰς Ἀρμένην κώμην καὶ λιμένα μέγαν εἰσὶ στάδιοι ν´. Ἔστι δὲ παρὰ τὸν λιμένα ποταμὸς Ὀχοσβάνης ὄνομα. Ἀπὸ Ἀρμένης εἰς Σινώπην πόλιν στάδιοι ν´. Κεῖται δὲ ἐπὶ τῶν ἄκρων νησίον ὃ καλεῖται Σκόπελος. Ἔχει δὲ διέκπλουν τοῖς ἐλάττοσι πλοίοις, τὰ δὲ μείζονα περιπλεῖν δεῖ, καὶ οὕτω καταίρειν εἰς τὴν πόλιν. Εἰσὶ δὲ τοῖς περιπλέουσι τὴν νῆσον πλείους ἄλλοι στάδιοι μ´. Ἀπὸ δὲ Καράμβιδος ἄκρας πλέοντι ἐπ' εὐθείας εἰς Σινώπην στάδιοι ψ´. Οἱ πάντες ἀπὸ Ἀμάστριδος εἰς Σινώπην στάδιοι ͵αυν´. Ἀπὸ δὲ Ἡρακλείας εἰς Σινώπην ͵βμ´. Ἀπὸ δὲ Ἱεροῦ εἰς Σινώπην εἰσὶ στάδιοι ͵γφο´.

[43] Salway 2004, 53–8 (especially 57–8). Salway (58) also draws attention to Menippus' emphasis on distances, and cites Constantine Porphyrogenitus' *De Thematibus* 2.7 (= Pertusi 1952), in which the emperor describes the geographer as "he who had written out the stade-measurements (*stadiasmoi*) of the whole *oikoumenē*" (Μένιππος ὁ τοὺς σταδιασμοὺς τῆς ὅλης οἰκουμένης ἀπογραψάμενος).

information is dedicated to lists of imports and exports of various regions and their trading emporia, there is a modicum of navigationally related material not found in any other writings of its kind for this region.

> In fact, this coasting voyage along the [Red Sea] coast of Arabia is altogether risky; the region lacks harbors, has poor anchorages, is foul with rocky shores and inaccessible due to its cliffs. It is fearsome in every way. For these reasons when we sail this sea we set our voyage to Arabia down the middle and add speed as far as Katakekaumene Island, immediately after which are places with civilized men and animals out to pasture and camels. And beyond these places, on the very last gulf on the left-hand shore of this sea, is Muza, a legally bound emporium on the coast, some 12,000 stades total from Bernice as one sails south.[45]

Even so, Casson has rightly called it "first and foremost a guide for merchants…The emphasis is overwhelmingly on trading information."[46]

h. *Arrian's* Periplus *of the Black Sea*

Arrian of Nicomedia, the transmitter of Nearchus' *Indica* and author of numerous other literary works, wrote an official report (in Latin, not extant) to Hadrian which also contained a *periplus* of the Black Sea (in Greek, and extant).[47] The occasion of their production appears to have been Arrian's assumption of the governorship of Cappadocia in A.D. 129 or 130. Upon assuming office, Arrian conducted a voyage of inspection of at least part of the Black Sea coast, then wrote the *periplus* in epistolary form.[48] Arrian opens with a salutation to Hadrian, then describes in chapters 1–10 his voyage along the Cappadocian

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[44] *GGM*, 1:xcv–cxi, cxli–iv, 257–305; Schoff 1912; Frisk 1927; Huntingford 1980; Casson 1989 is now the standard text and commentary.

[45] *Periplus Maris Erythraei* 20–1: *Καθόλου μὲν οὖν οὗτος ὁ τῆς Ἀραβικῆς ἠπείρου παράπλους ἐστὶν ἐπισφαλὴς, καὶ ἀλίμενος ἡ χώρα καὶ δύσορμος καὶ ἀκάθαρτος ῥαχίαις καὶ σπίλοις ἀπρόσιτος καὶ κατὰ πάντα φοβερά. Διὸ καὶ εἰσπλέοντες τὸν μέσον πλοῦν κατέχομεν καὶ εἰς τὴν Ἀραβικὴν χώραν μᾶλλον παροξύνομεν ἄχρι τῆς Κατακεκαυμένης νήσου, μεθ' ἣν εὐθέως ἡμέρων ἀνθρώπων καὶ νομαδιαίων θρεμμάτων καὶ καμήλων συνεχεῖς [χῶραι]. Καὶ μετὰ ταύτας ἐν κόλπῳ τῷ τελευταιοτάτῳ τῶν εὐωνύμων τούτου τοῦ πελάγους ἐμπόριόν ἐστι νόμιμον παραθαλάσσιον Μούζα, σταδίους ἀπέχον τοὺς πάντας ἀπὸ Βερνίκης, παρ' αὐτὸν τὸν νότον πλεόντων, ὡς εἰς μυρίους δισχιλίους*. For another sample passage, see above, page 112.

[46] Casson 1989, 8.

[47] *GGM*, 1:cxi–cxv, cxliv, 370–401; the standard text is Roos and Wirth's 1967 Teubner edition, but see also Marenghi 1958, Silberman 1995 and Liddle 2003. Liddle (2003, 27–32) discusses and argues for the authenticity of the text.

[48] On the *Periplus*' epistolary form and function within Second Sophistic writing, see Hodkinson 2005.

coast between Trapezus and Sebastopolis (Dioscurias). The area is naturally treated at the beginning, as it was his primary area of political and military responsibility. The storm described in 3.2–6.1 includes echoes of epic storm scenes but appears historical for all of the details he adduced. Chapters 12–16 backtrack to the Thracian Bosphorus to describe the coast between there and Sebastopolis. Chapter 17 summarizes the voyage from Byzantium to Sebastopolis, and the remaining material (chapters 18–25) continues counterclockwise around the northern and western shore to Byzantium. The *periplus* structure is consistent throughout except for the first section, which includes many of the navigational difficulties of his voyage, as well as numerous historical, mythical and military details. Arrian's eye for navigational details, especially regarding winds, was noted already in Chapter 4 (see above, page 86). Note here his effort to conform his work to the *periplus* formula:

> Weighing anchor from Apsaros we passed by the Akampsis by night, 15 stades distant from Apsaros. The river Bathys is 75 distant from there, and the Akinases is 90 stades from the Bathys, and the Isis is 90 stades from the Akinases. Both the Akampsis and the Isis are navigable, and send out stiff winds each morning. From the Isis we passed by the Mogros; there are 90 stades between the Mogros and the Isis. It is also navigable. From there we sailed 90 stades from the Mogros and into the Phasis, which provides the lightest and the strangest-colored water of any of the rivers I know.[49]

i. ***Marcian of Heraclea***

Marcian wrote his own *Periplus of the Outer Sea* in two books.[50] Book I treats the Red Sea, Arabian Gulf and Indian Ocean in the same circuit as the anonymous *Periplus of the Erythraean Sea*, described above. Book II proceeds from the pillars northward along the European coast beyond the Vistula, then ends with a circumnavigation of Britain. Marcian's intent with this work was to round out his *Epitome of the Periplus of the Inner Sea* by Artemidorus. Each of the two books is organized into several local *periploi* treating a

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[49] Arrian, *Periplus Ponti Euxini* 7.4.8: *ἀπὸ δὲ Ἀψάρου ἄραντες τὸν Ἄκαμψιν παρημείψαμεν νύκτωρ, ἐς πεντεκαίδεκα σταδίους ἀπέχοντα τοῦ Ἀψάρου. ὁ δὲ Βαθὺς ποταμὸς ἑβδομήκοντα καὶ πέντε ἀπέχει τούτου, καὶ ὁ Ἀκινάσης ἀπὸ τοῦ Βαθέος ἐνενήκοντα, ἐνενήκοντα δὲ καὶ ἀπὸ Ἀκινάσου ὁ Ἶσις. ναυσίποροι δέ εἰσιν ὅ τε Ἄκαμψις καὶ ὁ Ἶσις, καὶ αὔρας τὰς ἑωθινὰς ἰσχυρὰς ἐκπέμπουσιν. ἀπὸ δὲ Ἴσιος τὸν Μῶγρον παρημείψαμεν. ἐνενήκοντα στάδιοι μεταξὺ τοῦ Μώγρου εἰσὶν καὶ τοῦ Ἴσιος. καὶ οὗτος ναυσίπορος. ἐνθένδε εἰς τὸν Φᾶσιν εἰσεπλεύσαμεν ἐνενήκοντα τοῦ Μώγρου διέχοντα, ποταμῶν ὧν ἐγὼ ἔγνων κουφότατον ὕδωρ παρεχόμενον καὶ τὴν χροιὰν μάλιστα ἐξηλλαγμένον.*

[50] *GGM*, 1:cxxix–cxlv, 515–62.

particular region, with distance summaries at the end of each section. But where Artemidorus incorporated historical and ethnographic details in his large work, Marcian merely registers coastal features (cities, harbors, rivers and headlands) and distances in stadia. The extensive navigational information he included in his edition of Menippus' *Periplus* is virtually absent here. He leaves only one relevant comment, a criticism (1.2) against those who collect distance information at sea as though "measuring the sea with a line" and do not take the sinuosities of the shore into account.[51] Consequently he included both minimum and maximum distances between localities. Below is a sampling of his section on the pillars:

> From the promontory at the strait to the island of Gadira, it is 270 stadia, 240 stadia. From the harbor of Menestheus to the estuary at Astra, 210 stadia. Here begin the dwellings of the Turditani. From the estuary at Astra to the eastern mouth of the river Baetis 385 stadia, 285 stadia. From the mouths of the river Baetis to the sources of the same river, 3,350 stadia, 2,400 stadia. From the eastern mouth of the river Baetis to the bay of Onoba, 420 stadia, 300 stadia. From the bay of Onoba to the mouths of the river Anas, 210 stadia, 150 stadia. From the mouths of the river Anas to the sources of the same river 2,145 stadia, 1,550 stadia. Here is the present boundary of Hispania Baetica which touches the sea on either side of the strait of Hercules, not only our sea, but also the outer sea, or Ocean…The measure of Mediterranean Baetica is 6,709 stadia, 5,140 stadia. It has 5 peoples, 85 notable cities, 3 notable mountains, 5 notable rivers, 2 notable capes, 1 notable harbor.[52]

j. ***Anonymous Periplus of the Black Sea***

Last in this review of extant *periploi* is yet another *periplus* of the Black Sea.[53] Although the title lists Arrian as its author, and indeed Arrian's salutation to the emperor from the

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[51] Marcian, *Periplus Maris Externi* 1.2: *ὥσπερ σχοινίῳ διαμεμετρημένης τῆς θαλάττης.*

[52] Marcian, *Periplus Maris Externi* 2.9–10: *Ἔστι δὲ ἀπὸ τοῦ ἀκρωτηρίου, ἔνθα ὁ πορθμὸς, ἐπὶ τὰ Γάδειρα τὴν νῆσον στάδιοι σο´, στάδιοι σμ´. Ἀπὸ δὲ Μενεσθέως λιμένος εἰς τὴν κατὰ Ἄσταν ἀνάχυσιν στάδιοι σι´. Ἐντεῦθεν ἄρχονται παροικεῖν Τουρδητανοί. Ἀπὸ δὲ τῆς κατὰ Ἄσταν ἀναχύσεως ἐπὶ τὸ τοῦ Βαίτιος ποταμοῦ ἀνατολικώτερον στόμα στάδιοι τπε´, στάδιοι σπε´ Ἀπὸ δὲ τῶν ἐκβολῶν τοῦ Βαίτιος ποταμοῦ ἐπὶ τὰς πηγὰς τοῦ αὐτοῦ ποταμοῦ στάδιοι ͵γτν´, στάδιοι ͵βυ´. Ἀπὸ τοῦ ἀνατολικωτέρου στόματος τοῦ Βαίτιος ποταμοῦ ἐπὶ Ὀνόβα Αἰστουρίαν στάδιοι υκ´, στάδιοι τ´. Ἀπὸ δὲ Ὀνόβα Αἰστουρίας ἐπὶ τὰς τοῦ Ἄνα ποταμοῦ ἐκβολὰς στάδιοι σι´, στάδια ρν´. Ἀπὸ δὲ τῶν ἐκβολῶν τοῦ Ἄνα ποταμοῦ ἐπὶ τὰς πηγὰς τοῦ αὐτοῦ ποταμοῦ στάδιοι ͵βρμε´, στάδιοι ͵αφν´. Ἐνταῦθα πέραν ἔχει τῆς Βαιτικῆς Ἱσπανίας τὸ μέρος τὸ παρῆκον παρ' ἑκατέρας τὰς θαλάσσας, τὰς περὶ τὸν Ἡράκλειον πορθμὸν τυγχανούσας, τήν τε καθ' ἡμᾶς καὶ τὴν ἔξω, τουτέστι τὸν ὠκεανόν… Ἔστι δὲ τῆς Βαιτικῆς ὁ περιορισμὸς τῆς μεσογείας σταδίων ͵ ψθ´, σταδίων ͵ερμ´. Ἔχει δὲ ἔθνη ε´, πόλεις ἐπισήμους πε´, ὄρη ἐπίσημα γ´, ποταμοὺς ἐπισήμους ε´, ἀκρωτήρια ἐπίσημα β´, λιμένα ἐπίσημον α´.*

original second-century-A.D. work is repeated at the opening of this text, Diller has shown the work to be a sixth-century-A.D. compilation of three other *periploi*—Marcian's epitome of Menippus, Arrian's *periplus* addressed to Hadrian, and the *periegesis* of Pseudo-Scymnus (with some three hundred of its de-versified lines). Several details from the *periplus* of Pseudo-Scylax also make their appearance.[54] The work follows most closely the form and divisions found in Menippus, including its omissions and inaccuracies. And like the *periploi* of Menippus and Arrian, the work begins at the Thracian Bosphorus and proceeds counterclockwise. From these two authors are most of the localities and distances derived or interpolated. Although very little new material is introduced, the work demonstrates the derivative and compilatory aspects of many late *periploi*.

2. Stadiasmoi

The term *stadiasmus* (from Greek *στάδιον*) means a measurement by stades. As the title of a literary work we have only the lost *Stadiasmus* by one Hermogenes of Smyrna, probably from the second century (see below, page 184), and the extant *Stadiasmus Matritensis*.[55]

a. *The Anonymous* Stadiasmus Maris Magni

The anonymous *Stadiasmus Matritensis* is preserved within the geographic section of the *Chronicle of Hippolytus* (of A.D. 234–235) in codex Matritensis 4701 (previously 121) from the tenth century.[56] The full title is rendered *ΑΝΩΝΥΜΟΥ ΣΤΑΔΙΑΣΜΟΣ ΗΤΟΙ ΠΕΡΙΠΛΟΥΣ*

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[53] *GGM*, 1:cxv–cxii, 402–23 does not include the whole edition, as the central portion of the *Periplus* came to light only after its publication. Diller (1952, 102–46) has since re-edited the whole work and provided a helpful introduction and commentary. Hers remains the standard edition.

[54] On the Byzantine date of this *periplus* see Diller 1952, 110–13.

[55] Here mention should be made of the so-called *Stadiasmus Provinciae Lyciae*, an inscription found built into a Byzantine wall near the port of Patara (Şahin 1994, Işık 1999, 491–3 and figs. 3–5). This large stone monument (estimated at ca. 1.6 m x 2.35 m, at a height of ca. 5.5 m), erected in the reign of Claudius, listed in sign-post fashion the distances in stadia to all the cities within the province of Lycia. The title of the monument is the name given by the excavator and does not actually occur in the inscription.

[56] The codex (fol. 63v–82v) is now housed in Madrid's Biblioteca Nacional (see de Andres 1987, 264–5). The earlier standard edition was *GGM*, 1:cxxiii–cxxviii, cxlv, 427–514; see Marcotte 2000, xlix–liii. The latest critical

ΤΗΣ ΜΕΓΑΛΗΣ ΘΑΛΑΣΣΗΣ, but its Latinized title has come down to us as *Stadiasmus Maris Magni*. The *Stadiasmus* deals with the Mediterranean and is dated broadly to the first or second centuries A.D.[57] The title of the work is derived from its strict organizational structure based on distances recorded invariably in stadia between coastal localities. After a salutation to the author's "most honored brother," the description begins at Alexandria and continues westward along the Libyan coast to the pillars. The author then returns to Alexandria (thus revealing a strong connection to that cultural center) and treats the coasts of the Levant and Asia Minor as far as the Bosphorus and the entrance into the Black Sea. From here he proceeds to describe the northern Mediterranean coast back to the pillars. The surviving portions include the coast of Libya from Alexandria to Utica, the Levantine and Asia Minor coasts from Paltos to Miletus, and circumnavigations of Cyprus and Crete. The Black Sea was not included.[58] Notable at once is the comprehensive and heavily formulaic register, *place A to place B*, *distance C*. The list-style is derivative of its organization in the only surviving manuscript. Here the first column contains *A*, *B* and additional information *D*, while the second column lists distances *C* in terms of *stad.* or *stadd.*[59] The latter abbreviation designates the sum of distances covered in each section. As Salway has noted, this practical organization is mirrored in later Latin itinerary literature.[60]

In its concern for including practical navigational details to the exclusion of historical or mythological trivia, the *Stadiasmus* is comparable to Menippus' *periplus*. There are numerous references to places with drinking water, safe anchorages and harbors, towers (which are referenced more so here than in any other surviving *periplus*) and winds that made them accessible in summer or for wintering. Advice for anchoring even includes an

edition of the *Chronicle of Hippolytus* is Bauer 1955, sect. IV.9, 43–69; this volume includes a commentary on the *Stadiasmus Maris Magni* by Cuntz (1905, 243–88 and Taf. IV). The only available translation, in English but partial at that, is Nordenskiöld 1967, 11–14.

57 On the dating of the *Stadiasmus Maris Magni* see Diller 1952, 149–50 and updates in Salway 2004, 59–61. For reasons unspecified, Delatte (1947, xix) considers the work reflective of Byzantine navigation.

58 The introduction of the *Stadiasmus* lists its coverage as extending as far as Dioscuris (Sebastopolis, see Arrian's *Periplus* above) on the Black Sea. This would have resulted in incomplete coverage. As Müller (*GGM*, 1:428 note) surmised, this is likely a scribal error, with the shrine "of Zeus Urios" at the entrance of the Black Sea confused with "Dioscuris."

59 See a sample page of the codex in Cuntz 1905, 255, pl. IV.

60 Salway 2004, 65; cf. Dilke 1987, 237–8.

imperative (§18) to guard against the south wind (*phylassou noton*) in the roadstead at Graias Gonu, east of Paraetonium on the Egyptian coast.

The following passage on Syrtis Minor (modern Libya and Tunisia), organized as it is in the manuscript, conveys its organization and level of detail:

100.	From Sabratha to Locri; there is a village, and above the village a tall tower.	stad. 300
101.	From Locri to Zouchis; the fort has a tower; the tower in the harbor is easy to spot.	stad. 300
102.	From Zouchis to Gergis; there is a tower, and it has a fort, harbor and water.	stad. 350
103.	From Gergis to Meninge; it is a city and an island. The island is 8 stadia from the mainland. It has a few cities, but this is the chief town. This, then, is the island of the Lotus Eaters [Lotophages]. There is an altar of Herakles, which is considered the greatest. And there is a harbor with water. The sum total from Leptis to Meninge is:	stad. 150 stadd. 2,300
104.	From Meninge to the mainland [at Gergis or Gigthis?]; it is a city with a fine harbor and water.	stad. 200
105.	From Gergis to Cidiphtha; there is a city with a harbor.	stad. 180
106.	[from Cidiphtha to Tacape.]	stad. 200
107.	From Tacape to Neapolis; there is a city with a harbor.	stad. 400
108.	[From Neapolis to Thena (Thaenae).]	stad. 220
109.	[From Thena (Thaenae) to Acholla.	stad. 500
110.	From Acholla to Alipota.	stad. 120
111.	From Alipota to Thapsus.	stad. 120
112.	These cities have harbors, but because they lie in shallows ships of modest size sail to them: Acholla, Alipota, Cidiphtha and the island of Cercina, lying 120 stades away. From Lotophages at the place called Meninge to the island of Cercina is 750 stadia through the strait. From Thena to Cercina […] In the area of the city are shallows right up to the city. There are 700 stadia between Cercina and Thapsus; Cercina is a fine island in the open sea in the region of Thapsus, which is situated to the north 80 stadia away. It has a harbor and water. These are the islands in the Icarian [sc. Cercinaean] sea.[61]	

[61] *Stadiasmus Maris Magni* 100–12: *Ἀπὸ Σαβράθης ἐπὶ Λοκροὺς στάδιοι τ´· κώμη ἐστὶ, καὶ ὑπεράνω τῆς κώμης πύργος ὑψηλός. Ἀπὸ Λοκρῶν ἐπὶ Ζεύχαριν στάδιοι τ´· φρούριον ἔχον πύργον· (ὁ δὲ πύργος) λιμήν ἐστι ἐπίσημος. Ἀπὸ Ζευχάριος ἐπὶ Γέργιν στάδιοι τν´· πύργος ἐστὶ, καὶ φρούριον ἔχει καὶ λιμένα καὶ ὕδωρ. Ἀπὸ Γέργεως εἰς Μήνιγγα στάδιοι ρν´· πόλις ἐστὶν ἐπὶ νήσῳ· ἡ δὲ νῆσος ἀπέχει τῆς γῆς σταδίους η´· ἔχει δὲ πόλεις ἱκανὰς, μητρόπολις δέ ἐστιν [αὕτη]. Αὕτη οὖν ἐστιν ἡ τῶν Λωτοφάγων νῆσος. Ἔστιν ἐν αὐτῇ βωμὸς Ἡρακλέους· μέγιστος καλεῖται. Ἔστι δὲ λιμὴν καὶ ὕδωρ ἔχει. Οἱ πάντες ὁμοῦ ἀπὸ Λέπτεως εἰς Μήνιγγα στάδιοι βτ´. Ἀπὸ Μήνιγγος εἰς τὴν ἤπειρον* στάδιοι σ´· πόλις ἐστὶ, ἔχει δὲ καλὸν λιμένα καὶ ὕδωρ. Ἀπὸ δὲ τῆς Γέργεως εἰς Κιδιφθὰν στάδιοι ρπ´· πόλις ἐστὶ καὶ λιμένα ἔχει. [Ἀπὸ Κιδιφθῆς εἰς Τακάπην στάδιοι σ´]. Ἀπὸ Τακάπης εἰς Νεάπολιν στάδιοι ρ´· πόλις ἐστὶ καὶ λιμένα ἔχει. [Ἀπὸ Νεαπόλεως εἰς Θέναν στάδιοι σκ´]. [Ἀπὸ Θένης εἰς Ἄχολλαν στάδιοι φ´]. Ἀπὸ Ἀχόλλης εἰς Ἀλιπόταν στάδιοι ρκ´. [Ἀπὸ Ἀλιπότης εἰς Θάψον στάδιοι ρκ´]. Αὗται αἱ πόλεις λιμένας ἔχουσι, διὰ [δὲ] τὸ ἐπικεῖσθαι αὐταῖς βράχη εἰς ταύτας πλέουσι σύμμετρα πλοῖα. Τῇ δὲ Ἀχόλλῃ καὶ τῇ Ἀλιπότῃ καὶ τῇ Κιδιφθῇ ἐπίκειται Κέρκινα ἡ νῆσος, ἀπέχουσα σταδίους ρκ´. Ἀπὸ δὲ τῆς Λωτοφάγων, ἥπερ ἐστὶ Μῆνιγξ, ἐπὶ τὴν Κέρκιναν*

3. Limenai

The title alone, like the *periplus* genre, implies a treatise or handbook dedicated to conveying practical information for those moving from harbor to harbor, namely seafarers. One might envision a publication which provided myriad details on the distances between harbors, their size and depth, the types of holding ground they offer for anchoring, their facilities for portage, availability of drinking water, provisions for wintering, and perhaps the duties charged for entry and exit—in short, all the details to be encountered in medieval portolans. Unfortunately, this short-lived Hellenistic genre is represented by just three authors, and only a very few fragments of each of their works survive.

a. *Timosthenes*

Timosthenes of Rhodes appears to have inaugurated the genre. As we saw in Chapter 4, this commander of the fleet of Ptolemy II Philadelphus wrote a *Peri Limenōn* in ten books.[62] The forty surviving fragments demonstrate that it ranged widely in both geographic terms and in choices of topics. The work appears to operate on one level as a geography based on the scientific principles of the period. It contains not only a discussion of the divisions of the *oikoumenē* into four continents—uniquely adding Egypt to Asia, Europe and Africa (Frag. 8)—but also shows a Dicaearchean concern for defining the locations of certain cities according to their position along the same meridians and lines of

νῆσον διὰ πόρου στάδιοι ψν΄. Ἀπὸ Θένης εἰς Κέρκιναν κατὰ [τὴν] πόλιν βράχη ἐστὶ φερόμενα πρὸς τὴν πόλιν. Ἀπὸ Κερκίνης εἰς Θάψον στάδιοι ψ΄· ἔχει δὲ νῆσον καλὴν, πελαγίαν, κειμένην κατὰ Θάψον πρὸς βορρᾶν, ἀπέχουσαν σταδίους π΄· ἔχει δὲ λιμένα καὶ ὕδωρ. Αὗται αἱ νῆσοι περιέχουσι τὸ Ἰκάριον πέλαγος.

[62] On Timosthenes' fragments, see Wagner 1888. The title of his position within the Ptolemaic navy varies: Strabo (9.3.10) calls him *ὁ ναύαρχος τοῦ δευτέρου Πτολεμαίου ὁ καὶ τοὺς λιμένας συντάξας ἐν δέκα βίβλοις*); Marcian (*Epitome Peripli Menippi* 2.9) calls him *ἀρχικυβερνήτης τοῦ δευτέρου Πτολεμαίου*. Pliny (*NH* 6.35.183) describes him as *classium Philadelphi praefectus*. On the status, function and terms of office of the Ptolemaic nauarchate, see Tarn 1933, 67.

latitude as other cities.[63] Timosthenes' contemporary, Eratosthenes, accordingly drew heavily from this work.[64]

At another level the work resembles a *periplus*, and in fact Agathemerus considered it as such.[65] It appears to have measured the seaboard and its adjacent islands in *periplus* fashion from East Africa, though the Pillars of Hercules (including Carthaginian areas) to the Atlantic coast of Europe and the British isles. The fragments also make it clear that he treated certain Greek districts such as the mainland and Bosphorus areas; there is no evidence that he included the Black Sea. Like Pseudo-Scylax, it made room for some measure of mythical geography, as the fragments on the northern Aegean and Bosphorus demonstrate.

Timosthenes' level of detail in the maritime sphere is notable when compared to the periplographers of his own and former generations. Aside from the first geometric rose of twelve winds with which he is generally credited (see Chapter 4) there is some discussion on the etesian winds and their periodicity (fr. 7). Both of these topics bear directly on navigation and are unequivocally avoided in the *periploi*. The fragment on the star Sirius was probably part of a larger discussion on seasonal markers or Nile floods rather than bearing any information on nautical astronomy.

Paradoxically, there is very little information on harbors. They are confined to just two fragments, the first cited in Strabo, the second in Stephanus of Byzantium:

> For those sailing from Our Sea into the exterior this [mountain] is on the right; and near it, within a distance of 40 stadia, is the city Calpe, an important and ancient city, and once a naval station of the Iberians. And some also say that it was founded by Heracles, among whom is Timosthenes, who also that in ancient times it was also called Heraclea, and that its great city wall and shipsheds can be seen.[66]

[63] On Timosthenes use of Dichaearchus see Wagner 1888, 36–8.

[64] Eratosthenes was accused by Marcian (*Epitome Peripli Menippi* 3.24) of plagiarizing Timosthenes' work, in places wholesale; see discussion in Fraser 1972, 1:522, 536–7.

[65] Agathemerus 6 (see above, pages 93–4).

[66] Frag. 19 (Wagner) = Strab. 3.1.7: *ἐκπλέουσιν οὖν ἐκ τῆς ἡμετέρας θαλάττης εἰς τὴν ἔξω δεξιόν ἐστι τοῦτο, καὶ πρὸς αὐτῷ Κάλπη πόλις ἐν τετταράκοντα σταδίοις ἀξιόλογος καὶ παλαιά, ναύσταθμόν ποτε γενομένη τῶν Ἰβήρων. ἔνιοι δὲ καὶ Ἡρακλέους κτίσμα λέγουσιν αὐτήν, ὧν ἐστι καὶ Τιμοσθένης, ὅς φησι καὶ Ἡράκλειαν ὀνομάζεσθαι τὸ παλαιόν, δείκνυσθαί τε μέγαν περίβολον καὶ νεωσοίκους*. Some editors emend *Κάλπη* with *Καρτηία*, but see Jones 1949, 2:14–15, n. 1 and Fraser 1972, 2:265 n. 167.

> Artake: A Phrygian city and colony of Miletus. Demetrius says that it is an islet; Timosthenes says that "Artake is a mountain at Cyzicus, and the islet is one stade from the mainland. In it [Artake, near Cyzicus] there is a deep harbor for eight ships under the headland where the mountain turns into a beach."[67]

The inclusion of details of these two relatively unknown sites is strongly suggestive of the ambitious scope of the rest of the work.

b. *Timagetos*

The obscure Timagetos, perhaps also a Rhodian, wrote a *Peri Limenōn* in an unknown number of books. His *floruit* remains unknown. Of the seven fragments that have come down, six are found in a scholiast of Apollonius Rhodius' *Argonautica*. Four of these deal with the impossibly circuitous path of the Ister, which was believed to flow into both the Adriatic and Black Seas.

> Timagetos in Book I of his *On Harbors* says that the Ister flows down from the Celtic mountains and empties into a Celtic lake. After this its waters split in two, one stream entering the Euxine Pontus, the other the Celtic Sea. And through this river mouth the Argonauts sailed and came to Etruria. And Apollonius follows him.[68]

The other two fragments deal each with the Stymphalian birds and the construction of the vessel *Argo*—far, indeed, from practical seafaring information. Stephanus of Byzantium supplies the seventh fragment s.v. Akte (Acarnania). To judge from these few surviving lines, the work treated at least the western coast of the Black Sea and the Greek coast, and ostensibly gave much room to mythologizing topics.

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[67] Frag. 31 (Wagner) = Steph. Byz. *Ethnica*, s.v. Artake: *Ἀρτάκη, πόλις Φρυγίας, ἄποικος Μιλησίων. Δημήτριος δὲ νησίον εἶναί φησι καὶ Τιμοσθένης λέγων „Ἀρτάκη τοῦτο μὲν ὄρος ἐστὶ τῆς Κυζικηνῆς, τοῦτο δὲ νησίον [ἐστὶν] ἀπὸ γῆς ἀπέχον στάδιον· κατὰ τοῦτο λιμὴν ὑπάρχει βαθὺς ναυσὶν ὀκτὼ ὑπὸ τῷ ἀγκῶνι ὃν ποιεῖ τὸ ὄρος ἔχεσθαι τοῦ αἰγιαλοῦ“*. Artake is modern Erdek.

[68] Frag. 1a. = Schol. Ap. Rhod. 4.259: *Τιμάγητος δὲ ἐν α΄ Περὶ λιμένων τὸν Ἴστρον φησὶ καταφέρεσθαι ἐκ τῶν Κελτικῶν ὀρῶν, εἶτα ἐκδιδόναι εἰς Κελτικὴν λίμνην· μετὰ δὲ ταῦτα εἰς δύο σχίζεσθαι τὸ ὕδωρ, καὶ τὸ μὲν εἰς τὸν Εὔξεινον πόντον εἰσβάλλειν, τὸ δὲ εἰς τὴν Κελτικὴν θάλασσαν· διὰ δὲ τούτου τοῦ στόματος πλεῦσαι τοὺς Ἀργοναύτας, καὶ ἐλθεῖν εἰς Τυρρηνίαν. Κατακολουθεῖ δὲ αὐτῷ καὶ Ἀπολλώνιος.*

c. Kleon of Syracuse

Kleon of Syracuse is the third and final known author of a *Peri Limenōn*. The scholiast of Apollonius Rhodius 2.297 cites both Kleon's "*periplus*" and Timosthenes' "*limenai*" on the subject of a temple of Zeus atop Mt. Ainos on Cephallania, but Stephanus employs Kleon's *Peri Limenōn* to describe the treeless island of Aspis near Psyra in the central Aegean:

> Ainos is the mountain of Kephallenia, where there is a temple of Zeus Ainesios, as Kleon mentions in his *Periplus* and Timosthenes in his *Harbors*.[69]

> Aspis. [Aspis] is another island near Psyra [a small island off Chios], and treeless, as Kleon of Syracuse states in his *On Harbors*.[70]

II. Roles and Non-Roles of *Periploi*, *Stadiasmoi* and *Limenai*

With this sampling of extant works we may now return to the question of whether seafarers relied on these written materials to aid them in their navigational decisions. What all of these works have in common is an overriding concern for place (= position) and distance along the coast, and in these respects it seems clear that they are drawn, at least at some level, from a nautical tradition.[71] Despite the concession to their roots, however, it may be argued that the scope of nearly all of these works, judging from those that have survived, is too general to have been of any practical use in navigation. It is true that there existed geographical works that focused on local coastal areas to the exclusion of larger regions (such as the *Anaplus Bospori* by Dionysius of Byzantium or the *Periplus of the Propontis* by Androetas of Tenedos), but a great majority of these works treated immense maritime areas like the entire Mediterranean and Black Sea, or the Erythraean Sea which stretched, in ancient terms, from the head of the Red Sea to as far as Ethiopia and the Ganges. It is unlikely that Greece or Rome produced seafarers with a comprehensive navigational

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[69] Schol. Ap. Rhod. 2.297 (= Wagner 1888, fr. 39; *FHG*, 4:365): *ἔστι γὰρ Αἶνος ὄρος τῆς Κεφαλληνίας, ὅπου Αἰνησίου Διὸς ἱερόν ἐστιν, οὗ μνημονεύει Κλέων ἐν Περίπλῳ καὶ Τιμοσθένης ἐν τοῖς Λιμέσιν*. Cf. Strab. 10.2.15.

[70] Steph. Byz., *Ethnica*, s.v. Aspis (= *FHG*, 4:365): *Ἀσπίς· ἔστι καὶ νῆσος ἄλλη Ψύρων ἐγγύς. ἔστι καὶ ἄλλη, ὡς Κλέων ὁ Συρακούσιος ἐν τῷ Περὶ τῶν λιμένων, ἄδενδρος οὖσα.*

[71] Prontera 1992, 36–7.

knowledge of such large maritime regions, nor, evidently, did their exist schools of navigation where such information was compiled then distributed to seafarers. The crews which raced back and forth between the ports of Rome and Alexandria in the first three centuries A.D. (see Chapter 7), for instance, may be considered long-distance specialists of the Mediterranean, but none of their names survive, nor references in surviving voyage narratives to their use of these so-called "nautical instructions" before setting out or while en route. Similarly, to our knowledge, no one akin to a Flavius Zeuxis (part of whose epitaph graces the head of this chapter) wrote a *Periplus*, *Stadiasmos* or *Limenai* on just that area with which he was quite familiar. In any event the experiences of even these pilots would have included less than half of the Mediterranean. Only in the case of the *Periplus Maris Erythraei* is it possible to perceive a personal knowledge of a very large maritime area, although the strength of its details lay, as we saw above, more on the mercantile rather than navigational side.[72] It seems much more reasonable to suppose that if a seafarer were to have written a nautical manual it would have contained information on only those maritime corridors with which he was very familiar, and with a much greater level of detail.

If the scope of most *periploi* was too broad, their levels of navigational information were generally triflingly low to justify a modern equation with "nautical manual." In other words, it is highly unlikely that any Greek or Roman seafarer used one of these works as we know them for the purposes of navigating from place to place. There are at least three practical reasons for this. First, while the linear register of coastal localities and the distances between them would have been helpful for voyage planning (calculating cargos, estimating water and food provisions to sustain the crew for the voyage, recognizing potential ports to avoid), references to direction, traverses and coastal sinuosities are glaringly deficient, indeed in most *periploi* wholly absent.[73] And yet, as we saw in Chapter 4, the technical vocabulary of directional references was adequate for the task. The only exception is the anonymous *Stadiasmus Maris Magni* which made very limited use of the anemological language of orientation and direction. In general, however, in the absence of directional references, a bare list of localities and distances was of limited utility.

[72] Casson 1989, 7–10.

[73] Berggren and Jones (2000, 27) draw attention to the lack of directional references in *periploi*.

Second, if such works are to be equated with "manuals," "guides" or "handbooks" for sailors there is strikingly little or no information on those topics that pertain to daily navigational concerns. Generally absent are descriptions of local winds and weather phenomena, notices of dangerous sea areas, warnings with regard to approaches and departures, and items of information on notable currents, among other things.[74] As we have seen, the complex dynamics of Mediterranean winds and seas would have made such information highly valuable. When information on coastal features or anchorages is included, the level of detail is quite inadequate. Instead, the reader is fed a full plate of distracting (at least from a navigational standpoint) historical or mythological details pertaining to the coastal zone.

And finally, sailing ships on coastal voyages rarely maintained their courses at such a short and uniform distance from shore that their crews could focus on such things as a 'tower' here or a 'spring near a tree' there to track their progress according to a written record; the more salient headlands and the larger, whitewashed coastal cities would have been easily sighted during the day, but the necessities of tacking or wearing and the sinuosities of the shore would have guaranteed generally spotty visibility of many coastal features at any one time, more so in times of poor visibility. And the unevenness of coverage would also have given a false sense of what areas were safe to approach from the sea and what areas required diligence. For all of these reasons the oft-made equation of ancient *periploi*, *stadiasmoi* and *limenai* with later medieval portolans and their volumes of practical navigational information is unwarranted.[75]

The anchor of the view that *periploi* served as a sort of manual or guide for seafarers, then, rests on poor holding ground.

If not for navigation, what, then, was their purpose? The question of purpose is connected to questions of type, authorship and readership. Let us address type first. The first type of *periplus* is an actual voyage account, a journey experienced by the writer himself. We may adduce Hanno's first-person *periplus* here, but there were others, now non-extant, in

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[74] Noted by Prontera 1992, 38.

[75] See, e.g., Nordenskiöld 1967, 3, 10; Gray 1981; Taylor 1951, 84; Prontera 1992, 39 (where he equates only the *Stadiasmos Maris Magni* with portolans); Peretti 1979 (whose work on Pseudo-Scylax is subtitled *Studio sul primo portolano del Mediterraneo*); Arnaud 2005, 48; cf. Delatte 1947, xix.

circulation (see table 6.1).[76] Instances of these *periploi* wane by the Classical period, although some of these accounts (such as Arrian's *Indica*, his *periplus* for Hadrian and the anonymous *Periplus Maris Erythraei*) reappear in imperial times.

The second type is that represented by, perhaps even formalized in, the fourth-century B.C. publication of Pseudo-Scylax's *periplus*, which was widely used and cited throughout the Hellenistic, Roman and early Byzantine periods.[77] After its publication, there appears over succeeding centuries a steady flow of *periploi* in the same or similar vein. In the main these are not accounts of actual journeys by sea, but instead use a hypothetic coastal voyage as an organizing principle to describe the physical, historical and mythological landscape of the various regions of the *oikoumenē*. The genre with its style, like that of the first type, of paratactic coastal description spills over into *historia* and *geographia* from the end of the Classical period when, for example, Ephorus wrote his universal history according to a *periplus* structure.[78] But, as our summary above demonstrates, the Pseudo-Scylaxian type with its useful formula remains distinct well into Byzantine times.

What of the authors of this second type of *periploi*? Is there anything in their backgrounds or in the texts themselves that supports the notion that these works were intended for seafaring purposes? We have the names and titles of some forty periplographers, nearly none of whom is recognized as a captain or admiral or someone whose occupation involves seafaring.[79] Nor are any of the few dedications and salutations that have come down to us addressed from one seafarer to another but appear to have been written by learned writers for learned readers.[80] Indeed, many of the periplographers wrote

[76] E.g., the sixth-century B.C. Massaliote explorer Euthymenes, who appears to have explored down the west coast of Africa (*FHG* IV, 408–9) and published a report about it, now lost.

[77] See above, n 27.

[78] Strab. 8.1.3: "He [Ephorus] uses the coastline as a measure whence he makes his start, judging the sea as a kind of guide in his topographic descriptions…thus it seems proper also for me in following the natural layout of the region to make the sea my counselor" (*οὗτος τῆι παραλίαι μέτρωι χρώμενος ἐντεῦθεν ποιεῖται τὴν ἀρχήν, ἡγεμονικόν τι τὴν θάλατταν κρίνων πρὸς τὰς τοπογραφίας…οὕτω καὶ ἡμῖν προσήκει ἀκολουθοῦσι τῇ φύσει τῶν τόπων σύμβουλον ποιεῖσθαι τὴν θάλατταν*). Cf. Strab. 9.2.21.

[79] It is difficult to determine from a brief reference in Marcian (*Epitome Peripli Menippi* 1.2) whether Sosander "the helmsman" (*ὁ κυβερνήτης*), a periplographer on the Erythraean Sea probably from before the first century B.C., was a sailing master by trade or had the moniker given him subsequent to his (now non extant) publication.

[80] Surviving proems are spotty. The *periplus* of Pseudo-Scylax, the archetype, includes no salutation or introduction, but Pseudo-Scymnus' long and obsequious introduction to King Nicomedes betrays his

other works on historical or paradoxigraphical or literary topics. Damastes of Sigeum, a contemporary of Herodotus, wrote not only a *periplus* (described by the Suda as a *Catalogue of Tribes and Cities*) but also an *On Events in Greece* and *On Poets and Sophists*.[81] The Hellenistic writer Nymphodorus of Syracuse wrote both a *periplus* and work entitled *On Strange Things in Sicily*.[82] In addition to a *Periplus of Asia*, Nymphis of Heraclea Pontica (*fl.* 3rd century B.C.) wrote a history of his home city and another on the Diadochi and their successors.[83]

Greek intellectuals under Roman hegemony continued the Greek tradition. Alexander 'Polyhistor' of Miletus, enslaved in the Mithradatic Wars but freed in Rome by Sulla, was a prodigious paradoxographer and encyclopaedist, producing books on Rome, Delphi, Egypt, the Jews and many others topics, including one if not two *periploi*.[84] The learned Hermogenes of Smyrna from the second century, whose epitaph, partly in hexameters, lists his exhaustive bibliography including seventy-seven books on medicine and dozens on various other topics, also penned a *Stadiasmus* of Asia and another of Europe.[85] In the context of the total literary output of many of these writers it is clear that the *periplus* was meant to supplement historical or geographical or paradoxigraphical works, and not necessarily to serve as practical "nautical manuals" or "handbooks" in any useful sense. The conclusion is not surprising: As employment aboard ship was considered one of the lowest occupations on the social scale (see below, pages 199–201) we should not expect the literate authors of *periploi* to be so closely involved with the physical tasks involved with the operation of a ship, among which was navigation.

All of this is not to say, however, that *all periploi* had no practical role in *travel* by sea. As we have seen, the merchant author of the *Periplus Maris Erythraei* granted some place to navigational data, but only as it impacted on crucial commercial information. Here the

occupation as a poet in the service of the Pergamene court. Marcian, at the beginning of his epitome of the *Periplous of the Inner Sea by Menippus of Pergamum*, bids greetings to one Amphithalios (otherwise unknown), but makes no claim to professional knowledge of the sea in any of his three works. The anonymous author of the *Stadiasmus Maris Magni* similarly dedicated his work to his unnamed learned brother. And Avienus dedicated his *Ora Maritima* (16–21) to a younger, but "open minded and intellectually capable" (*patuli pectoris, sensu capacem*) Probus.

81 Suda, s.v.; *FHG*, 2:64–7.

82 *FHG*, 2:376–81.

83 *FHG*, 3:12–16.

84 *FHG*, 3:207–39, esp. 232 and 239.

transmission of harbor and distance information was meant to be conveyed not from one pilot to another, but between merchants of like commercial interests. The overwhelming concern was toward exploiting markets widely disbersed throughout a maritime geography. The more detailed the geographic information, the better informed the merchant on where and when to sail. This practical application of what is essentially a literary genre is also seen in the writings of Galen, the court physician of Marcus Aurelius. Like Hermogenes of Smyrna, Galen wrote widely and copiously on medicine and other intellectual topics, and also wrote what appears to have been either a *periplus* or a *stadiasmus* as a result of his efforts to undertake a voyage to a specific city on Lemnos. "I have written (*egrapsa*) about my voyage and the stadia at length, so that anyone who might, like me, want to visit Hephaistia knows its location and can thus arrange for the journey."[86] So what details have survived in terms of content and authorship point to at least certain of these works as guides or itineraries for travelers or merchants in their attempts to find passage and carriers to particular destinations. In this regard, they come to have much more in common with the itinerary literature used by a traveling public under of the Roman Empire than with any sort of function manual for seafarers.[87]

A perspective from the vantage point of readership provides reinforcement. At the head of this chapter is an epigram from the *Greek Anthology* by Crinagoras, a contemporary of Strabo and a Mytilenean envoy to Rome around 25 B.C.[88] The epigram reminds us first of the close association of *periploi*, especially those based on the Pseudo-Scylaxian model, with the larger genre of *geographia*: "you [Menippus] who have written a circular account (*histora kyklon*), you who know all geography;" and second, of the practical use of *periploi* among Greek-speaking (or at least Greek-reading) travelers: "I am searching for a *periplus* that will

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[85] *IGRR* IV.1445; *CIG* 3311.

[86] Galen, *De Simplicium Medicamentorum Temperamentis ac Facultatibus* 12 (= Kühn 1965, 12:171–3): *καὶ διὰ τοῦτ' ἐξεπίτηδες ἔγραψα περί τε τοῦ πλοῦ καὶ τῶν σταδίων, ὅπως εἴ τις ἐθέλῃ θεάσασθαι καὶ αὐτὸς ὁμοίως ἐμοὶ τὴν Ἡφαιστιάδα διαγινώσκων τὴν θέσιν αὐτῆς, οὕτως παρασκευάζοιτο πρὸς τὸν πλοῦν*. Cf. Democedes' similar task on behalf of Darius over six centuries prior, below pages 191–2.

[87] Dilke 1987, esp. 254.

[88] On the date of the epigram, see *GGM*, 1:cxxv; Gow and Page 1968, 2: 243–4 (Crinagoras XXXII).

lead me as a guide."[89] Viewed in this light, the inclusion of monotonous but fundamental distance information alongside various levels of ethnography, history and myth—all at a regional scale—ensured the popularity of the genre with a public on the move.

Here it is useful to recall that passenger traffic operated at a high volume during the more seasonal months of the year. The medium-sized and larger commercial ships of antiquity hauled dozens and even hundreds of passengers on each voyage: Demosthenes lists 330 passengers on a ship sailing from Pontus to Piraeus; Josephus records on his voyage to Rome a passenger complement of 600; Luke a complement of 276 minus the crew on a similar passage; and Synesius' ship to Cyrene some 50 passengers in all.[90] The travel planning of so many people each year would have ensured a steady demand for *periploi*, as well as their transmission. A scenario of widespread publication for practical passenger travel, rather than for libraries of elites, is implicit in Marcian's access to *periploi* already well over five centuries old. A voluminous circulation among Mediterranean centers goes some way in explaining why those *periploi* that have survived are so heavily compilatory in nature: their simple unadorned style, generally bereft of literary ambitions, encouraged the incorporation and recirculation of ever newer material.

What purpose, then, did the *limenai* serve? Historically, scholars have been quick to lump *limenai* together with *periploi* in serving as a sort of practical nautical manual for seafarers, or similarly as a sort of "nautical encyclopedia."[91] Implicitly, they assign the origins of the genre to some previously unattested need for such works in the seafaring community, one that only a seafarer of Timosthenes' experience and caliber could produce.[92] The subject matter of the fragments, however, suggests something quite different. Here there is nothing not already found, albeit separately, in *periegeseis*, *periploi* and other geographic and scientific

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89 Lucilius, the later second-century B.C. Roman satirist from Campania, is thought by de Saint-Denis (1935a, 95–6) to have used a *periplus* to aid him in his description of a coastal voyage, with stops between Rome and Messina. See the fragments from Lucilius' Book III in Krenkel 1970, 140–51; cf. Warmington 1938, 3: 38–47).

90 Dem. 34.10; Jos. *Vit.* 3; *Acts of the Apostles* 27.37 (the number of passengers varies in different manuscripts, but 276 is most commonly used: see Aland et al. 1993, 513, note to v. 37); Syn. *Ep.* 4.20–35 (see Appendix C). On sea travel in the ancient world, see Skeel 1901, 77–99; Casson 1994, 149–62. The lower numbers are comparable to the eleventh and twelfth centuries: according to the Cairo Geniza (Goitein 1999, 315, 321), ships transporting between 300 and 400 passengers between Alexandria and ports in the central Mediterranean were common.

91 See, e.g., Wagner 1888, 8.

92 Fraser 1972, 1:522; Nielsen 1945, 41–6.

writings. Meyer in her article on Timosthenes rightly approached the question from the standpoint of Alexandrian readership. She assigned the general stimulus behind the *limenai* genre to the political expansion of the Greek world in the wake of Alexander and his successors on the one hand, and on the other to the intellectual milieu of Alexandrian scholars who were increasingly interested in cataloguing and contextualizing their expanding knowledge of geography.[93] Under Ptolemy II in particular the Library of Alexandria flourished, attracting scholars from all over the Greek world, its librarians compiling and cataloguing works of all genres. The numerous *periploi* that were written during or shortly after Alexander's conquests were either produced here or soon found their way here (see table 6.1). Connected with the Library were two Cyrenaeans whose works impinged upon that of Timosthenes (probably ca. 250 B.C.): Eratosthenes the polymath librarian (lived ca. 285–194 B.C.), whose interests in scientific geography would result in the most important work on the subject to date; and Callimachus (*fl.* ca. 280–240 B.C.), the poet and scholar who produced several prose works on geographical and paradoxigraphical subjects, including writings on the foundations of islands and cities, on winds, and on the rivers of the Europe.[94] Similar interests are echoed in the geographically erudite *Argonautica* of Apollonius of Rhodes (*fl.* 270–245 B.C.) who drew on *periploi* and *limenai* for some of his material.[95] Timosthenes' ties to Alexander's geographer, Dicaearchus (*fl.* 320–300 B.C.), has already been noted (see above, pages 94, 101–2).

Within this intellectual setting, and using the now popular *periplus* as a model, Timosthenes appears to have written a geographic work with several aims. At the most fundamental level it attempted to register the locations of all notable harbors within the *oikoumenē* and the distances between them. This regular *periplus* structure led to confusion in later writers regarding the work's title. Certain harbor areas or regions inspired further expansion on related mythological and historical topics. Either in the introductory book or in select areas of the work he engaged in a discourse on a variety of geographic subjects that would have been familiar to readers of *periodoi ges* and *perigeseis*. And throughout the work he

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[93] Meyer 1998, 213.

[94] The source for Callimachus' many works is Suda, s.v. Fraser (1972, 1:455) suggest that many of these minor works assigned to Callimachus may be prolegomena or headings of the main *Collection of Wonders*.

injected some of his own practical seafaring knowledge acquired in the service of Ptolemy II.[96] The result was an authoritative and unique work meant for geographers, and perhaps learned travelers, but one whose genre was short-lived. The important geographical works of Eratosthenes, Hipparchus and Strabo, all critics of Timosthenes, corrected and superseded the admiral's oeuvre. And despite the spinoff *Limenai* of Timagetos and Kleon the genre failed to survive beyond the end of the Hellenistic period. By Marcian's day, Timosthenes was simply considered an early geographer.

III. Recording at Sea? Possible Sources behind *Periploi*, *Stadiasmoi* and *Limenai*

From these observations and general conclusions are we to gather that seafarers completely shunned written aids and instead relied on their cognitive abilities alone to store and call up the important navigational information they learned from experience? Or did they use written materials that simply have not survived in any form? Is it possible that some used texts while others did not?

Although the meager state of the evidence prevents us from making solid conclusions, there is some support for the notion that at least some seafarers produced navigational texts of some sort. A brief look at the form of the extant *periploi* reveals two salient features. The first is their compilatory character: nearly all of them show positive signs that they are amalgams of disparate sources, perhaps lists, culled together and then reorganized under a single hand. The second is their heavily formulaic format, generally rendered as *place A to place B, distance C, additional information D*. These features suggest a scenario in which certain seafarers recorded the navigational details of their voyages in list form, perhaps in an *A-B-C* format, after which, by some mechanism or series of mechanisms, these lists filtered up to periplographers (among whom I include writers of

[95] Apollonius Rhodius' use of *periploi* as source material is discussed by Rostropowicz 1990, 113.

[96] Based on the geographical distribution of Timosthenes' fragments, Fraser (1972, 1:152) plausibly suggests that the admiral made "two notable journeys, one to central Africa and one to the Atlantic end of the Mediterranean."

stadiasmoi and *limenai*) who mined them selectively for useful information and perhaps even adopted some of their organizational structure.[97]

That the list was a widespread and utilitarian form of early writing at all societal levels is demonstrated by the social anthropologist J. Goody.[98] He sees the list as serving two crucial functions: the storage of information that permits "communication over time and space," and the facilitation of sorting and reorganizing that information.[99] He recognized three kinds of lists in early writing: (1) a retrospective list that recorded events, people and objects (e.g., Mesopotamian king-lists, inventories, administrative details, we may add Homer's *Catalogue of Ships*); (2) a "shopping list" or plan in which "items get struck off, mentally or physically, as they are dealt with," or which have a sequential character, such as itineraries and routes; and (3) the lexical list (e.g., Sumerian tablets).[100]

If we look at the textual evidence in naval and commercial maritime contexts we find some evidence of the first two of Goody's types:

- *Lists aboard naval vessels*: Provision was made aboard ships for orderly administration and "list-keeping," particularly with regard to keeping track of on-board stores, supplies and spares, as well as the pay and caretaking of rowers and fighting personnel. In the Athenian navy of the fifth and fourth centuries B.C. the trierarch of each ship relied on an officer, the *pentekontarchos*, to perform these duties.[101] The Rhodian navy of the Hellenistic period assigned the responsibility to the *grammateus*, who kept lists and records for the trierarch.[102] And the Roman imperial navy expanded the ship's administrative staff; here the hierarchy was headed by the *scriba* with his yeomen the *adiutor* (chief clerk), *librarius* (record keeper) and *exceptor* (stenographer).[103] Naval ships and fleets travelling in convoys would likely have kept

[97] On the possible existence of lost texts that informed the *periplus* genre, see *FGrH*, 2687–8.
[98] Goody 1978, 78–111.
[99] Goody 1978, 78.
[100] Goody 1978, 80–1.
[101] Casson 1995, 303 and n. 12. On the types and volumes of records produced for triearchs, see Bakewell 2008, esp. 146–55.
[102] Casson 1995, 307 and n. 30.
[103] Starr 1993, 57.

written accounts for recording enemy dispositions, detailing logistical needs and dispatching situation reports to superiors.[104]

- *Lists aboard commercial ships*: Administrative responsibilities aboard ship fell either to the ship's master himself (*magister navis*, *pistikos*) in the case of smaller vessels, or, in the case of large vessels, to the *toicharchos* and his assistants, the *mnemon*, the *perineos* (cargo clerk) and *naustologoi* (service personnel).[105] The larger ships that carried multiple types of cargo and hundreds of passengers would then have had a cache of semi-permanent records dealing with the materiel condition of the ship itself, and each voyage would have entailed the production of written records and manifests to track cargo, crew and passengers, among other administrative minutiae.[106] Perhaps it was such materials to which Xenophon refers in his description of wooden chests full of books (*βίβλοι*) that wash up on Pontic shores after shipwreck.[107]

The administrative needs of maritime and commercial activity, then, enable us to envision certain crew members compiling lists of pertinent navigational data, some elements of which are found in *periploi* and *limenai*. Indeed, the tabular format of the *Stadiasmus Maris*

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[104] Thucydides (6.42) makes a point of describing the tight organization of the Athenian armada at Corcyra prior to heading to Syracuse in the summer of 415 B.C. The context leaves little doubt that records and lists of ships, commanders and potential harbors were employed for planning and logistical purposes.

[105] The evidence is collected by Casson 1995, 317–19. On the *mnemon* as the "archivist" in the service of the *naukleros*, see Vélissaropoulos 1980, 84–5

[106] *P. Cairo Zen.* 59012 (of 259 B.C.) is a cargo manifest of two merchant galleys (*kybaiai*) that transported wine and oil from Syria to Alexandria via Pelusium. On these and other types of documentation ships routinely carried, see Schwahn 1932 (Classical and Hellenistic period) and Ashburner 1909, cxxxvii–cxxxviii (late antiquity). Lucian in his *Cataplus* (5.4–9) provides a satirical sample of a passenger list kept by Charon's crewmember, Clotho, who keeps track of passengers embarking for the trip across the river Styx. The listing of passenger name and origin was probably customary: "Clotho: You are right. Let them embark. And I, with my passenger list in hand, and taking my seat at the gangway as is my custom, will make my diagnosis of each of them as he embarks—who he is and where he comes from, and what the manner of his death. And you take them and pack them together, and put them in regular order" (*ΚΛΩΘΩ: Εὖ λέγεις· ἐμβαινέτωσαν. ἐγὼ δὲ προχειρισαμένη τὸ βιβλίον καὶ παρὰ τὴν ἀποβάθραν καθεζομένη, ὡς ἔθος, ἐπιβαίνοντα ἕκαστον αὐτῶν διαγνώσομαι, τίς καὶ πόθεν καὶ ὅντινα τεθνεὼς τὸν τρόπον· σὺ δὲ παραλαμβάνων στοίβαζε καὶ συντίθει*).

[107] Xen. *Anab.* 7.5.12, 14: "Here [in Thrace] many ships sailing to the Pontus run aground and are wrecked… Here there were found great numbers of beds and boxes and written books, and lots of other items that shipowners carry in wooden chests" (*ἔνθα τῶν εἰς τὸν Πόντον πλεουσῶν νεῶν πολλαὶ ὀκέλλουσι καὶ ἐκπίπτουσι…ἐνταῦθα ηὑρίσκοντο πολλαὶ μὲν κλῖναι, πολλὰ δὲ κιβώτια, πολλαὶ δὲ βίβλοι γεγραμμέναι, καὶ τἆλλα πολλὰ ὅσα ἐν ξυλίνοις τεύχεσι ναύκληροι ἄγουσιν*).

Magni, and to a lesser extent Menippus' *Periplus Maris Interni* (which appears to have lost its original format in transmission, becoming instead a running narrative), appear to suit the image of concise but utilitarian lists of Goody's second type. We may speculate that they were kept by the sailing masters of ships for ease and quickness of reference. Even in these two examples, however, the lists contained a limited number of directional references and other navigational details associated with various regions and locales. The near absence of such information in the *periploi* and *limenai* may be explained either by their absence in the original texts or a heavy filtation process in which geographers privileged details of place and distance in copying and compiling these works for a traveling public.

The literary record provides very few anecdotal references to the production of such lists aboard ships. The two best examples come from accounts of royal commissions. The first is provided by Herodotus in his tale of Democedes, the famous physician from Croton who served in Polycrates' court ca. 522 B.C. before being taken in chains to Susa to heal Darius' foot injury.[108] As a result of his skill in healing the Persian king, Democedes was rewarded with wealth and privilege. As the story goes, he convinced Darius' wife Atossa to persuade the king to allow him to reconnoiter the coastlands of Greece in advance of the Persian campaign. The geographical information would have been of strategic importance, obviously, but the minutiae of havens, anchorages, winds and prominent natural features would also have been of use to future Persian admirals. Darius assented, and Democedes and a Persian cohort proceeded to Sidon, whereupon they fitted out two triremes and a merchant vessel for the task: "When all preparations were made they set sail for Greece. Upon arrival there they surveyed and recorded (*apegraphonto*) the coasts, giving names to most of the notable features, and arrived at Tarentum in Italy."[109] From here Democedes escaped the Persian guards and made his way home to Croton. Nothing of this survey

[108] The story is told in Hdt. 3.125, 129–38. Democedes, according to Herodotus (3.125), was the most famous physician of his time and was also associated with the Pythagorean movement in Croton (his testimonia are found in Diels and Kranz 1956, no. 19). His task of recording features of seacoasts is reminiscent of two later physicians we visited above, Hermogenes of Smyrna (see above, page 184) and Galen of Pergamum (page 185).
[109] Hdt. 3.136: *παρεσκευασμένοι δὲ πάντα ἔπλεον ἐς τὴν Ἑλλάδα. Προσίσχοντες δὲ αὐτῆς τὰ παραθαλάσσια ἐθηεῦντο καὶ ἀπεγράφοντο, ἐς ὃ τὰ πολλὰ αὐτῆς καὶ ὀνομαστὰ θεησάμενοι ἀπίκοντο τῆς Ἰταλίης ἐς Τάραντα.* The middle verb *ἀπεγράφοντο* in Herodotus means 'to register' or 'to enter into a list' (see, e.g., Hdt. 5.29, 7.100).

survives (not surprisingly) but the story indicates that state-sponsored missions requiring a detailed recording of the coasts were undertaken.[110]

Posidonius, via Strabo, provides the other example. He tells of the adventurer Eudoxus of Cyzicus, who visited the court of Ptolemy VIII Euergetes II (182–116 B.C.) in an official capacity and was commissioned shortly thereafter by the king to find the sea route to India.[111] The first voyage was successful, and he returned with a lucrative cargo which was quickly confiscated by the crown. On the return from his second voyage a gale forced Eudoxus' ship down the east coast of Africa, whereupon he shared some of his food with the natives. "In return he received a supply of fresh water and the guidance of pilots, and he also made a list (*apographesthai*) of their words."[112] The reference to *topoi* (here meaning "localities") in the passage immediately preceding this one implies that by "words" he likely meant "place-names." The implication is that Eudoxus was keeping track of his locations from day to day, and was recording political and/or commercial information that would have been useful in subsequent voyages to the region.

The documentary practices of Ptolemaic Egypt have helped to preserve some evidence of navigational texts ostensibly produced aboard ships. Mentions of *hypomnemata* ('notes' or 'memoranda') appear in Agatharchides' *De Mari Erythraeo*, a regional history from the first half of the second century B.C. with surviving extracts and epitomes found in Diodorus Siculus and Photius.[113] Agatharchides' description of the African coast of the Red Sea is based on "information that we have obtained from the royal *hypomnemata* at Alexandria and eyewitnesses."[114] These "royal" records were apparently kept in the palace archives in the Library of Alexandria, as at the end of Book 5 Agatharchides mentions his lack of access to the *hypomnemata* due to disturbances there, a circumstance that led him to minimize the scope of his work.[115] These texts are generally characterized as official and semi-official

[110] Cf. Nearchus' voyage from the Indus to the head of the Persian Gulf in Arrian (*Ind.* 8.20–43, esp. 8.32) and Polybius' account (all but lost) of his own voyage of exploration along the north and west coast of Africa in 146 B.C. at the behest of Scipio Aemilianus (Plin. *NH* 5.1.9).

[111] Strabo (2.3.4–5) spends some time retelling Posidonius' account of Eudoxus of Cyzicus only to dismiss most of the details. For a critical commentary, see Thiel 1966.

[112] Strab. 2.3.4: *ἀντὶ δὲ τούτων ὑδρείας τε τυγχάνειν καὶ καθοδηγίας, ἀπογράφεσθαί τε τῶν ῥημάτων ἔνια.*

[113] *GGM*, 1:111–95. For the latest translation and commentary, see most recently Burstein 1989.

[114] Diodorus 3.38.1; Burstein 1989, 30, 132.

[115] Agatharchides, *De Mari Erythraeo*, fragment 112 (Burstein 1989, 173).

reports of the voyages of Ptolemaic agents, explorers and merchants.[116] Indeed, it appears that Agatharchides relied solely on such reports and other published materials archived in Alexandria, as opposed to autopsy and personal experience, to write the entire *De Mari Erythraeo*.[117]

There is very little evidence of the mechanisms by which the Library acquired its holdings of geographic works and these so-called *hypomnemata* (as well as the rest of its collection), but Galen provides an interesting story. In his commentary on the third book of the *Epidemics* he describes the efforts exerted by Ptolemy III Euergetes (284–221 B.C.) to boost his Library's holdings by issuing an order to seize and copy all books found on ships unloading at Alexandria, then to return only the copies to their owners. The books thus received were marked with the label *ek ploiōn*, "from the ships."[118] Traditionally, the label has been explained as a means to distinguish the high literary works confiscated from ships from

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116 See Susemihl 1965, 1:668 and n. 255; Peremans 1967, 443; Fraser 1972, 1:187; Burstein 1989, 30–1. Burstein includes among these *hypomnemata* the reports of three explorers of the Red Sea: Satyrus, Simmias (a periplographer) and Ariston, but only Simmias is explicitly mentioned by Agatharchides (fragment 41; Burstein 1989, 79). Cf. the numerous merchant testimonies regarding the Erythraean Sea referenced by Marinus in Ptolemy's *Geographica* 1.6, 9. Marinus may have recorded verbal testimony, but it is just as likely that he consulted their respective *hypomnemata* in the Library of Alexandria.

117 Burstein 1989, 17–18, 30–3.

118 Galen, *Comm. in Hipp. Epidem.* III; xvii a 606–7; *CMG* v.10.2.1, pages 78–9: "Some say that he (sc. *Μνήμονα*) took the third book of the *Epidemics* from the great Library of Alexandria in order to read it, then returned it after having annotated it with symbols in both ink and lines. But others say that the book itself had been acquired in a marked-up state from Pamphylia, and that Ptolemy, the king of Egypt at that time, was so ambitious that he ordered the books of all those sailing in [to Alexandria] to be collected for him; and having copied them onto fresh rolls handed these to the owners…, then had the seized documents deposited in the Library. They also say that there was a mark on them: "From the ships." One such work that was reportedly so marked was the third book of the *Epidemics*: "From the ships, by favor of the editor Mnemon of Side." But still others say that it was not marked in this fashion, but simply had the name Mnemon, since the servants of the king wrote on those books placed in storerooms the name of all those who had arrived by ship. For they did not bear them directly to the Library, but first placed them in heaps in some storerooms" (*ἔνιοι μὲν γάρ φασιν αὐτόν, λαβόντα τὸ τρίτον τῶν Ἐπιδημιῶν ἐκ τῆς ἐν Ἀλεξανδρείᾳ μεγάλης βιβλιοθήκης ὡς ἀναγνωσόμενον, ἀποδοῦναι παρεγγράψαντα ἐν αὐτῷ καὶ μέλανι καὶ γράμμασι παραπλησίοις τοὺς χαρακτῆρας τούτους. ἔνιοι δὲ παρεγγεγραμμένον τὸ βιβλίον αὐτὸν ἐκ Παμφυλίας κεκομικέναι, φιλότιμον δὲ περὶ βιβλία τὸν τότε βασιλέα τῆς Αἰγύπτου Πτολεμαῖον οὕτω γενέσθαι φασίν, ὡς καὶ τῶν καταπλεόντων ἁπάντων τὰ βιβλία κελεῦσαι πρὸς αὐτὸν κομίζεσθαι καὶ ταῦτ᾽ εἰς καινοὺς χάρτας γράψαντα διδόναι μὲν τὰ γραφέντα τοῖς δεσπόταις…εἰς δὲ τὰς βιβλιοθήκας ἀποτίθεσθαι τὰ κομισθέντα, καὶ εἶναι τὴν ἐπιγραφὴν αὐτοῖς Τῶν ἐκ πλοίων. ἓν δή τι τοιοῦτόν φασιν εὑρεθῆναι καὶ τὸ τρίτον τῶν Ἐπιδημιῶν ἐπιγεγραμμένον· Τῶν ἐκ πλοίων κατὰ διορθωτὴν Μνήμονα Σιδήτην, ἔνιοι δ᾽ οὐ κατὰ διορθωτὴν ἐπιγεγράφθαι φασίν, ἀλλ᾽ ἁπλῶς τοὔνομα τοῦ Μνήμονος, ἐπειδὴ καὶ τῶν ἄλλων ἁπάντων τῶν καταπλευσάντων ἅμα βιβλίοις ἐπέγραφον οἱ τοῦ βασιλέως ὑπηρέται τὸ ὄνομα τοῖς ἀποτιθεμένοις εἰς τὰς ἀποθήκας. οὐ γὰρ εὐθέως εἰς τὰς βιβλιοθήκας αὐτὰ φέρειν, ἀλλὰ πρότερον ἐν οἴκοις τισὶ κατατίθεσθαι σωρηδόν*).

those bought by crown book agents working in Athens and Rhodes.[119] The Library, however, would have already abounded in books of significant literary value (Callimachus, a contemporary of Ptolemy III, catalogued 120,000 scrolls of classical poetry and prose in his lost *Pinakes*[120]), and in any event most of the works that arrived from outside Alexandria may be presumed to have come by sea as a matter of course. It seems more reasonable to suggest that the label referred not to writings of literary merit *taken from* ships (how many ships on a given day would have been expected to carry works of high value?), but works that were *produced* aboard ships and pertained to geography, such as log books, travelogues and navigational materials—in other words, the same *hypomnemata* mentioned by Agatharchides.[121] In such cases, the crews of ships would probably have welcomed fresh copies of their originals, provided the scribes copied them accurately.[122]

The existence of such lists or records produced aboard ships, whether or not they were later archived on shore, would go some way toward explaining the context of Plutarch's maxim in his *Old Men in Public Affairs*: "*Grammata kybernētika* do not make commanders of ships who have not often stood on the stern as spectators of the struggles against wave and wind and storm at night."[123] Here, the phrase could mean "navigational treatises" in general, as Fowler renders it, but it could just as well be translated as "navigational records" or "navigational accounts."[124] What seems to be meant is a reliable written guide that would aid the statesman in navigating the ship of state through troubled waters. It is interesting to note that Plutarch could easily have inserted "*periploi*," but chose instead a more specific, but to us elusive, category of writings which seafarers may have consulted for navigational purposes.

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119 See, e.g., Fraser 1972, 1:325; Erskine 1995, 39. Although cf. Blum (1991, 103) who suggests that Galen's story "may be an exaggerated generalization."

120 On the organization and evident content of Callimachus' *Pinakes*, see Witty 1958.

121 Cf. Geus 2004, 11.

122 I thank R. Taylor for his insight on this point.

123 Plut. *Mor.*, *An seni* 790D: *πλοίων μὲν ἄρχοντας οὐ ποιεῖ γράμματα κυβερνητικά, μὴ πολλάκις γενομένους ἐν πρύμνῃ θεατὰς τῶν πρὸς κῦμα καὶ πνεῦμα καὶ νύκτα χειμέριον ἀγώνων*. Cf. Polyb. 12.25d6: "for verily they are like sailing masters [learning their art] from books [as opposed to experience]" (*εἰσὶ γὰρ ἀληθῶς ὅμοιοι τοῖς ἐκ βυβλίου κυβερνῶσιν*).

124 Fowler 1936, 115. On other possible meanings, see *LSJ*, s.v.

IV. Conclusions

In all, it must be admitted that the role of written aids in Greek and Roman navigation is poorly understood. There is little hard evidence to indicate whether seafarers required written aids to navigate safely and efficiently. The fact that seafaring on the open sea predates agriculture in the Mediterranean, and that distant voyages took place in the Bronze Age (an era with minimal literacy) are indications that the seafarers of antiquity could have managed without "navigational manuals," and likely did manage without them for the most part.[125] But the accidents of survival have left us with a corpus of *periploi*, *stadiasmoi* and *limenai* that seem particularly suited to serving the needs of safe coastal navigation, particularly with their formula of distances measured against time. But where some of the form and content seems aptly suited, a contextualized reading and an analysis of authorship and readership reveal little that would have been required reading for seafarers, and much that would have been of real use instead to geographers, travelers and merchants. For geographers, these texts served as loci of the raw data required to construct macroscopic literary versions of the *oikoumenē*: the 26,000 km of sinuous coastline that comprised the Mediterranean and Black Sea served not only as a convenient organizing principle for geographic literature, but also as an expedient means by which to locate a "place" within a broader geography that in most areas was oriented more toward the maritime than toward an expansive hinterland. For sophisticated travelers like Crinagoras and the *communitas literraria* in general, the *periplus* (and no doubt *stadiasmoi* and *limenai*) proved useful in voyage planning. And for merchants looking for markets, the data on harborage, environment and political organizations made the *periplus* formula a fitting format for arranging information.

On the other hand, the safe and efficient operation of ships in both ancient and modern times has relied on lists, and indeed there is evidence to demonstrate that on both naval and commercial ships throughout the Classical, Hellenistic and Roman period there were literate crew members assigned to produce and maintain written records, mostly for the purposes of ship-board administration and logistics. It is entirely possible, perhaps even probable, that on occasion some crewmembers produced lists containing navigational

[125] On the characteristics of Mediterranean Bronze Age navigation, see Wachsmann 1998, 295–301.

information related to particular voyages, particularly the salient characteristics of the coasts. In such environments we could not expect such writings to have survived, although from the third century B.C.—an era of quickly expanding horizons in the Greek sphere—such lists produced by Ptolemaic agents and merchants appear to have been collected by the Library of Alexandria, which thus served as an archive for geographers and periplographers.

On the whole, however, the main school of navigation was certainly the time spent at sea experiencing the routines of well-trodden passages as well as those "struggles against wave and storm" to which Plutarch referred. Heretofore we have concentrated on the techniques of navigation and the manifestations of its written expressions. We have yet to ask who the people were who mastered the *kybernētikē*, or the *ars gubernatoris*. To what extent did their experience enable them to determine the movements and position of their vessels?

Chapter 7: *The Technicians and* Technē *of Maritime Movement*

> As much as the sea differs from the land, so too are we workmen of the sea distinguished from those who dwell in cities and villages. For they either remain inside their gates and conduct public affairs, or devoting themselves to their farm plot wait for the crops to emerge from the soil for their sustenance. But land is death for us whose life is among the waves, just as for the fishes who are unable to breath the air.
>
> —Alciphron[1]

> Know that Diodorus, the son of Calligenes of Olynthus, who could make his way even as far as Atlas, and knew the Cretan waters and the navigation of the Black Sea, died in port, falling off the prow at night, while he was spewing out the excess of the feast. Ah, how small a bit of water was fatal to him who had been proved in so vast an expanse of ocean!
>
> —Antipater of Sidon[2]

> Damis of Nysa, once navigating a small vessel from the Ionian Sea to the Peloponnese, brought safe and sound to land the ship with all on board, which the waves and winds had swept out of its course; but just as they were casting anchor on the rocks the old man died from the chilling snow-storm, having fallen asleep. Mark, stranger, how having found a sweet haven for others, he himself entered the haven of Lethe.
>
> —Antipater of Sidon[3]

In the last four chapters we have explored several distinct facets of Greek and Roman navigation and the ways in which seafarers solved (or attempted to solve) the fundamental challenges of determining direction, orientation, speed and distance at sea. A study of ancient navigation, however, would be incomplete if it did not consider the people responsible for its practice and the navigational methods and routines they established to effect maritime movement safely and effectively. The first part of this chapter aims at establishing an outline of the social setting of commercial sailing masters—*kybernētai* in the Greek tradition, *gubernatores* in the Roman tradition—and their essential navigational role

[1] Alciphron, *Ep.* 1.4, Kymothos to Tritonis: *Ὅσον ἡ θάλαττα τῆς γῆς διαλλάττει, τοσοῦτον καὶ ἡμεῖς οἱ ταύτης ἐργάται τῶν κατὰ πόλεις ἢ κώμας οἰκούντων διαφέρομεν. οἱ μὲν γὰρ ἢ μένοντες εἴσω πυλῶν τὰ δημοτικὰ διαπράττονται, ἢ γεωμορίᾳ προσανέχοντες τὴν ἐκ τῆς βώλου πρὸς διατροφὴν ἀναμένουσιν ἐπικαρπίαν· ἡμῖν δὲ οἷς βίος ἐν ὕδασι, θάνατος ἡ γῆ καθάπερ τοῖς ἰχθύσιν ἥκιστα δυναμένοις ἀναπνεῖν τὸν ἀέρα.* Alciphron was writing in the second or third centuries A.D.

[2] *Gr. Anth.* 7.625: *Εἰδότα κὴπ' Ἄτλαντα τεμεῖν πόρον εἰδότα Κρήτης | κύματα καὶ Πόντου ναυτιλίην Μέλανος,| Καλλιγένευς Διόδωρον Ὀλύνθιον ἴσθι θανόντα | ἐν λιμένι πρῴρης νύκτερον ἐκχύμενον, | δαιτὸς ἐκεῖ τὸ περισσὸν ὅτ' ἤμεεν. ἆ πόσον ὕδωρ | ὤλεσε τὸν τόσσῳ κεκριμένον πελάγει.*

within the hierarchy of a typical merchant vessel's crew. The second part draws and elaborates on discussions from previous chapters to narrate in chronological sequence a hypothetical voyage of an Alexandrian grain freighter between that city and Portus, the main port of imperial Rome. This précis of ancient navigation at the acme of its development is designed to tie together the numerous threads that constituted the *technē* of navigation in antiquity, and to serve as a framework for the considerations and practices behind all voyages in antiquity.

I. THE SAILING MASTERS OF COMMERCIAL SHIPS

As we have seen throughout this study, those responsible for navigating the ships of classical antiquity are known to us primarily through myth and literature. *Kybernētai* won renown for their acute and often heaven-inspired knowledge of *kybernētikē*, the "steering" art. Phrontis son of Onetor, for example, was famed for his navigational skills and steered Menelaus' ship on his return from Troy, earning for himself a place in Polygnotus' famous but now lost Classical painting at Delphi, the *Iliupersis*.[4] Tiphys, *kybernētēs* of the *Argo*, learned his skill from Minerva (at least in Valerius Flaccus' version of the *Argonautica*) and was also immortalized in art.[5] Odysseus in his role as the sole *kybernētēs* aboard a makeshift raft, as we have seen, learned from Calypso how to navigate home to Ithaca by the stars (see above, page 121). In Athens tradition held that Theseus honored the skills of his *kybernētēs*

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[3] *Gr. Anth.* 7.498: *Δᾶμις ὁ Νυσαεύς, ἐλαχὺ σκάφος ἔκ ποτε πόντου | Ἰονίου ποτὶ γᾶν ναυστολέων Πέλοπος | φορτίδα μὲν καὶ πάντα νεὼς ἐπιβήτορα λαὸν | κύματι καὶ συρμῷ πλαζομένους ἀνέμων | ἀσκηθεῖς ἐσάωσε· καθιεμένης δ' ἐπὶ πέτραις | ἀγκύρης ψυχρῶν κάτθανεν ἐκ νιφάδων | ἠμύσας ὁ πρέσβυς.*

[4] Paus. 10.25.1–2. On proposed reconstructions of this lost, monumental mural executed around the middle of the fifth century B.C., see the bibliography in Stansbury-O'Donnell 1989 as well as his own reconstruction in figs. 2–5. For depictions of helmsmen in Greek art, see the Basch 1987, 171–236.

[5] Flaccus, *Argon.* 2.47–68: "But Tiphys strengthened their hearts and said, "We do not direct our ship without divine power, and not by my own skill; so often as the Tritonian queen refined our course" (*sed pectora firmans | Hagniades 'non hanc' inquit 'sine numine pinum | derigimus nec me tantum Tritonia cursus | erudiit*); cf. 1.15–20; 1.472–6; 5.44–52 and Sen. *Med.* 318–19. Philostratus (*Imag.* 2.15.15–22) states: "And Tiphys, my boy, steers the ship; and he is said to be the first of men to brave the art that was at that time untrustworthy" (*καὶ Τῖφυς μέν, ὦ παῖ, κυβερνᾷ, λέγεται δὲ οὑτοσὶ πρῶτος ἀνθρώπων ἀπιστουμένην θαρρῆσαι τὴν τέχνην*). Although the trend in scholarship is to view Philostratus' descriptions of paintings in his *Imagines* (εἰκόνες) more as "word pictures" than literal works of art (see, e.g., Beall 1993), his description of Tiphys in an *Argonautica* painting had a real-world correlate in Mikon's mid-fifth-century B.C. painting of the voyage to Colchis that was once displayed in the Sanctuary of the Dioskouroi in Athens (Paus. 1.18.1).

Nausithoos with an *heroon* and a festival, the *Kybernēsia*.[6] From these and other characterizations of *kybernētai* of the heroic age we may form a picture of their early role aboard ship and their skills in navigation: the pilot was distinguished from the crew for his special knowledge and experience, drew on the heavens to guide the ship through calm and storm, expertly used the winds by day and the stars by night to guide the vessel across large stretches of sea and through dangerous waters, was cognizant of weather and weather signs, and possessed a comprehensive knowledge of maritime geography.

These are the general characteristics of mythical pilots and their art. Who were the real pilots who served aboard Greek and Roman commercial ships? What do we know of such experts in navigation as Diodorus son of Calligenes and Damis of Nysa, whose epitaphs head this chapter? What specific role did they and their counterparts play within society and the hierarchy of a ship's crew?

Little is known of the social history of Greek and Roman merchant sailors in general, and sailing masters in particular. Greek and Roman writers outside of poetry and high literature have little to say, and they are nearly invisible in the epigraphic evidence. Much of what know is based on occasional epigrams and the inferences that can be drawn from their notable absence in the textual record. In broad terms, the sailors who signed on (or were assigned) to Greek and Roman merchant vessels appear to have been drawn from a low stratum of society, the labor class which, to a large degree, included agricultural labor. Some willfully shunned a livelihood in the fields and placed their hopes in future rewards at sea, as one of Alciphron's letters to fishermen at the beginning of this chapter makes clear. In another, one seafarer tells his colleague, "since the land does not sufficiently repay me for my labors, I have resolved to entrust myself to the sea and the waves…For it is better for me to return from the Bosphorus and Propontis with new wealth, than to establish myself in the

[6] Known from Plutarch, *Thes.* 17.5–7, who cites Philochorus (*FGrHist* 328), the last of the atthidographers from the third century B.C.: "Philochorus says that Theseus received from Skiros of Salamis Nausithoos to serve as his pilot, and Phaiax for his lookout, the Athenians at that time not yet being attached to the sea, and that Skiros did so because one of the chosen youths, Menesthes, was born of his daughter. And to this the *heroa* of Nausithoos and Phaiax, built by Theseus, bear witness, built as they are at Phaleron next to the temple of Skiros, and they say that the festival of the *Kybernēsia* is celebrated in their honor" (*Φιλόχορος δὲ παρὰ Σκίρου φησὶν ἐκ Σαλαμῖνος τὸν Θησέα λαβεῖν κυβερνήτην μὲν Ναυσίθοον, πρωρέα δὲ Φαίακα, μηδέπω τότε τῶν Ἀθηναίων προσεχόντων τῇ θαλάσσῃ· καὶ γὰρ εἶναι τῶν ἠιθέων ἕνα ενέσθην Σκίρου θυγατριδοῦν· μαρτυρεῖν δὲ*

far reaches of Attica to lead a life of misery and poverty."[7] Laborers of various other stripes found themselves seeking work at the waterfront and aboard ship due to harsher individual circumstances (social, criminal or otherwise), and still others came as a result frequent wars and conflicts which displaced rural laborers out to sea. The crew of Synesius' ship, for example, was largely made up of farmers who "a year ago had not yet gripped an oar."[8]

Throughout classical antiquity these "castoffs" were an ethnically diverse mix of freeborn and slave, as much criminals as above-board laborers.[9] One of the more illuminating sources on the illicit tendencies of merchant sailors is the *Rhodian Sea Law* (*Nomos Rhodiōn Nautikos*), an admixture of maritime jurisprudence dating to the sixth and seventh centuries A.D., but with much earlier antecedents in the Roman imperial era.[10] Among its numerous provisions it lists the penalties against predatory sailors for robbing other ships or merchants and passengers on board, for fighting other sailors (with fist, stone and ax!), for killing other crew members, and more.[11] The penalties for these and other infractions included severe fines and corporal punishment, an indication that, as Ashburner noted, "mariners as a rule were not treated with much consideration by the law. In wreck inquiries they and even their captain might be tortured."[12] Their low social and civic status, combined with living and working in an isolated and harsh environment for much of the year, prevented a stabilization of this labor class as a whole. The more violent types drifted from port to port and ship to ship, or were attracted to piracy. The less sordid were occasionally recruited into naval units.[13] Most if not all participated in the seedy underworld

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τούτοις ἡρῷα Ναυσιθόου καὶ Φαίακος εἱσαμένου Θησέως Φαληροῖ πρὸς τῷ τοῦ Σκίρου [ἱερῷ], καὶ τὴν ἑορτὴν τὰ Κυβερνήσιά φησιν ἐκείνοις τελεῖσθαι).

[7] Alciphron, *Ep.* 2.4: *Οὐδέν με τῆς γῆς ἀμειβομένης τῶν πόνων ἀντάξιον, ἔγνων ἐμαυτὸν ἐπιδοῦναι θαλάττῃ καὶ κύμασι…κρεῖττον γὰρ ἐπανήκειν ἐκ Βοσπόρου καὶ Προποντίδος νεόπλουτον, ἢ καθήμενον ἐπὶ ταῖς τῆς Ἀττικῆς ἐσχατιαῖς λιμῶδες καὶ αὐχμηρὸν ἐρυγγάνειν*. See also Isidorus' epigram at the head of Chapter 2, page 16.

[8] Syn. *Ep.* 4.25 (see Appendix C).

[9] Crews of both Greek and Roman merchant vessels included slaves and freedmen (see, e.g., Dem. 33.8–10; Dem. 34.10; Ps.-Xen. *Ath. Pol.* 1.19; Caes. *B Civ.* 3.14; cf. Hdt. 2.164). On the impoverished and low class status of Greek sailors, see Bourriot 1972, esp. 27–9. On the criminal elements among sailors of the Roman era, see the two illuminating studies by Rauh (2003, 146–68) and Rauh et al. 2008, esp. 222–7).

[10] The primary source on the *Nomos Rhodiōn Nautikos* remains Ashburner 1909. On the date of the compilation, see liii, cxii–cxiii.

[11] See Ashburner 1909, 71–5, 79–87.

[12] Ashburner 1909, lxxix.

[13] During his siege of Massilia Caesar (*BC* 1.58) describes how his warships "indifferently employed rowers and sailing masters who had been hastily recruited from merchant ships, and were not yet familiar with the names

that characterized the waterfronts of ancient harbor cities.[14] "Branded faces, foul odours, bad language, physical infirmities, and leather-hardened skin all physically separated maritime workers from their land-dwelling contemporaries."[15] While the sailing master was perhaps the most respected of all sailors aboard ship,[16] his skill and respectability appears never to have translated into upward social or civic mobility. Even in the prosperous nautical environment of imperial Ostia and Portus, where there were guilds of shipbuilders, shipowners, stevedores, boatmen, skiffmen, rope makers and divers (under the curious name *urinatores*), there is no evidence of a guild established by and for sailors of any rank, not even the most professional sailing masters who took part in the Alexandrian grain trade. The progeny of the heroic pilots of myth clearly belonged to the naval rather than the commercial sphere.

To a large extent the lives and backgrounds of Greek and Roman sailing masters were governed by the operational needs and parameters of the ships on which they lived and labored. The ship, it will be recalled, was one of the most complex and dangerous machines of antiquity, and it operated in a hostile and dynamic natural environment known for claiming hundreds of lives at a time. The rigors of travel by sea and the mechanisms invented to make the ship travel effectively in the desired direction demanded a tough, skilled and seasoned crew capable of operating and improvising on a daily basis. To mitigate the danger duties aboard ship were divided according to skill and experience into a regular hierarchy.[17] In Homer and subsequent poets the hierarchy began with the ship's *archos* or leader (Jason, Odysseus, Menelaus, etc), followed by the *kybernētēs* ("steerer"), *keleustes* ("orderer") and *prorates* ("fore-looker"), then the rowers.[18] The *kybernētēs* steered the ship and

of the tackle" (*remigibus minusque peritis gubernatoribus utebantur, qui repente ex onerariis navibus erant producti neque dum etiam vocabulis armamentorum cognitis*). The question of the mobility of Greek and Roman sailors between commercial, naval and piratical spheres is worthy of a study of its own (cf. Bourriot 1972, 10).

[14] Rauh 2003, 161–2.

[15] Rauh 2003, 162. Another area worth of study is the physical separation of sailors from society within harbor cities. Strabo (17.1.6), for example, describes the sailors of Alexandria as living on Pharos island near the lighthouse, at a time when Pharos was otherwise uninhabited.

[16] See, e.g., Plato's glowing praise of commercial *kybernētai* in *Grg.* 511d–512c. Cf. Plin. *Ep.* 9.26.4. See also below, notes 35 and 36.

[17] The following section relies in large part on evidence collected by Casson 1995, 314–21.

[18] On the *archos* figure see, e.g., *Hymn. Hom. Ap. Dion.* 25. On the *kybernētēs*: *Il.* 19.43, 23.316; *Od.* 3.279, 8.557, 9.78, 11.10, 12.152, 12.217, 12.412, 14.256. On the *keleustēs*: Eur. *Hel.* 1576. On the *proratēs*: Eur. *Fragmenta*

commanded the crew, while he or the *keleustes* kept the time for the rowers and the *proratēs* served as a lookout in the bow. All of these figures are portrayed separately or together on numerous Greek vases of the Archaic and Classical periods.[19]

In the Classical and Hellenistic periods (if not earlier) it was the ship's owner (*naukleros*) who engaged a small group of officers to run the ship. The *kybernētēs* (Lat. *gubernator*) served as the sailing master, and was tasked with the navigation of the ship and command of the crew while at sea. He gave orders to the sailors to maneuver and adjust the sails as needed, and he likely had quartermasters to relieve him at the steering oars on a regular watch rotation (see above, pages 139–41).[20] The *keleustēs* continued his essential responsibility of calling the time to rowers aboard warships,[21] but to my knowledge the position is never attested aboard merchant galleys for the rest of antiquity; when the need arose the *kybernētēs* or his quartermasters likely kept the rowing time. At sea, the *proreus* served as second in command and kept to the forward half of the ship; as the steerer's sightlines were blocked by the mast, rigging and sail, the eyes of the *proreus* were essential for maintaining a safe watch over the course ahead and for warning the helm of obstacles and shoal water when close to shore.[22] He was also responsible for the maintenance of the ship and its gear.[23] When the owner had interests in the cargo he sometimes accompanied the vessel or sent a representative in his stead; in cases of smaller vessels the owner could double as a *nauklērokybernētēs*, or merchant-captain.[24]

In the Roman period, as ships grew in size and trading ventures grew more complex, a few changes and additions were introduced for larger vessels, and the vocabulary was

papyracea 149.3–6 (= Austin 1968): "Sit yourself at the helm and instruct the man at the bow immediately to keep an eye on the course taken to Troy by the sons of Atreus" (*σύ τε π̣[ηδ]α̣λίωι παρεδρεύω̣[ν | φράσει̣[ς τ]ῶ̣ι̣ κατὰ πρῶιραν | εὐθὺς Ἰλ̣[ίο]υ πόρον | Ἀτρεΐδα̣[ις] ἰ̣δέσθαι*).

[19] See, e.g., Morrison and Williams 1968, plates 11d, 12f, 14a–b and 15a; Basch 1987, 171–236 passim.

[20] Casson 1995, 300 n. 1, 320.

[21] See, e.g., Thuc. 2.84.3, 7.70.6.

[22] de Saint-Denis 1967, 206.

[23] See, e.g., Xen. *Oec.* 8.14: "Then I found the sailing master's assistant, the one who is called the *proreus* of the ship. He was so well acquainted with the placement of each and every thing that even off the ship he could tell you where each set of things was placed and how many there were of each" (*τὸν δὲ τοῦ κυβερνήτου διάκονον, ὃς πρῳρεὺς τῆς νεὼς καλεῖται, οὕτως ηὗρον ἐπιστάμενον ἑκάστων τὴν χώραν ὡς καὶ ἀπὼν ἂν εἴποι ὅπου ἕκαστα κεῖται καὶ ὁπόσα ἐστὶν*).

[24] Although the term is found only in fourth-century A.D. papyri from Roman Egypt (see Wilcken, *Chr.* 434; *PFlor.* 75.8, 29; *PLugb. Bat.* 11.1, col. 1 3–5 and col. II 2–4).

expanded to include Latin terms. The *kybernētēs* became the *gubernator*, but no longer did he necessarily report directly to the owner. Instead, the *naukleros* (Lat. *navicularius*) hired a *magister navis*, or "ship's master," to fit out the vessel, hire the crew and arrange cargoes and passengers. He could sail with the ship, and even operate it,[25] but more often than not he turned the ship over to the *gubernator*, who as before retained his duties and authorities as sailing master and gave orders to the crew while underway—Give sail! Correct your course! Wear off! Come about! Make way against the head wind! Take in all sail![26] The *proreus* continued his responsibilities as before, but much of his day-to-day administrative duties were subsumed by a new figure, the *toicharchos*, who on larger ships was assisted by still other cargo clerks. Larger vessels would have also engaged a ship's carpenter (*naupegos*) to repair and maintain the hull.

The number of sailors who served below this cadre of officers depended on the size of the vessel. For smaller and purely sail-driven merchant vessels engaging in cabotage or longer-range hauls the numbers probably never exceeded four of five crew members. The late-fourth-century-B.C. Kyrenia ship found and fully excavated off northern Cyprus, for example, measured just 14 m in length and carried four sets of dinner ware (including oil jars, plates, bowls, saucers, drinking cups and wooden spoons), thus suggesting the total complement of the crew.[27] At the other extreme were the large wine-carriers and grain ships: Lucian is obviously hyperbolizing when he likens the crew of the *Isis* to an army, but it is certain that these enormous ships swarmed with two dozen or more sailors, all of whom were needed for handling the rigging, standing watches while underway, loading and shifting cargo, bailing the bilges, rowing the ship's boat and conducting anchoring and mooring

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[25] See below, n. 64.

[26] On orders to the helm and nautical maneuvers in Greek, see Morrison and Williams 1968, 312–13. For Latin equivalents, see de Saint-Denis 1935b.

[27] Swiny and Katzev 1973, 345. Perhaps the four crew members included a captain (*kybernētēs*), first mate (*proreus*) and two all-purpose seamen.

operations.[28] Synesius appears to describe a vessel of mid size with its crew complement of thirteen, including the owner who also acted as sailing master.[29]

How did sailors earn experience and attain to higher positions aboard ship, including the position of sailing master? Medas adopts the view that Greek and Roman merchant sailors and fishermen took their sons to sea and raised them in the profession aboard ship, just as many Mediterranean fishermen do and have done with their sons in modern and early modern times.[30] The Greek and Roman textual tradition make no room for this anachronism, however. Even in Alciphron's letters of fishermen, which generally reflect a positive view of life spent at sea, there is a strong sentiment expressing a willingness to prevent one's children from choosing (or being forced to choose) a life spent working at sea.[31] Rather it is apparent that those individuals who found themselves pushed out to sea to earn their livelihood on a more permanent basis gained experience over time and could rise through the ranks to occupy more important positions with added responsibility and, presumably, better pay.[32] The pathway through the hierarchy aboard commercial vessels is nowhere specified, but in Classical, Hellenistic and Roman imperial navies to become a sailing master first required a turn as an oarsman, then as a quartermaster (*pedaliouchos*,

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[28] Lucian, *Navigium* 6 (Appendix B). In Demosthenes 34.10 we read of a large ship departing the Cimmercian Bosphorus and coming to grief not far from shore with the loss of thirty people; that "there was much mourning in Bosporus," however, strongly suggests that many if not most of them were passengers and not crew members. Cf. Philostr. *VA* 4.9 (see below, n. 65) and Ashburner 1909, clxxxvi, 93.

[29] Syn. *Ep.* 4.20–3.

[30] Medas 2004, 31–3. Interestingly, there is some epigraphic evidence of fathers and sons assigned to the same ship in the Rhodian navy of the Hellenistic period. As Gabrielsen (1997, 104–5) has shown, however, each ship drew its crew from a naval aristocracy that dominated the fleet; familial ties (father-son, brothers etc) among crew members were an inevitable outcome of recruiting.

[31] See, e.g., Alciphron, *Ep.* 1.3: "Happy is he who dwells on land! A plot of earth involves no danger… Grievous is the sea, and seafaring is full of reckless…Why, then, wife, should we not be wise, and, though it be late, flee a life that is so near death? We have children; and, although our poverty prevents us from bequeathing anything considerable, we shall be able to keep them in happy ignorance of the mighty swells and the dangers of the deep. They will be brought up in farming and will lead a life of security and fearlessness" (*Χρηστὸν ἡ γῆ καὶ ἡ βῶλος ἀκίνδυνον…χαλεπὸν ἡ θάλαττα καὶ ἡ ναυτιλία ῥιψοκίνδυνον…τί οὖν, ὦ γύναι, οὐ σωφρονοῦμεν καὶ ὀψὲ τοῦ καιροῦ φεύγομεν τὴν πρὸς θάνατον γειτνίασιν, καὶ ταῦτα ἐπὶ παιδίοις ζῶντες, οἷς εἰ καὶ μηδὲν μέγα παρέχειν δι' παιδίοις ζῶντες, οἷς εἰ καὶ μηδὲν μέγα παρέχειν δι' ἀχρηματίαν ἔχομεν, τάδε παρέξομεν καὶ χαριούμεθα, τὸ τὰς τρικυμίας καὶ τοὺς ἐκ βυθοῦ κινδύνους ἀγνοῆσαι, γεωργίᾳ δὲ συντραφῆναι καὶ τὸν ἀσφαλῆ καὶ ἀδεᾶ βίον ἀσπάσασθαι*). Cf. *Gr. Anth.* 7.650, 9.23.

[32] According to the *Nomos Rhodiōn Nautikos* (see Ashburner 1909, clxvi–clxvii, 1, 57), a *kybernētēs* and *proreus* receive one and a half share in the profit of a voyage, whereas the ship's master (*nauklēros*) receives two and sailors one: *ναυκλήρου μισθὸς μέρη δύο…κυβερνήτου μισθὸς μέρος ἓν ἥμισυ…πρωρέως μισθὸς μέρος ἓν ἥμισυ…ναύτου μισθὸς ἕν.*

"steering oar holder"), then as a *proreus*.[33] Aboard merchant vessels, the career path of those with some ambition who continued to work at sea year after year was likely very similar. A rough form of apprenticeship served to move the general-purpose sailor up to quartermaster, then to *proreus*.[34] A determined *proreus* who exhibited exceptional skill and responsibility could attain ultimately to sailing master.

The more sizeable ships that carried large, valuable cargoes were likely commissioned to reputable and highly experienced sailing masters who possessed years if not decades of experience at sea. These were the commercial equivalents of the famed naval *kybernētai* of the Classical period, such as Phantias of Athens, Ariston of Corinth and Hermo of Megara.[35] Those who toured Lucian's *Isis*, for example, described Heron the sailing master as a "little old man…with receding curly hair" who was "amazing at his job…and wiser than Proteus at things to do with the sea."[36] The refined epitaphs of Diodorus of Olynthus and Damis of Nysa at the head of this chapter contrast their seafaring competence and years of experience with the tragic means of their downfall; these were men who had lived a dangerous but successful life at sea, no doubt moving their way up the ladder step by step, only to succumb to deaths unassociated with their profession. The negative sketch Synesius made of the *nauklērokybernētēs* Amarantus does little justice to the apparent seafaring acumen he exhibited at key moments on the difficult voyage from Alexandria to Azarium.[37] It was these qualities found in professional sailing masters—good judgment, skill, experience, prudence and an ability to command—to which Plato turned in his popular metaphor of the enlightened ruler and the ship of state.[38]

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[33] Ar. *Eq.* 542–4: "You have to be a rower first before putting your hand to the steering oars; then, from there, to serve as bow officer and to keep an eye on the winds; then to sailing master" (*ἐρέτην χρῆναι πρῶτα γενέσθαι πρὶν πηδαλίοις ἐπιχειρεῖν, κᾆτ' ἐντεῦθεν πρῳρατεῦσαι καὶ τοὺς ἀνέμους διαθρῆσαι, κᾆτα κυβερνᾶν*); Plut. *Agis* 1.4.2: "For although the bow officers see what is ahead before the sailing masters, yet constantly look back to the them and do what is ordered by them" (*καθάπερ γὰρ οἱ πρωρεῖς, τὰ ἔμπροσθεν προορώμενοι τῶν κυβερνητῶν, ἀφορῶσι πρὸς ἐκείνους καὶ τὸ προστασσόμενον ὑπ' ἐκείνων ποιοῦσιν*). Cf. Claud. *Consulship of Manlius* 42–6. See also Casson 1995, 302 and n. 9; Starr 1993, 56.

[34] Rougé 1966, 225; Rauh 2003, 150.

[35] Phantias of Athens: Lysias 21.10; Hermo of Megara: Dem. 23.212; Ariston of Corinth: Thuc. 7.39.2. Cf. Thuc. 1.143.1, where Pericles boasts that Athens has a larger class of native *kybernētai* than all of Greece.

[36] Lucian, *Navigium* 6 (Appendix B): *μικρός τις ἀνθρωπίσκος γέρων…ἐδείχθη γάρ μοι ἀναφαλαντίας τις, οὖλος, Ἥρων, οἶμαι, τοὔνομα. Θαυμάσιος τὴν τέχνην…καὶ τὰ θαλάττια σοφὸς ὑπὲρ τὸν Πρωτέα.*

[37] Amarantus' skills in navigation have been aptly explained by Casson (1952).

[38] Pl. *Resp.* 488d. Cf. Hor. *Carm.* 1.14.

II. THE NAVIGATION ROUTINE: FROM ALEXANDRIA TO PORTUS

Such is our meager pool of evidence regarding the position of sailing masters aboard ship and the general social background of Greek and Roman sailors. To learn more about these technicians requires an investigation into their profession and the navigational routines they practiced aboard ship. Having examined the physical environment and the various fundamental aspects of pre-instrument navigation, we are now in a position to obtain a general picture of the various phases of a voyage and the navigational skills drawn upon during each one. As many of the extant voyage narratives and other sources refer to the large Alexandrian grain ships of the Roman imperial period, let us consider a hypothetical voyage of one of the hundreds of grain ships that each year departed that city bound for Portus, the main port of Rome from the later first century A.D. (see above, pages 78–80, 153–4). This, as we have seen, was one of the more challenging routes in the Mediterranean—over some 1,700 nm of difficult seas—and demanded seasoned sailing masters with a broad knowledge of geography, winds, weather and nautical astronomy.

1. Planning

For the sailing master, navigational planning involved sober considerations of economy and risk. The primary challenge of transporting cargoes efficiently and safely between Egypt and Rome was the dynamic seasonal weather of a large maritime area. Years and generations of experience accumulated by seafarers had shown that Alexandrian grain ships could accomplish one, sometimes two, round trips per year by taking advantage of the long seasonal weather window. As we saw in Chapter 3, the ships that spent the winter in Alexandria customarily departed under convoy fully laden in April and took the slow northerly route to Italy, usually arriving in May or June.[39] They immediately unloaded their

[39] For a discussion on the organization and composition of the grain convoy, see Rougé 1963, 265–8. Cf. the mysterious fleet (*commeatus*, *classis*) of merchant ships forced to winter in Sardinia in the fifth century A.D. (Paulinus of Nola, *Ep.* 49.1–3; see also below, pages 225–6 and n. 100). Whether these were Alexandrian grain clippers, or smaller ships carrying grain from Africa (or Sardinia), is impossible to determine (cf. below, n. 139).

cargoes, then sped back to Alexandria under ballast with the aid of the etesian winds, arriving in July or perhaps early August. After filling their holds again, they immediately set off a second time and tried to advance as far as possible before the fierce depressions of autumn began. Some made it all the way to Rome's ports, others (such as Paul's ship and Lucian's *Isis*) were caught short and forced by weather into winter havens, leaving the last leg of the voyage for the following spring.

In Alexandria, upon loading the cargo, the immediate concern of sailing masters was to determine from the harbormaster the day and time of departure. An efficient departure from Alexandria (or any harbor for that matter) required winds favorable for propulsion and maneuvering on the way out to open water. Although Alexandria and the delta region were not included among those regions characterized for their steady departure winds (see Chapter 4), a local wind known in later times as the khamsin, a southeast wind, would have aided ships departing Alexandria and headed for points north and northwest (see above, pages 38–9 and fig. 2.10). Indeed, the Oxford *parapegma* (see below) makes mention of a south wind for 25 April, but it blows just five days per month on average between February and the end of May. Grain convoys could easily have spoiled the chance of a double run between Alexandria and Rome in season by waiting for it to arrive.

In the absence of a khamsin, diurnal winds would have sufficed to move the ships of the convoy offshore to take advantage of the predominantly northwesterly and westerly offshore winds. As diurnal winds behaved differently in different areas, depending on the orientation of the coast with respect to the sun and other factors, determining when to depart under their influence required some degree of strategy. As we saw in Chapter 2, sea breezes, winds which blow from shore to sea, typically rise in the early to mid afternoon, after the warmth near the sea's surface has matched, then exceeded, that on land. The consequence of departing closer to evening was less daylight available for visual navigation in the first few critical hours of departing the coast. On the other hand, diurnal winds were at their weakest in the early morning, just before sunrise, and so moving offshore at that time may have been torturously slow for sailing ships, but offered much more daylight time than an evening departure.[40] Local conditions in Alexandria and the personal and collective preferences of sailing masters in the convoy were likely determinants in deciding the time of day to depart.

The date of departure was just as important as the time of day, and again weather was of prime concern. How was it possible to predict the weather for the first few days of the voyage? As we saw in Chapter 5, farming and seafaring communities early on employed the risings and settings of certain stars and star groups to demarcate the boundaries of seasonal activities, but by at least the third century B.C. a more developed system of weather prediction appeared which correlated stellar phases with weather. The large volume of astrometeorological associations warranted the production of *parapegmata* (so called because a physical peg was moved from day to day) to keep track of them. Some of these *parapegmata* adopted a literary form, others were produced in stone and erected in public places. One simply found the date, then took note of the weather to be expected on that day. A literary example from the Oxford *parapegma*, a papyrus generally dated to the first century B.C., gives a flavor of the astrometeorological predictions for the months of April and May, the window of the first voyage of grain clippers heading from Alexandria to the ports of Rome:

> April, according to the Greeks *Xanthikos*.
>
> 12. *Hypsōma* of the sun.
> 15. Perseus begins to rise and the south wind blows.
> 21. Frost.
> 25. The star on the belt of Orion is hidden and there is a south wind. This month is situated in the constellation Aries. Night is 11 hours, day 13.
>
> May, according to the Greeks *Artemisios*, according to the Egyptians *Pachon*.
>
> 1. The bright star of Lyra rises in the evening. The air is misty, and the Hyades rise at the same time as the sun does.
> 6. Capella rises in the morning and the air begins to calm.
> 8. Much frost.
> 14. Procyon rises. Thundery and snowy.
> 19. The Hyades appear in the morning and the air is particularly changed for one or two days before.
> 22. The southern twin, Heracles, rises. Clear airs and the completion of the frost.
> 24. Capella disappears in the evening. This month is situated in the constellation of Taurus. Night is 10 hours, day 14.[41]

[40] Dawn departures appear to have been a normal practice. See, e.g., Syn. *Ep.* 4.1–3, 183–5 (Appendix C), Rutilius Namatianus, *De Reditu Suo* 1.217–18, 277–8, 314–15.

From the perspective of voyage planning, it seems reasonable to draw the inference that *parapegmata*—to the (uncertain) extent that they were available and visible to the public at large—provided a *rough* picture of the weather that was to be associated with stellar risings and calendar dates: the first time that Orion and the stars on his belt were clearly observable on 25 April, or the first time that Capella arose in inclement weather on 6 May, would have shown even the least observant that *parapegmata* were not absolutely trustworthy. It was simply enough to know, for example, that a south wind was *usually* to be encountered in mid April around the time of Perseus' rising. Similarly with Procyon's rising in mid May. Exactitude on the part of *parapegma* writers was not only improbable, but impossible.

For seemingly more certain readings and immediate predictions of the weather than could be provided by *parapegmata*, Greek and Roman seafarers relied on a large body of weather and sea lore inspired by years and generations of incessant observation of winds, weather and other meteorological phenomena. This maritime lore took the form of weather rules ("if-then"), maxims, proverbs and adages, all of which were expressed as "signs" derived from patterns discernible in nature—the changing appearances of the sun, moon, and stars, and the appearance and behavior of clouds, the sea and seabirds, and more. Some were formulated from personal experience, others were in circulation among local sailors and fishermen; all were intended to help forecast the weather in order to avoid putting to sea in advance of inclement weather. The universality of weather lore is manifest in the large number of cross-cultural parallels to be found among the seafaring cultures of the ancient Mediterranean, Viking and Renaissance Europe, and as far removed in time and place as the various island cultures of Oceania.[42]

Some elements of this lore can be traced back to the Bronze Age Levant and subsequently the Archaic period,[43] but most of the signs and weather prognostications that

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[41] The Oxford *parapegma* is found in the Barocci collection in the Bodleian Library: C. Baroccianus 131, fols. 423–423v. See the edition in *CCAG* IX, 1:128–37; for text, translation and commentary, see Lehoux 2007, 164, 392–9.

[42] On Early European weather lore, see, e.g., Cortès 1992 [1561], fol. l–li and Heninger 1960. On the weather lore of Oceania, see Lewis 1994, 259.

[43] On weather prognostication in the Bronze Age, see, e.g., the *Tale of the Shipwrecked Sailor* from Middle Kingdom Egypt (Simpson 1972, 51–2): "One hundred and twenty sailors from among the best of Egypt were

appear to have originated in the Greek maritime sphere were collected in the fourth-century-B.C. works of the Peripatetics, such as Aristotle's *Meteorology*, the Aristotelian *Problemata*, and the Theophrastian works *De Signis* and *De Ventis*.[44] Aratus, as we saw above in Chapter 5, devoted a large portion of his *Phaenomena* to weather signs, advising those who entrust themselves to ships to "take care to learn all the signs that are provided anywhere of storm winds or a hurricane at sea…For often on a calm night [the seafarer] secures his ship in fear of the sea at dawn."[45] Similarly, Vegetius, as we saw in Chapter 4, advised on the importance of knowing weather signs when planning fleet movements. Roman writers in general (e.g., Vergil and the Elder Pliny) drew extensively from their Greek predecessors while making very few additions of their own. Whereas this lore lacks scientific precision, many of the individual elements contain a measure of veracity and are disposed to scientific explanation.[46]

Two examples will illustrate the point. The first involves the night sky. It was widely believed in classical antiquity that the changing appearances of the sun, moon, and stars—their brightness, dimness, color, sharpness, and even their shape—served as indicators of impending fair weather, wind, rain, and storms.[47] The apparent behavior of a star group within the zodiacal constellation of Cancer (Gr. *Karkinos*), as we saw in Chapter 5, was singled out among numerous ancient writers as such a marker of coming weather. Within this constellation, between two bright stars called the Asses (Lat. *Aselli*, Gr. *Oinoi*: γ and δ *Cancri*), is a tight cluster of stars called the Manger (Lat. *Praesaepe*, Gr. *Phatnē*). The peripatetic author of *De Signis*, followed by Aratus and Pliny, agreed that fair weather was to be

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in it. Whether they looked at the sky or whether they looked at the land, their hearts were fiercer than those of lions. They could foretell a storm wind before it came and a downpour before it happened." On Archaic Greece, see, e.g., Alcaeus fr. 249.7: "from land one should look ahead for [a fair] voyage if one can and has the skill" (*ἐκ γᾶς χρῆ προΐδην πλόον αἰ < > δύναται καὶ παλάμαν ἔχηι*).

44 On Theophrastus' *De Ventis*, see Coutant and Eichenlaub 1975. On the attribution of *De Signis*, see Cronin 1992.

45 Arat. *Phaen*. 758–60, 765–6: *Μέλοι δέ τοι, εἴ ποτε νηῒ | πιστεύεις, εὑρεῖν ὅσα που κεχρημένα κεῖται | σήματα χειμερίοις ἀνέμοις ἢ λαίλαπι πόντου…Πολλάκι γὰρ καί τίς κε γαληναίῃ ὑπὸ νυκτὶ | νῆα περιστέλλοι πεφοβημένος ἦρι θαλάσσης*.

46 On scientific explanations of traditional weather lore, see Freier 1992, 54–5.

47 Theophr. *De Ventis* 36: "The following are also common to most winds, such as the appearance and the fading or breakup of stars, moon, haloes, mock-suns, and any other such phenomenon. For what happens to the upper air foretells the nature of the winds" (*Κοινὰ δὲ καὶ τὰ τοιαῦτα πλειόνων οἷον ἀστέρων τε διᾳττόντων*

expected if this nebula (appearing throughout the night from December to late June) was clear and bright; if it grew hazy, it was a sign of impending rain; and if it disappeared altogether, of a storm.[48] Aratus and Pliny even went so far as to specify the direction of the storm's approach based on whether the northern or southern Asellus appeared hazy.[49] While it is unlikely that a modern meteorologist would endorse the latter method of forecasting, it is understood that the twinkling or scintillating of stars results from the refraction of light through an unstable atmosphere, an indicator of strengthening winds.[50] And storms may be predicted based on stellar haloes and dimming stars, both the result of an approaching thin cirrus haze that typically precedes a weather front.[51]

According to Aratus, the sun furnished more reliable signs than stars, "both when setting and when rising over the horizon."[52] For those about to embark (or for those already at sea) a glance at the morning and evening sun provided a sign of weather over the next several hours. Among our sources that span some eight centuries of antiquity were several widespread notions linking the sun with weather: a sun rising and setting bright and clear inaugurated fine weather; a fiery sun at rising and setting presaged strong winds and rain; a pale and blotchy sun rain and storm. These notions live on today in the so-called red-sky proverb. The English version reads:

> Red sky at night, sailors delight
> Red sky at morning, sailors take warning

καὶ παρηλίων φάσις καὶ ἀπομάρανσις ἢ ῥῆξις καὶ εἴ τι τοιοῦθ' ἕτερον. Πρότερον γὰρ ὁ ἀὴρ ὁ ἄνω τῷ πάσχειν ἀποδηλοῖ τὴν τῶν πνευμάτων φύσιν).

[48] [Theophr.] *De Signis* 23, 43 and 51 (see above, page 128 and n. 39); Arat. *Phaen.* 892–908, cf. 996–8 (above, page 128 and n. 40); Pliny *HN* 18.80.351–3. Cf. Theoc. *Id.* 22.21–2.

[49] Arat. *Phaen.* 905–8; Plin. *NH* 18.80.351–3.

[50] Pliny *HN* 18.80.351; Freier 1992, 54–5; Minnaert (1954, 69–70) notes that scintillation "increases with low barometric pressure, low temperature, intense humidity, strong curvature of the isobars and great change in pressure with altitude, and it is stronger when the wind is of normal strength than when the wind is either slight or very strong. It is, therefore, clear that atmospheric rest or motion depends on so many complicated factors, that, for the present, scintillation of stars could not be made use of for weather forecasts."

[51] Arat. *Phaen.* 940–2, 1013–16, Pliny *HN* 18.80.352. Traditional navigators of the Gilbert islands in Oceania also considered twinkling stars to be a sign of storm (Lewis 1994, 259).

[52] Arat. *Phaen.* 819–821.

This maxim is found in so many words in peripatetic writings, as well as those of Aratus and Pliny.[53] It is perhaps best expressed in the New Testament book of *Matthew*, where Jesus, replying to the Pharisees and Sadducees, says: "When it is evening, you say, "It will be fair weather, for the sky is red." And in the morning, "There will be stormy weather today, for the sky is overcast in red." You know how to read the face of the heavens, but can you not read the signs of the times?"[54]

Both elements of the maxim contain a core of meteorological substance. In principle, hues of sunlight reveal the composition of the atmosphere between the observer and the sun. These hues are dependant on the type of particulates (dust or moisture) in the upper strata. At dawn and dusk, when the atmosphere through which sunlight must penetrate is thickest, shorter-wavelength colors fail to penetrate and only longer wavelength colors—pinks and reds—shine through. If the light ricochets off dust and smoke, hues of pink and dark pink appear. If moisture is present in quantity, the hues grow redder. Since weather in the Mediterranean, as in the northern hemisphere in general, moves from west to east, a "red" sky in the west must refer to the dark-pink hues of a dusty but stable high pressure system that typically presages a period of fair weather.[55] At sunrise, on the other hand, if the sky is still pink, we may conclude that the high pressure system is easing out of the area, to be followed by unsettled conditions. And if the sun rises a fiery red, then wet weather is very close at hand. Of the two, the evening portion of the proverb was thought to be more reliable.[56] "They speak of a definite kind of approaching weather. The morning forecasts

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53 [Theophr.] *De Signis* 10–11, 26, 50; Arat. *Phaen.* 821–4; Verg. *G.* 1.438–53; Pliny *HN* 18.78.342–3; Veg. *Mil.* 4.41.

54 Matthew 16:2–3 (*ὁ δὲ ἀποκριθεὶς εἶπεν αὐτοῖς, "[Ὀψίας γενομένης λέγετε, Εὐδία, πυρράζει γὰρ ὁ οὐρανός· καὶ πρωΐ, Σήμερον χειμών, πυρράζει γὰρ στυγνάζων ὁ οὐρανός. τὸ μὲν πρόσωπον τοῦ οὐρανοῦ γινώσκετε διακρίνειν, τὰ δὲ σημεῖα τῶν καιρῶν οὐ δύνασθε"*]. The earliest manuscripts lack these verses, which first appear in the fifth century (see Aland et al. 1993, 60, and notes to verses 2–3). Cf. Luke 12:54–6: "He said to the crowd: 'When you see a cloud rising in the west, you say on once that a storm is coming, and so it happens; and when a south wind is blowing, you say that there will be heat, and it is so'" (*Ἔλεγεν δὲ καὶ τοῖς ὄχλοις, " Ὅταν ἴδητε ⌊τὴν⌋ νεφέλην ἀνατέλλουσαν ἐπὶ δυσμῶν, εὐθέως λέγετε ὅτι Ὄμβρος ἔρχεται, καὶ γίνεται οὕτως· καὶ ὅταν νότον πνέοντα, λέγετε ὅτι Καύσων ἔσται, καὶ γίνεται"*).

55 See Freier 1992, 32, 96; Minnaert 1954, 280–1. For an explanation of the atmospheric optics, see Meinel and Meinel 1983, 9–12.

56 [Theophr.] *De Signis* 10.

look at a departing weather and depend for their accuracy on the conditions that can be normally—but not necessarily—expected to follow it."[57]

These and numerous other elements of weather lore demonstrate an active concern on the part of Greek and Roman seafarers, particularly sailing masters, to employ the clues found in nature in order to read and predict the weather at nearly every phase of a voyage. Accuracy or error in this planning phase meant the difference between life and death.

2. Clearing the Harbor and Getting Underway

Once the ship had been cleared to leave Alexandria and the decision to sail had been reached among the sailing masters of the convoy, and permission to do so had been obtained from the harbor master,[58] then came the task of clearing the harbor and getting underway. Alexandria boasted two large harbors formed by the island of Pharos to the north of the city and the Heptastadion causeway that linked the island to the mainland.[59] The eastern harbor, known as the Grand Harbor, contained naval yards, extensive quays, docks and imports warehouses, as well as the private harbor of the royal residence on the Lochias promontory to the east. At the eastern end of the Pharos island, flanking the channel into and out of the Grand Harbor, stood the famous Pharos lighthouse. Built in the early third century B.C., the lofty octagonal, three-stage tower burned a beacon fire at the summit, which shone several miles out to sea.[60] The large but lesser-known western harbor, known to Strabo as Eunostos (Harbor of Safe Return),[61] was framed by a headland to the west, Pharos

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[57] Dolan 1988, 110; see also Humphreys 1912, 376–7 and Russell 1926.

[58] The *procurator Phari* of *POxy* 1271, 3118; *CIL* 6.8582, 10.1271; see also Strab. 2.3.5.

[59] Both Diodorus and Strabo write extended descriptions of Egypt. Strabo (Book 17), however, visited Alexandria in 24 B.C. and lived there for a time (see Fraser 1972, 1:7; 2:12–13, n. 29). Of all ancient writers he provides the most reliable and informative description of the city.

[60] For the most thorough discussion of the Pharos lighthouse, see Fraser 1972, 1:17–21 and references there. The height of the tower in antiquity is unknown, although Thiersch's (1909) reconstructions in the 120 m range (based on Arabic sources) is probably not far off the mark. According to Josephus (*BJ* 4.10.5) it was visible from the sea from 300 stadia (= 55 km or about 30 nm).

[61] The western harbor's name is given only be Strabo (17.1.6) and is of problematic origin. Early arguments either translated *Eunostos* literally as the harbor "of good return," or associated it with *Eunostos*, Ptolemy-Soter's rather insignificant son-in-law, the King of Soloi on Cyprus. Fraser (1972, 2:77–8, n. 181) draws attention to the fact that *Eunostos* was also the name of a deity or genius of ambiguous sex "who presided over the activity of millers and the grinding of corn" (here he quotes Hesychius and Eustathius, s.v.). As the western harbors

island and the Heptastadion to the east, and a long sandstone ridge in between which created two entrances. Recessed within Eunostus Harbor, or perhaps positioned astride the canal linking it with Lake Mareotis, was the artificial harbor known as Kitobos ("box").[62] Ancient sources nowhere specify from which harbor Alexandrian grain ships departed, but hints in Strabo suggest that Eunostos and Kitobos served as the main transshipments hubs, with grain unloaded from river barges (see Chapter 3) coming through Lake Mareotis via the delta river systems, or loaded directly onto grain ships bound for overseas destinations.[63]

Those merchant galleys that operated in the canals, harbors and nearshore waters in the environs of Alexandria (such as the *akatoi* discussed in Chapter 3) would have had little trouble in maintaining the speed and maneuverability required to navigate these complex waterways. The large grain ships that relied solely on sail for propulsion, on the other hand, were too large and clumsy in confined waters to maneuver safely under their own power. Therefore, major Roman harbors employed tugboat services and guilds to handle the necessary task of organizing the arrivals, departures, berthing and unberthing of these large ships, and each freighter had at least one small boat and a dedicated crew to tow or push the ship into and out of berths and through confined waters (see above, page 57). Once clear of coastal obstructions the crew set the small boat under tow astern (with one or more watchmen embarked[64]), then turned to loosening the mainsail, a task that required great exertion on the part of several sailors aloft in the rigging and on deck. As the main canvas grew taut the ship crept forward under its own power, through the channel and into the open sea. Philostratus' description of a large, three-masted freighter departing Smyrna's

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were linked with the interior—whence came barges loaded with grain each season—"it is not impossible that this harbour was regarded as pre-eminently the 'corn Harbour', and thence called after the patron of millers." As the western harbor was almost certainly the destination harbor of the grain fleet returning from Italy, it is not improbable that the name embodied both ideas.

62 Strab. 17.1.6.

63 See above, n. 61. Cf. also Strab. 17.1.7.

64 Petronius, *Sat.* 102.5: "one of the crew is stationed in the skiff continually night and day" (*unum nautam stationis perpetuae interdiu noctuque iacere in scapha*); but cf. Cicero's hypothetical legal argument in *Inv. rhet.* 2.154: "[a] storm began to toss them also about violently, to such a degree that the ship's master, who was also the sailing master, got into the ship's boat, and from that he guided the ship as well as he could by the rope by which the boat was fastened to the ship, and so towed along" (*Tempestas iactare coepit usque adeo ut dominus navis, cum idem gubernator esset, in scapham confugeret et inde funiculo, qui a puppi religatus scapham annexam trahebat, navi, quoad posset, moderaretur*). The ship's boat in this case may or may not have been manned before the master embarked on it.

harbor describes a typical sendoff of a large merchant vessel: "Now look at that ship's crew, how some who are rowers have embarked in the tug-boats, while others are winding up and securing the anchors, and others again are spreading the sails to the wind, and others are keeping a lookout at bow and stern."[65]

Once the ship cleared the harbor the sailing master would have tried to set a course to the northeast that would take them toward Cyprus, the route marker that signaled a turn westward toward the southern coast of Asia Minor (see above, pages 78–9). A dawn departure from Eunostos would likely have been accompanied by weak onshore winds in the vicinity of the coast, making the first few hours (perhaps days) slow and tedious, with reaches of short duration designed to gain more sea room.[66] These were undoubtedly the "weak winds" under which Lucian's *Isis* departed Alexandria.[67] The Pharos lighthouse and the rising sun would have provided expedient references on the horizon for nearly the entire day as the ship of the convoy made slow progress northeastward along the coast, past the Zephyrium promontory at the Canopic mouth (with its tower), then past the last point of land at Agnou Keras where there stood the so-called watchtower of Perseus.[68]

Before this point, the sailing master would have established a system of regular watches for the helm and prow, along with a deduced reckoning of their progress based on wind strength, direction and a sense of the ship's speed through the water (see above, pages 60–4). As the day wore on and the prevailing northwesterlies and westerlies strengthened, the ship would have been placed on a port tack on a general northeasterly course over the open sea. The Pharos lighthouse and the coast of the delta would have eventually fallen out of sight, and variations in the swell and wind stream would have spread out the convoy. By

[65] Philostr. *V A* 4.9: *"ὁρᾶτε…τὸν τῆς νεὼς δῆμον, ὡς οἱ μὲν τὰς ἐφολκίδας ἐμβεβήκασιν ἐρετικοὶ ὄντες, οἱ δ' ἀγκύρας ἀνιμῶσί τε καὶ ἀναρτῶσιν, οἱ δὲ ὑπέχουσι τὰ ἱστία τῷ ἀνέμῳ, οἱ δὲ ἐκ πρύμνης τε καὶ πρῴρας προορῶσιν."*

[66] On attempts to gain as much sea room as possible before contrary winds began blowing, see Syn. *Ep.* 4.41–54 (Appendix C). See also Rutilius Namatianus, *De Reditu Suo* 1.277–9.

[67] Lucian, *Navigium* 7 (Appendix B): *οὐ πάνυ βιαίῳ πνεύματι.*

[68] Hdt. 2.15; Eur. *Hel.* 769; Strab. 17.1.18; cf. Diod. Sic. 1.33.8. The exact position of this tower remains unknown. Strabo places it near or adjacent to Agnou Keras at the Bolbitinnic mouth of the Nile (modern Rosetta), just to the east of Canopus (see Talbert 2000, 74, 2C). It would have provided a convenient jump-off point for ships leaving the delta for points north and east. On the name and its relation to Perseus, see Sauneron 1966, 191 n. 3.

nightfall, as each ship pressed northward, the steersmen of each ship attempted to track the others in the convoy by the dim light of each ship's lamp.[69]

3. Northward to Cyprus

This already time-worn corridor between the delta and Cyprus is nearly 230 nm in length, with winds from the western quarter governing most of the area throughout the spring, summer and autumn months (fig. 7.1).[70] The practical strategy for large sailing vessels from Alexandria was to move northward toward Cyprus while maintaining a safe distance from the Levantine coast to starboard, especially as the roving lows that periodically strike from the west in spring made the entire coast of the Levant a dangerous lee shore (see fig. 2.11).

The rate of progress on this first leg depended primarily on the strength, constancy and precise origin of the westerly winds, and the ship's ability to hold a northerly heading under these conditions. With the west-northwest and northwest winds that predominate in this area, a square-rigged ship could probably hold a north-northeast course, and this is indeed the course that Lucian's *Isis* managed (at an average speed of 2 kt) before sighting Cape Akamas (modern Cape Arnauti) off western Cyprus.[71] Detecting and adjusting the course for changes in the wind on this long course, however, required years of experience. Expert sailors and sailing masters would have been able to sense changes in the wind by its play on wind tell-tales, on the trim of the sails, the position of the yards and interruptions in the usual rhythmic roll and spray of the ship in the swell (see above, pages 109–10, 114–15). The position of the sun at dawn and dusk would have helped reorient the crew probably to within one segment of the twelve-wind rose, and common experience would have taught seasoned crew members to maintain the north celestial pole and the Bears just off the port bow during the hours of darkness (see above, pages 141–2). Simple measurements of the pole by dactyls each night would have shown it rising incrementally as the ship made

[69] On lighting aboard Greek and Roman vessels, see Casson 1995, 248.
[70] *CRMS*, 121, 147, 173, 199, 225.
[71] Casson 1950, 45–6.

progress northward: on this particular passage the pole would rise some 3°, or a little less than 2 finger widths, by the time Cyprus was sighted (see above, page 146). The star Canopus to the south, whose culmination could also be used to gauge northing and southing, was visible at night only during the depths of winter, from December to March (see above, pages 143–4, 147).

There were several tangible hazards associated with this leg, including the possibility of collision with ships utilizing the same maritime corridor, and of occasional lulls in the wind which would keep the ship at sea longer than planned.[72] The greatest danger, however, came in the form of roving depressions, which, as we saw in Chapter 2, track eastward across the Mediterranean from the west and can wreak havoc on all shipping in the region. It was off western Cyprus, for example, that Lucian's *Isis* was struck by a strong westerly wind that drove the ship as far as Sidon, after which the crew must have attempted to maneuver northward along the leeward coast of eastern Cyprus before rounding Cape Kleides (modern Cape Andreas) and heading west through the Cilician Strait (see Appendix B).

Eventually, after several days and nights at sea, the crew would have either sighted Cyprus or detected its presence on the horizon by the pillar of clouds that often hangs over its taller peaks (see above, page 42). Upon closer approach, the sailing master and lookouts could detect the extent of the island and make for its western end at Cape Akamas, which juts northwestward and points directly to the Chelidoniae isles off the coast of Asia Minor.[73] Unless the ship had business in Curium or Paphos, it probably continued past these seaports without stopping.

4. From Cyprus to the Gates of the Aegean

Upon reaching the waters off northwest Cyprus, the ship entered a completely different navigational environment (fig. 7.2). Whereas on the open sea between the Nile

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[72] The experimental ship *Kyrenia II* (see above, pages 60–2, 203), on its experimental voyage from Cyprus to Piraeus during the month of April, 1987, encountered a prolonged lull and completely calm seas off Cyprus on the leg to Rhodes (Cariolou 1997, 86). As a result the ship "had to be towed to Paphos!" On a merchant ship becalmed in the open water off Cyprus, see Plut. *Quest. Graec.* 54.
[73] For coastal profiles of Cape Andreas and Cape Gelidonya, see *Med Pilot* V, 296–9.

Delta and Cyprus the chief hazards consisted of westerly gales and difficulties in orientation for course maintenance, now with Cyprus falling away astern there loomed in the near distance ahead a large wall of coastal mountains, recessed shores and jutting headlands. Arriving in nearshore waters each ship would have skirted westward along this stretch of coast toward Rhodes, the gateway of the Aegean. As the convoy broke up further to permit each ship some measure of sailing room, the sailing master and *proreus* of each ship drew from their collective fund of experience and local knowledge to identify their relative position along the coast, all the while mentally updating and storing (and possibly physically noting) relevant information that would prove useful for the next voyage (see above, pages 190–2).

The basic strategy on this second leg of the voyage was to maneuver the ship in the lee of this lengthy curtain range, where it would be protected from the strong and persistent northwesterly etesian winds which spill outward from the Aegean corridor and onto the Eastern Mediterranean, and to employ milder coastal winds and current to make effective headway.[74] As we saw in Chapter 2, the diurnal winds of the coast consist of onshore and offshore winds that shift in response to the track of the sun across the sky and are felt often no more than 15 or 20 nm offshore. During the fairer months along the Pamphylian, Lycian and Carian coasts, onshore winds from the southerly quarter govern in the morning and afternoon, then shift offshore as northerlies in the late afternoon and evening.[75] These conditions permitted sailing ships to push westward with the current on a prolonged series of tacks lasting from a half to a full day.[76]

The greatest hazard for this leg of the voyage was the ever-present danger of striking the rocky coast to starboard while shifting tacks near shore—as the dozens of ancient shipwrecks so far discovered in this area attest.[77] The danger that was heightened especially

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[74] On employing land breezes along this coast to sail westward, see Smith 1848, 28–9.

[75] *Med Pilot* V, 37.

[76] On the behavior of currents along this coast, see Beaufort 1818, 41–3; Smith 1848, 28–9; *Med Pilot* V, 171–4. The same wind conditions permitted ships to sail eastward along this coast, and so there must have been very real dangers of night-time collisions, as Pliny mentions (*NH* 2.48.128): "a navigator by slacking sheets can move in contrary directions in the same winds, so that vessels collide often at night when sailing on opposite tacks" (*Iisdem autem ventis in contrarium navigator prolatis pedibus, ut noctu plerumque adversa vela concurrant*).

[77] On ancient wrecks along the southern shore of Turkey, see Parker 1992, Map 1 (woefully outdated). In the author's personal experience of sailing this coast in the summer of 1997, strong winds at one point jammed the

at night. These were moments when the crew was on edge as they listened for the break of the surf,[78] noticed the smells of land, strained to sight coastal silhouettes against the backdrop of stars and searched for lighted structures on shore.[79] The crew of Lucian's *Isis*, arriving at night in a storm off the Chelidoniae isles in Lycia, sensed the terrifying signs of a rapidly advancing coast (loud surf), but turned away in time after sighting lights on shore (see Appendix B).[80] In moments of great doubt, when an assessment of the ship's proximity to land was paramount, the sailing master could also have ordered soundings to be taken with a lead line.[81]

Some of the grain ships bound for Rome and the Aegean made stops at some of the harbor towns along this stretch of coast, such as Myra, Patara and Rhodes.[82] Passengers from Alexandria disembarked. Locals booked passage to Rome. The crew topped up stores of food and fresh water and made necessary repairs. The *naukleroi* who traveled with the ship may have engaged in minor trade or commerce.[83] The Adramyttian ship that Paul boarded at Caesarea in A.D. 62 , for example, stopped at Myra (or at its port of Andriaki) and there he transferred to an Alexandrian grain ship "bound for Italy."[84] This ship probably shaped a course from Alexandria similar to that intended by Lucian's *Isis*—to Myra by way of Akamas.[85]

5. From Asia Minor to Crete

Whether the ship stopped in Myra, Patara, Rhodes or Cnidus, the third leg would take it out of the wind shadow of southern Asia Minor and southwestward toward the eastern and southern coast of Crete (another wind shadow area), nearly 100 nm away (fig.

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spinnaker, prevented a timely tack and brought the boat dangerously close to a coastal cliff. Only the cool action of the captain, who went below and turned on the engine, averted disaster.

[78] See Arat. *Phaen.* 909–11.

[79] On the varying amounts of lamp and torch light that cities produced at night, see Forbes 1966, 169–71.

[80] Mela (2.102) describes these islands as directly opposite the spur of the Taurus Range—"unluckily for those sailing by."

[81] On the use of the sounding lead in antiquity, see Oleson 2008.

[82] On Alexandrian grain ships stopping at Rhodes, see Cic. *Off.* 3.50 and Jos. *BJ* 1.280.

[83] As the *Nomos Rhodiōn Nautikos* suggests (see Ashburner 1909, 113).

[84] *Acts of the Apostles* 27.5–6 (Appendix A).

7.3). In this maritime corridor, flanked by Rhodes, Telos, Karpathos and Kasos, the ship would have felt the full brunt of the westerly and northwesterly winds that exit the southeast Aegean (see fig. 2.10). Paul's ship out of Myra, for example, maneuvered against contrary winds (probably strong westerlies) as far as Cnidus, but managed to bridge the windward passage with no reported problems and arrived off the northeast tip of Crete.[86] Lucian's *Isis*, on the other hand, having encountered a stormy early- or late-season southwest wind (*Lips* and *Notos*) in this area, was forced into the Aegean, whereupon the sailing master decided to put in to Piraeus for the winter;[87] as one of Lucian's protagonists relates, however, "They should have kept Crete to starboard, sailing beyond Malea so as to be in Italy by now."[88]

Those ships (like Paul's) that kept to the windward side of the island chain sailed with winds on the starboard beam or quarter (an optimal position), but nevertheless had to avoid being driven onto rocky coasts, or in high winds take emergency measures to maneuver through and around the islands to their leeward sides until the winds slackened.[89] The windward maritime corridor was also home to several low-lying rocky islets (e.g., Stakidha and Ouniarisia) which would have been undetectable during a night passage and offered virtually no haven from strong winds on their leeward sides (see above, page 42). We may surmise that only experienced sailing masters would have developed maneuvering strategies to avoid these hazards.

The ships that took the outer, leeward passage to the southeast of Karpathos and Kasos were exposed to the channel winds that undergo severe intensification as they funnel

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[85] Casson 1950, 46 n. 5.

[86] *Acts of the Apostles* 27.6–7 (Appendix A).

[87] Lucian, *Navigium* 9 (Appendix B). On strong southwesterly winds near Rhodes, cf. Theophr. *De Ventis* 53: "…like Argestes and Lips, which they employ especially around Cnidus and Rhodes, "Lips makes clouds quickly and makes fair weather quickly, and every cloud follows Argestes"" (*ὥσπερ τοῦ ἀργέστου καὶ λιβὸς, ᾗ χρῶνται μάλιστα περὶ Κνίδον καὶ Ῥόδον, 'λὶψ ἄνεμος ταχὺ μὲν νεφέλας ταχὺ δ' αἴθρια ποιεῖ, ἀργέστῃ δ' ἀνέμῳ πᾶσ' ἕπεται νεφέλη'*). Lucian's *Isis* certainly was not "forced to dock in the Peiraeus," as Hirschfeld (1990, 26) asserts: the greater half of the Aegean archipelago lies between Rhodes and the Saronic Gulf. *Isis*' owner and crew decided to winter there since they could not sail past Crete on the way to Italy. The deep and well-protected harbor of the Piraeus, we may presume, may have been the draw, as well as the setting of Lucian's satirical dialogue.

[88] Lucian, *Navigium* 9 (Appendix B).

[89] There was no guarantee of shelter in the lee of these islands, even in summer. As Heikell (1998, 439) notes, "during the *meltemi* season strong gusts blow off the S and E sides of Kasos and Karpathos. Large and disturbed seas will be encountered in Stenon Kasou (Kasos Strait) between Kasos and Crete and especially in Stenon Karpathou (Karpathos Strait) near the southern tip of Rhodes."

between these lofty islands (see above, page 35).[90] If their crews were unprepared for rapidly shortening sail while crossing these channels, they faced the possibility of being driven across the Eastern Mediterranean toward the original point of origin, Alexandria and the Nile Delta. Indeed, as Rougé points out, it was because sparsely populated Karpathos (Homer's "windy Karpathos") sits astride the natural wind corridor between the Aegean and Egypt that these waters were called the Karpathian Sea by numerous ancient authors.[91]

The large island of Crete with its perennially cloud-capped peaks, a conspicuous landfall target on approach from any direction, marked the approximate mid-point of this arduous journey. The closest calm waters on this windward passage were to be found at Cape Sidero, ancient Salmone, which projects northeastward into the Aegean. The cape was well-known in the maritime geography of antiquity, finding mention in the *Argonautica* tale and serving as a route marker for ships heading to Egypt from the Aegean.[92] The sailing master of Paul's ship sought shelter in its lee after making the windward passage.[93]

The next destination was Crete's southern coast, a lofty (and comparably harborless) wall of rock that stretched east to west for most of its 135 nm, ending at the Kriou Metopon promontory (modern Cape Krio) at the southwestern end of the island. Here in the wind shadow the grain ships could employ land and sea breezes, much as they did under Asia Minor, to tack and wear their way to the western end of the island, a process that could take as long as a week. Crete's winds, however, had an added element of danger. In Asia Minor, the high elevation of the coastal range continued deep into the interior, a factor which had a tempering effect on winds near shore. Crete, however, like Karpathos, sat athwart one of the Mediterranean's major wind streams. The Aegean's northerlies and etesians that strike the northern face of the island ascend to the peaks, cause intense turbulence and cloud

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90 Semple's argument (1931, 630) that ancient ships sailed along the leeward sides of these islands on their way to Cape Salmone to escape the north wind is unconvincing. Her citation of Ap. Rhod. *Argon.* 4.169 (really 4.1693) does little to bolster her claim, although Morton (2001, 78 n. 14) concurred.

91 Rougé 1963, 256–61. On "windy Karpathos" (*Κάρπαθος ἠνεμόεσσα*), see *Hom. Hymn Ap.* 1.43. Cf. *Gr. Anth.* 6.245.

92 Ap. Rhod. *Argon.* 4.1693; Strab. 10.4.5: "The voyage from Samonium to Egypt requires four days and nights, though some say three" (*ἀπὸ δὲ τοῦ Σαμωνίου πρὸς Αἴγυπτον τεττάρων ἡμερῶν καὶ νυκτῶν πλοῦς, οἱ δὲ τριῶν φασι*). The *Stadiasmus Maris Magni* (318), at the beginning of its section on Crete, begins with the distance between Kasos and Sa(l)monion (300 stades), and mentions a temple of Athena on or near the cape (see Sanders 1982, 138).

93 *Acts of the Apostles* 27.7 (see Appendix A).

formation, then fall down the southern slopes and onto the sea as violent downdrafts and squalls. Those ships that transited along this coast in the fair months of spring and early summer were more likely to avoid them, but from July through October the effects of strong etesian winds on the windward face had severe consequences for maritime traffic along the south coast. Paul's ship encountered one of these violent winds in October, a *Eurakylōn* or east-northeast wind (see above, pages 102–3 and below, Appendix A), which drove them southwest toward the island of Kaudos, then across the Ionian to Malta.

The safest sea areas to avoid these katabatic winds were near shore, but hugging the coast entailed more frequent tacks, and therefore slower rates of progress. These conditions, combined with a relative lack of harbors, safe havens and larger port cities, made this coast and leg particularly difficult. It is with little wonder that the *naukleros* and *kybernētēs* of Paul's ship, both of whom were responsible for the large vessel and its valuable cargo, not to mention a multitude of passengers, were apprehensive at the thought of spending a winter at the isolated site of Kaloi Limenai, east of Matalon. In truth, their options were very limited.

6. Crossing the Ionian

Kriou Metopon, like Salmone at Crete's eastern end, was crystallized in the maritime consciousness of antiquity.[94] It served as a critical node in a multitude of pathways that stretched in all directions over the open main. For ships heading west from Crete over the Ionian Sea toward Malta or Sicily (440 and 410 nm away, respectively), it was a point of no return, and for this reason the headland and the cluster of small ports to the east of it (Syla, Lissos, Kalamyde and Biennos) probably also served as a regrouping point for the convoy that may have become staggered since leaving Alexandria (figs. 7.3 and 7.4).[95] Ahead lay a large expanse of sea requiring weeks to cross, with no islands to serve as guides or to offer

[94] See, e.g., Strab. 10.4.5: "The voyage from Cyrene to Kriou Metapon takes two days and two nights… Eratosthenes says that the distance from Cyrene to Kriou Metapon is two thousand [stadia]" (*Ἔστι δ' ἀπὸ τῆς Κυρηναίας ἐπὶ τὸ Κριοῦ μέτωπον δυεῖν ἡμερῶν καὶ νυκτῶν πλοῦς…Ἐρατοσθένης δ' ἀπὸ μὲν τῆς Κυρηναίας μέχρι Κριοῦ μετώπου δισχιλίους φησίν*).

[95] Strabo (8.5.1) gives the distance from Tainaron (at the southern tip of the Peloponnese (northwest of Kriou Metapon) to Pachynum promontory as 4,600, "though some say 4,000." In reality it is nearly 400 nm (on the

haven from inclement weather. It required every skill that the ship's sailing master and crew possessed to make a safe and efficient crossing.

The most important consideration at this point was how to maneuver the ship with respect to the winds in order to make an accurate landfall. Malta, a small target island, lies nearly due west, and the large island of Sicily lies west-northwest. Together they occupy only about 20° (or 5%) of the horizon (between 276° and 295°) as viewed from the western end of Crete. There are no prevailing easterly winds such as a *Subsolanus* or *Vulturnus* to push ships toward these destinations, and southerlies are fairly rare. Instead, westerly and northwesterly winds (equivalent to *Favonius*, *Corus* and *Thrascias*; see Table 4.1) overwhelmingly predominate over the entire Ionian basin from May to October, a window of time that corresponded with Alexandrian ship traffic across this sea area. In other words, their destinations lay directly upwind and therefore required sailing masters to develop strategies to make way toward their destination without being blown to Africa or through the Strait of Sicily. The ideal strategy under prevailing conditions called for a series of long starboard tacks to the southwest, toward the African shore, followed by shorter tacks to the northeast,[96] all the while holding the head as close as possible into the wind on both tacks so as not to arrive south (and therefore downwind) of Malta and southern Sicily (see above, pages 60–1 and 102). These long, slow and tedious tacks would have doubled, and perhaps even trebled, the straight-line distance—that is, unless ships encountered the occasional but propitious scirocco blowing off the North African coast (see above, pages 38–9).

The effectiveness of making multiple tacks spanning great distances over the course of several days and even weeks depended primarily on the sailing master's overall sense of the axis of movement between Crete and Malta/Sicily. Orientation with respect to this axis was a constant concern, and one that could be achieved most effectively by reference to the setting sun (which on this leg happens to set directly over Sicily), the steadiness and strength of the predominantly northwesterly winds and the visibility of the stars at night. As we saw in Chapter 5 (pages 153–4 and fig. 5.7), the leg from Crete to Malta/Sicily is conveniently

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conversion from stades to nm, see above, pages 62–3 and n. 56). The accuracy of the distance implies a well-trafficked route across the Ionian. On the Greek cities along this coast, see Sanders 1982, 170–2.

[96] As Casson (1950, 49–50) deduced.

marked out by the ecliptic and its rotating band of zodiacal constellations. These would have provided the most convenient benchmark by which to judge course offsets while making short and long tacks.

After several days at sea the sailing master and lookouts would have maintained a keen watch for sighting land on the horizon and the other ships that populated this corridor. If the long crossing went smoothly, then recognizing the first point of land would have been relatively effortless. In times of fair visibility, the relatively small and low-lying islands of Malta, composed of Melita, Gozo and Camino (see above, pages 23 and 45–50), are easily distinguishable from the long and lofty coast of Sicily with its mountainous interior. In the case of landfall at Malta, seasoned sailing masters would have been able to discern at what angle the ship was approaching the small island group and make course adjustments accordingly toward one of its several good harbors.

If the ship arrived in the waters off the Sicilian coast somewhere north of the Pachynum promontory, the excellent haven and harbor of Syracuse lay less than 30 nm northward along the coast, with the towering peak of Aetna commanding the horizon during times of good visibility. This is the harbor at which Paul's third ship to Rome, an Alexandrian clipper called the *Dioskouroi*, put in after departing from its winter sojourn in Malta.[97]

7. Storm Sailing

Ships participating in both the spring and the late summer sailings from Alexandria (April/May and September/October) faced the strong likelihood of encountering storms of various severity at some point en route to the Tyrrhenian Sea, particularly while crossing the wide Ionian Sea. Most of the stormy weather, as we discussed above and in Chapter 2, is attributable to the roving depressions that track eastward through the Mediterranean region throughout late autumn, winter and spring, bringing with them varying degrees of rain, violent winds and dangerously high seas. These storms, as we saw above, provided many obvious signs of their approach, but if they remained undetected until too late then the sailing master was faced with developing emergency strategies to bring the ship through safely.

Essentially there were two choices to make upon first detecting the onset of foul weather—to seek haven or to commit to completing the leg. The decision would not have been reached hastily, but would have been informed by local knowledge and practical geographical and meteorological circumstances.[98] If the ship was close to a coast or island, then seeking a sheltered lee to ride out the storm at anchor would have been attractive. As we saw in Chapter 2, the northern coast of the Mediterranean abounds in headlands and islands behind which shelter could be sought if time and winds allowed. Many offered adequate protection and anchor holding ground for ships, but some areas were insufficient in the face of exceptionally violent storms. Paul's ship was probably safe for wintering at the eponymous Kaloi Limenai in southern Crete, for example, but after setting off from there to edge farther west toward more suitable winter accommodations they encountered a fierce northeasterly wind coming off the mountains. The sailing master was forced to seek the lee of Kaudos, a small island due south of Crete's White Mountains.[99] Here the crew managed to haul in the skiff they were towing astern and undergird the ship for rough weather (see below), but the winds continued to bear the ship into the Libyan Sea toward Cyrene and Syrtis Maior. In a similar story told over three centuries later by Paulinus of Nola, a fleet (*commeatus*, *classis*) of grain ships seeking haven from a winter storm off Sardinia was all broken up on shore except one. The crew of this ship managed to throw out several anchors in the lee of a small island called Pulvini (location unknown), but soon high winds caused its cables to part and the crew abandoned ship. They crowded into their small boat (*lembulus*), but in their haste left the elderly bilge-man (*sentinator*) behind in the hold. The boat and its

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97 *Acts of the Apostles* 28.11 (Appendix A).

98 Crucial navigation decisions, at least in the Roman period, appear to have been made by a committee composed of the sailing master, the ship's master and possibly a selection of merchants who happen to be traveling with their cargo. For jurisprudential aspects of this committee in Late Antiquity and the Early Byzantine period, see Ashburner 1909, cxli–cxlii, cxxxi; cf. *Acts of the Apostles* 27.9–12, esp. 12 (Appendix A), where the "majority" (οἱ πλείονες—meaning the *kybernētēs*, the *nauklēros* and, in this case, the centurion guarding Paul) were in favor of putting to sea from Kaloi Limenai on Crete.

99 *Acts of the Apostles* 27.16 (Appendix A).

sailors perished on the rocks, while the ship and its lone crew-member by some miracle managed to clear the coast and drift on the open sea for several days.[100]

If the ship had passed a point of no return and was compelled to ride out the storm at sea, then the immediate priority of the sailing master and his crew was to ensure there was sufficient sea room for maneuvering before the wind and at the same time to rig the ship for heavy seas.[101] Taking these fundamental actions helped to ensure a successful voyage with minimal damage or loss of gear and cargo, and most importantly, a minimal loss of life. The ancient voyage and storm narratives outline most of the basic steps:

- Stow loose tackle and tools, and clear the decks of unnecessary gear.[102]
- Shut and secure cabin doors and cargo hatches to prevent swamping.[103]
- Haul in and secure the ship's boat, if possible.[104]
- Lower the yard to drop the ship's center of gravity.[105]

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[100] Paulinus of Nola, *Ep.* 49.1–3, 12. The circumstances of the large ship that Paulinus described recalls Suetonius' description (*Gal.* 10.4) of a crewless Alexandrian ship laden with weapons arriving off Dertosa in April of A.D. 68. It was heralded as a favorable sign in Galba's bid to overthrow Nero, but it may simply have been a ship abandoned in a storm (off Sardinia?) by its crew and driven along by wind and wave to the Spanish shore. In this light Morgan's assertion (2004, 312–14) that the ship departed Rome for Alexandria laden with arms for Nero's planned eastern adventure but was "caught in an unexpected storm off the Italian coast…abandoned by its crew and…carried westward to Dertosa" makes good sense.

[101] See Amarantus' comment to the same effect: Syn. *Ep.* 4.73–9 (Appendix C).

[102] Xen. *Oec.* 8.15–16: "I saw this man closely examining at his leisure all the things that are required for us aboard a ship. I was surprised to seem looking over them and asked what he was doing. "Sir," he said, "I am looking at how all the ship's gear is stowed in the ship in case there is some bad circumstance, or whether something is missing or clumsily put away. For there is no time for it when the god makes a storm at sea, neither to search for what's needed, nor to give it a sloppy fix. For the god threatens and punishes fools. You are altogether lucky if he refrains from destroying the innocent. And if he saves those who serve well aboard ship, there is much thanks to give to the gods." So having seen the tidiness of the ship's gear I said to my wife "considering that those aboard merchant vessels, even though they are small, discover a place for things and maintain order, though tossed violently about, and find what they want to get, though overcome with fear""" (*εἶδον…ἐξετάζοντα τοῦτον αὐτὸν ἐν τῇ σχολῇ πάντα ὁπόσοις ἄρα δεῖ ἐν τῷ πλοίῳ χρῆσθαι. θαυμάσας δέ, ἔφη, τὴν ἐπίσκεψιν αὐτοῦ ἠρόμην τί πράττοι. ὁ δ' εἶπεν· Ἐπισκοπῶ, ἔφη, ὦ ξένε, εἴ τι συμβαίνοι γίγνεσθαι, πῶς κεῖται, ἔφη, τὰ ἐν τῇ νηί, ἢ εἴ τι ἀποστατεῖ ἢ εἰ δυστραπέλως τι σύγκειται. οὐ γάρ, ἔφη, ἐγχωρεῖ, ὅταν χειμάζῃ ὁ θεὸς ἐν τῇ θαλάττῃ, οὔτε μαστεύειν ὅτου ἂν δέῃ οὔτε δυστραπέλως ἔχον διδόναι. ἀπειλεῖ γὰρ ὁ θεὸς καὶ κολάζει τοὺς βλᾶκας. ἐὰν δὲ μόνον μὴ ἀπολέσῃ τοὺς μὴ ἁμαρτάνοντας, πάνυ ἀγαπητόν· ἐὰν δὲ καὶ πάνυ καλῶς ὑπηρετοῦντας σῴζῃ, πολλὴ χάρις, ἔφη, τοῖς θεοῖς. ἐγὼ οὖν κατιδὼν ταύτην τὴν ἀκρίβειαν τῆς κατασκευῆς ἔλεγον τῇ γυναικὶ ὅτι πάνυ ἂν ἡμῶν εἴη βλακικόν, εἰ οἱ μὲν ἐν τοῖς πλοίοις καὶ μικροῖς οὖσι χώρας εὑρίσκουσι, καὶ σαλεύοντες ἰσχυρῶς ὅμως σῴζουσι τὴν τάξιν, καὶ ὑπερφοβούμενοι ὅμως εὑρίσκουσι τὸ δέον λαμβάνειν*).

[103] The upper elements of ships including decks, hatches and cabins never survive in the archaeological record, and therefore next to nothing is known about their dimensions or architecture.

[104] *Acts of the Apostles* 27.16–17 (Appendix A).

- Shorten the sail(s) or replace the mainsail with a smaller *nothos* ("bastard") sail to maintain headway.[106]
- Brace the hull with cables running athwartship in order to keep planking seams tight in harsh seas, especially on older vessels.[107]
- Keep up with pumping and bailing the bilges to prevent the cargo of grain from becoming damp and the ship from sitting too low in the water.[108]

If the storm was especially severe, and the conditions on aboard were deteriorating, then the sailing master and crew were compelled to act further to avert a crisis and save their own and their passengers' lives. At this stage waves and swells would have been breaking over the rails rendering the deck continually awash. Most of the water would have run off through the scuppers, but significant quantities would have leaked into the hold through hatch coamings and in the seams of the deck planks. Myriad small leaks in the plank seams

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105 *Acts of the Apostles* 27.17 (Appendix A). Many translators take *χαλάσαντες τὸ σκεῦος* to mean "lowering the sea-anchor," a device used in later times to keep the ship's head pointed downwind and down-current in heavy sea states, thus preventing broaching or tipping (see, e.g., the *Revised English Bible* and the *New International Version* and Meijer 2000, 127–8). *Χαλάω*, however, conveys the sense of slackening, loosening or unstringing (e.g., a bow), and in Greek nautical contexts, *σκεῦος* typically means equipment, gear or naval stores and does not typically include anchors (see *LSJ*, s.v.). Here "gear" in the sense of yard, the mainsail lashed to it and the fair-weather topsail (*supparum*) is most likely meant. Lowering these components was critical for preventing the mast from cracking and for deploying a storm sail at a level closer to the deck (see note below) for maintaining steerageway. Cf. the King James version, "strake sail…" and the discussion in Smith 1848, 68–72.

106 Synesius (*Ep.* 4.164–5; Appendix C) described how he and the passengers "were not able to exchange the sail for a "bastard" sail, since [the captain] had pawned it off" (*ὑπαλλάττειν μὲν οὖν ἱστίον ἕτερον νόθον οὐκ εἴχομεν, ἠνεχυρίαστο γάρ*).

107 *Acts of the Apostles* 27.17 (Appendix A): "they used cables for undergirding the ship" (*βοηθείαις ἐχρῶντο ὑποζωννύντες τὸ πλοῖον*); Syn. *Ep.* 4.198: "and we thought of tightening the ship [with ropes]" (*καὶ ἡμεῖς ᾠόμεθα προτονίζειν τὴν ναῦν*). On the routine undergirding of sailing ships prior to storms before the advent of steel hulls, see Smith 1848, 65–7. Hirschfeld (1990, 26–7) misreads how and why *hypozomata* were used aboard commercial vessels (see the basic sense of *ὑποζώννυμι* in *LSJ*, s.v.). Long, narrow warships employed these long cables longitudinally to prevent the stresses of hogging and sagging in moderate and heavy seas. Commercial vessels rigged them around the hull laterally to prevent plank joinery from splitting and seams from opening as a result of the twisting and flexing of the hull in exceptionally harsh sea states.

108 Cf. *Nomos Rhodiōn Nautikos* 38 (= Ashburner 1909, 32–3, 112): "If a ship loaded with corn is caught in a squall, let the ship's master provide skins [for protection from water] and the sailors bale the water. If they are negligent and the cargo is wetted by bilge water, let the sailors pay the penalty" (*ἐάν πλοῖον πεφορτωμένον σῖτον ἐν ζάλῃ καταληφθῇ, ὁ ναύκληρος διφθέρας παρεχέτω καὶ οἱ νάῦται ἀντλείτωσαν. Εἰ δὲ ἀμελήσωσι καὶ βραχῇ ὁ φόρτος ἐκ τῆς ἀντλίας, οἱ ναῦται ζημιούσθωσαν*). Cf. the *sentinator* in the grain ship, above, n. 100. When grain gets wet it swells easily to double its size, thereby posing a danger to the integrity of a ship's hull. Hatches on grain ships must therefore have been watertight or water resistant, and the grain must have been

of the hull caused by the ship's constant flexing and twisting in the swells would have further added to the volume of the water in the bilge.[109] The main concern was to slow the leakage of water into the hold as much as possible to prevent the ship from deepening its draft and compounding the problem. As dewatering with force or chain pumps became more and more ineffective, the only solution was for the crew and passengers to jettison part or all of the cargo. On Paul's voyage, Luke says that they "lightened the ship by throwing out the grain into the sea" (*ekouphizon to ploion ekballomenoi ton siton eis tēn thalassan*), but there were other words to describe the jettisoning of cargo—to put overboard (*ekthesthai*), to defreight or unload (*apophortisasthai*), or to lighten the ship (*epilaphrunai*).[110] Later Roman and Byzantine legal codes formalized the practice. The *Rhodian Sea-Law* stipules that "if a ship's master is deliberating about jettison, let him ask the passengers who have goods on board; and let them vote on what is to be done."[111] It then proceeds to place a valuation on different goods that are thrown overboard according to rank among crew, merchants and passengers, to be recorded by someone for legal redress at a later date. Presumably these considerations were worked out well ahead of time to avoid time-wasting deliberations during a storm, with contingencies probably formulated by the ship's master and the merchants during the loading phase in port prior to getting underway.

The mast could also fall victim to jettison, either because it de-socketed itself with the rolling, yawing and heaving of the ship in rough seas and high winds,[112] or because the

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stored well above the level of the bilge, perhaps in sacks and further protected by waterproof skins (see Rickman 1980, 265–6).

[109] As wrecks of these larger Roman grain ships have yet to be found in the archaeological record, we can only speculate that their hulls would have been double-planked, much like the large wine-carrier discovered at Madrague de Giens in southern France, dating from the first century B.C., along with a scattering of others (see Parker 1992, 249–50). Grain ships would have required exceptionally watertight hulls to protect the valuable cargo from going damp and spoiling (see note above).

[110] *Acts of the Apostles* 27.38 (Appendix A); Poll. *Onom.* 1.99: *ἐκθέσθαι, ἀποφορτίσασθαι, κουφίσαι τὴν ναῦν, ἐπελαφρῦναι, ἐκβολὴν ποιήσασθαι τῶν φορτίων*. Cf. Plaut. *Rud.* 2.3.42–3: "Neptune is like that. He is an unforgiving market inspector: If the goods are bad, he tosses everything overboard" (*Neptunus ita solet, quamvis fastidiosus aedilis est: si quae improbae sunt merces, iactat omnis*).

[111] *Nomos Rhodiōn Nautikos* 9 (= Ashburner 1909, 16, 87): *ἐὰν περὶ ἐκβολῆς βουλεύσηται ὁ ναύκληρος, ἐπερωτάτω τοὺς ἐπιβάτας οἷς χρήματά ἐστιν ἐν τῷ πλοίῳ. ὅ,τι δὲ ἐὰν γένηται, τοῦτο ψῆφον ποιείτωσαν*.

[112] Cf. Hom. *Od.* 12.409–13: "a murderous gale tore off both forestays and the mast fell backward, with all the tackle pouring into the bilge. The mast itself crashed into the stern. It struck the helmsman's head and crushed all the bones of his skull together" (*ἱστοῦ δὲ προτόνους ἔρρηξ' ἀνέμοιο θύελλα | ἀμφοτέρους, ἱστὸς δ' ὀπίσω πέσεν, ὅπλα τε πάντα | εἰς ἄντλον κατέχυνθ'· ὁ δ' ἄρα πρυμνῇ ἐνὶ νηῒ | πλῆξε κυβερνήτεω κεφαλήν, σὺν δ' ὀστέ' ἄραξε | πάντ' ἄμυδις κεφαλῆς*).

crew felt the dire need to lighten the ship quickly with a few swings of the axe. In such circumstances the ship was left with only the artemon sail or some makeshift arrangement to keep the prow pointed downwind. Juvenal's satire of Catullus' storm-tossed voyage provides some insights:

> Since the hold was half full of sea water, and the waves tossed the ship from side to side, so that the wise, white-haired captain (*rector*), for all his skill, could do nothing about the wavering mast, he began to come to terms with the winds…And now the greater part of the cargo has been hurled overboard, but even these losses do not lighten the ship. And so with things not going his way, he cut away at the mast to find a way out of his straits. It is the ultimate paradox when we have to administer aid to the ship by weakening it! Go now, and commit your life to the winds! Entrust yourself to a hewn plank, which separates you from death by only four finger-breadths, or seven if it's wider. In the future, take along with your mesh bag, your bread and your fat flagon some axes for use in a storm.
>
> But soon the sea fell flat, and the crew experienced better times. Destiny was stronger than the Eurus wind and the sea, and soon the blessed Fates with kindly hand spun a cheerful wool of spinning white thread. A wind arose, not much stronger than a modest breeze, and the poor, destitute ship ran fast with the help of garments spread out and the single sail remaining on her own prow.[113]

That the practice of de-masting a ship was no infrequent occurrence is demonstrated by Roman law, which made provision for the owners of demasted ships. The Severan jurist Papinian, and later Hermogenian, declare the right to contribution from the merchants involved in the voyage if the mast had to be cut down or other rigging destroyed in order to save the ship and cargo,[114] as does the Rhodian Sea-Law, "whether it [the mast] breaks of its own accord or is cut."[115]

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[113] Juv. 12.30–69 (in parts): *cum plenus fluctu medius foret alueus et iam | alternum puppis latus avertentibus undis | arboris incertae, nullam prudentia cani | rectoris cum ferret opem, decidere iactu | coepit cum ventis, | …iactatur rerum utilium pars maxima, sed nec | damna levant. Tunc adversis urguentibus illuc | reccidit ut malum ferro summitteret, ac se | explicat angustum: discriminis ultima, quando | praesidia adferimus navem factura minorem. | I nunc et ventis animam committe dolato | confisus ligno, digitis a morte remotus | quattuor aut septem, si sit latissima, taedae; | mox cum reticulis et pane et ventre lagonae | accipe sumendas in temptestate secures. | Sed postquam iacuit planum mare, tempora postquam | prospera vectoris fatumque valentius euro | et pelago, postquam Parcae meliora benigna | pensa manu ducunt hilares et staminis albi | lanificae, modica nec multum fortior aura | ventus adest, inopi miserabilis arte cucurrit | vestibus extentis et, quod suepraverat unum, velo prora suo.*

[114] Papinianus: *Dig.* 14.2.3: "When the mast or some other piece of ship's equipment that must be removed due to some general danger is thrown overboard, there is a contribution" (*Cum arbor aut aliud navis instrumentum removendi communis periculi causa deiectum est, contributio debetur*). Hermogenianus: *Dig.* 14.2.5 pr. 1: "When the mast is cut away, so that the ship carrying goods can be unencumbered, there will be an equal contribution" (*Arbore caesa, ut navis cum mercibus liberari possit, aequitas contributionis habebit*). For a discussion of these provisions, see Ashburner 1909, ccliii–ccliv.

[115] *Nomos Rhodiōn Nautikos* 35 (= Ashburner 1909, 31, 110): αὐτομάτως ἀποβαλλομένης ἢ κοπτομένης.

It was when all of these efforts to keep the ship afloat had failed that crew and passengers abandoned ship. The ship's boat, if it survived to this point, was the last hope of salvation, at least for those few who could make their way aboard in the chaos of a sinking ship.[116] But, as Paulinus' story above demonstrates, the small boat was a meager lifeline in seas and winds capable of sinking even the largest vessels. These were the moments of large-scale tragedy (and, as we explored in Chapter 1, a perpetual font of poetic inspiration) as passengers and crew struggled to find anything to which to cling for salvation.

8. From Sicily to Portus

After departing Malta or Syracuse the penultimate phase of the long voyage entailed a passage through the Strait of Messina in order to reach the Tyrrhenian Sea (fig. 7.5). The strait, as we saw in Chapter 2, was recognized in antiquity as a difficult passage to navigate, and one that required a specialized knowledge of its strong currents and countercurrents, which change every six hours.[117] As winds during late spring, summer and autumn are relatively calm in the strait,[118] the strategy of sailing masters heading northward was to enter the southern end of the strait at mid-channel in the morning at or near the onset of the *Rema montante*, the northerly flood current which averages approximately 5 kts. Here, with its head turned around, a ship could ride the current a substantial way past Messina toward the northern end of the strait—a time honored practice documented from the Roman era to the Age of Sail.[119] If the current went slack before reaching the point at Pelorus, the ship could

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[116] According to *Acts of the Apostles* 27.30–2 (see Appendix A), Paul warned the centurion that some of the sailors were trying to flee the ship by the ship's boat, whereupon the soldiers cut the rope of the boat and let it drift away. Cf. Plaut. *Rud.* 2.3.36–41: "Both of us in our fear leapt from the ship into a boat, because we saw that the ship was being borne onto a rock; quickly I unloosed the rope while they were seized with fear. The storm separated us from them with the boat off to the right. Thus we wretched ladies were hurled about by winds and waves in a multitude of ways throughout the night; the wind today has scarce borne us, nearly lifeless, to the shore" (*de navi timidae ambae in scapham insiluimus, quia videmus | ad saxa navem ferrier; properans exsolvi restim, | dum illi timent; nos cum scapha tempestas dextrovorsum | differt ab illis. itaque nos ventisque fluctibusque | iactatae exemplis plurimis miserae perpetuam noctem; | vix hodie ad litus pertulit nos ventus exanimatas*).

[117] See, e.g., Polyb. 34.2.5 and Strab. 1.2.15, where the strait is described as δυσέκπλους, "difficult to sail out of."

[118] *Med Pilot* II, 560.

[119] Aristid. *Hieroi Logoi* 2.66 (= Dindorf 1964, 305): "It was nearly midnight when we were carried to the Peloric promontory of Sicily. Then we weaved our way and ran in the strait, sometimes forwards, sometimes

heave to in the protected harbors of Messina or Regium, as Paul's did,[120] or draw near to either coast to await the onset of the slower northerly countercurrents which spin off the southerly flowing *Rema scendente* (ebb current), and so continue to make progress for a few hours more. The passage in fair weather could have been accomplished within the hours of daylight, with the sailing master and lookouts tracking the ship's progress by the sequence of landmarks and towers along the way.[121] Windy weather called for heightened caution, especially in the waters near both coasts where violent katabatic winds are known to exit the numerous river valleys and destroy passing ships.[122] We may be sure that the navigation of sail-driven commercial vessels through the strait would have been avoided at night.[123]

As the ship drew near the northern end of the strait it entered into an area known in myth and history for its violent eddies and vortices—Charybdis off the Pelorus promontory, Scylla near the Scyllaeum promontory on the mainland shore, the so-called Galofaro eddy off Braccio di Santo Rainiere at Messina and various other minor but persistent eddies near the shallow sill of the strait (see fig. 7.5 inset).[124] These posed more of a hazard (or

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backwards. We crossed the Adriatic in two nights and a day, escorted quietly by the current" (*μέσαι νύκτες σχεδὸν ἦσαν, ἡνίκα πρὸς τὴν Πελωρίδα ἄκραν τῆς Σικελίας προσηνέχθημεν. ἔπειτα ἐν πορθμῷ πλάναι καὶ δρόμοι, τὰ μὲν εἰς τὸ πρόσθεν, τὰ δὲ εἰς τοὐπίσω. τοῦ δὲ Ἀδρίου τὸ μὲν πέλαγος δυοῖν νυξὶ καὶ ἡμέρᾳ διήλθομεν, ἀψοφητὶ παραπέμποντος τοῦ ῥεύματος*). For a more recent example of sailing vessels riding this current, see the account of British Rear-Admiral William Henry Smyth (1854, 180): "[The] beaches are so steep [on either side of the strait], that the stream enables vessels to glide safely along them. In light breezes, the current may be stronger than the ship's effort, and by turning her round, often alarms a person unacquainted with the phenomenon, although there is no actual danger."

120 *Acts of the Apostles* 27.13 (Appendix A). Regium and the Sicilian ports, Josephus tells us (*AJ* 19.205), were developed specifically as havens for Roman grain ships under the emperor Gaius: *πλήν γε τοῦ περὶ Ῥήγιον καὶ Σικελίαν ἐπινοηθέντος ἐν ὑποδοχῇ τῶν ἀπ' Αἰγύπτου σιτηγῶν πλοίων.*

121 Strabo (3.5.5; 6.1.5), for example, mentions a Columna Rheginorum at the narrow part of the strait. Across from it stood a tower at Pelorus on the point. Messina was famed for its lighthouse, which was depicted on its coinage from the first century B.C.

122 Smyth (1854, 181) describes one such occurrence: "…a fine barge [of the Sicilian flotilla], with eighteen of the best sailors we had…was assailed by so sudden a squall on her return, that they could not lower the mainsail, and she instantly overset; the bodies of the unfortunate men were picked up the next day, between Scaletta and Taormina, about twenty miles to the southward. It is remarkable that there has been found in Messina a Greek inscription to the memory of thirty-seven youths of Cyzicus, who met a similar fate in the Faro [Strait of Messina]; and in honour of whom, as many statues—the workmanship of Calion—were erected with a suitable inscription."

123 While there may have been expert pilots on hand in antiquity to assist vessels with this passage through the strait, there are to my knowledge no obvious references to them in ancient sources.

124 On currents and eddies in the strait, see Giacobbe 2005, 22–4.

inconvenience) to shipping during times of calm, but with an experienced sailing master could be skirted cautiously in the presence of even light winds.[125]

As they emerged into the Tyrrhenian Sea the sailing masters of these grain ships were faced with the difficulty of shaping a set of courses that would take them toward their final destination, the ports of the Tiber river mouth. These lie some 260 nm away to the northwest of Sicily's Pelorus promontory. Those who set out early enough in spring from Alexandria or various winter ports en route may have benefited from the southerlies that periodically arise in the strait and in the southeast Tyrrhenian Sea. Paul's ship *Dioskouroi*, for example, was carried with quarter winds from Regium to Puteoli, a distance of approximately 200 nm, in just two days (an average speed of just over 4 kts).[126] Those ships that exited the strait in the summer and autumn, however, were more often forced to contend with a predominantly northwesterly wind, the modern mistral (or *Kirkios*), which governs this sea area during these months.[127] The sailing strategy in these circumstances would have required a series of long port tacks northeast toward the Italic shore followed by shorter starboard tacks to the west and west-southwest. As the western Italic shore trends generally northwest for several hundred nautical miles, so too must have the sailing master's perceptual axis of movement, which during the day was easily referenced by the wind and swell out of the northwest, and during the night by the western limit of Ursa Major (at a bearing of between 310° and 320°) and the setting of Boötes and its brightest star Arcturus (at 315°). By the time they reached Portus the north celestial pole will have risen an additional 4° higher (or two dactyls) in the northern sky than it was in the strait, and 10.5° (or five dactyls) total since departing Alexandria.

The adverse meteorological conditions on this leg were compensated by numerous headlands that project prominently from the coast, all between 20 and 40 nm apart—the Palinurus and Poseideion promontories in Lucania, the Minerva promontory (Surrentine

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125 The Cambridge historian Thomas Smart Hughes (1820, 134) traveled through the strait aboard HMS *Revenge* in 1813 and made an easy passage under "a fair breeze…but if the wind happens to fail, they [the boats] are inevitably lost unless they contain a sufficient number of hands to extricate themselves by the aid of oars: nay, several times during the late war have our own line of battle ships and frigates, when caught here in a calm, ran imminent danger from the rocks of Scylla, and have been exposed for hours to the incessant fire of the French batteries, until they were towed off by the flotilla sent to their assistance from the English posts."

126 *Acts of the Apostles* 28.13 (Appendix A).

Peninsula) and the isle of Capreae (modern Capri, with its lighthouse at the Villa Iovis[128]), the island of Pithekoussai across from Misenum in the Bay of Naples, the Caieta and Kirkaion promontories in Latium (the latter the home to the eponymous wind) and finally the projecting spit of Antium. All of these points along the coast and the numerous small isles of the Pontine archipelago provided salient benchmarks for tracking progress and safe havens from high winds, squalls and more extensive storms.

9. Landfall

Until the middle of the first century A.D. the city and river port of Ostia at the mouth of the Tiber served as Rome's access point to the sea. The shallow river mouth permitted the passage of only oared ships and lighters: the heavier commercial vessels were forced to stand off in the open roadstead and transship their cargoes onto lighters.[129] The main port of call for the grain ships that supplied the city of Rome before this time was Puteoli/Dikaiarcheia in Campania, some 200 km to the south. This was the closest destination that offered deep, protected harborage and facilities for large ships (like Paul's *Dioskouroi*), whose cargoes were offloaded and reloaded onto smaller coastal vessels for the final push northward to Ostia, then up the Tiber to Rome.[130] To ameliorate the cumbersome and expensive logistics of the grain supply the emperor Claudius in A.D. 42 began construction on the monumental harbor of Portus, with a canal linking it with the Tiber, just north of Ostia.[131] His engineers constructed two long moles with wharfs, both of which curved toward a man-made island whose concrete foundations incorporated the immense ship constructed under Caligula to carry the Vatican obelisk from Egypt.[132] On the island

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[127] *CRMS*, 119, 145, 171, 197, 223.

[128] Stat. *Silv*. 3.5.100; Suet. *Tib*. 65.15–18; Suetonius (74.4–6) adds that the lighthouse (*turris phari*) was toppled in an earthquake just before Tiberius' death. Whether it was rebuilt and continued to serve that function remains unknown; Tuck (2008, 325–6) believes that it would have been lighted only during Tiberius' actual presence in the Villa Iovis, but this is speculation. There certainly would have been a need for a lighthouse along this busy maritime corridor.

[129] Strab. 5.3.5.

[130] Casson 1965, 32; Meiggs 1973, 50, 56–7.

[131] The latest fundamental work on Portus is Keay et al. 2005.

[132] Plin. *NH* 16.76.201, 36.14.70; Suet. *Claud*. 20.3.

was erected a four-stage lighthouse, which stood watch over the two entrance channels to either side.[133] A flame burned on the summit, like the Pharos of Alexandria (its putative prototype), and adjacent to it, or probably on the penultimate stage of the tower, stood a colossal statue of Claudius in a *contrapposto* pose.[134] The enormous basin was designed to offer protected waters for the multitude of ships of the grain fleet, but its great size gave winds and swells enough room to generate hazardous conditions: a fleet of 200 grain ships anchored within the harbor was destroyed in a storm in A.D. 62.[135] To improve the facilities the emperor Trajan in the years following A.D. 100 built a large hexagonal inner harbor, which he surrounded with proper quays and warehouses and linked it by canal to both the outer Claudian harbor and the Tiber. Each side of the inner basin measured nearly 360 m in length, thus offering nearly 2 km of perfectly sheltered quay space. It was at this time that Puteoli was finally fully eclipsed as a destination for grain vessels.[136]

It was toward Claudius' lighthouse, one of the few salient coastal markers to be seen along the lengthy flat coast of Latium and Etruria, that the grain ships from Alexandria steered as they progressed up the coast past the headland at Antium. Dispatch boats were sent ahead of the first ships of the convoy to announce their advent.[137] Upon arrival off the harbor entrance each ship hove to or anchored in queue: smaller sailing vessels and oared craft could enter and exit as needed,[138] but the larger grain vessels were too large to maneuver under their own power within the confines of even these large harbors.[139] The crew awaited the arrival of oared tugboats known as *lenunculi*, which were operated by a guild of boatmen at Ostia known as the *lenuncularii tabularii auxiliarii*. These personnel, as the name implies, assessed the cargo of each ship, its size and its *portarium* (harbor toll), then with the

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[133] Pliny (*NH* 16.76.201–2) describes the pharos on the "left side" of the harbor, while Suetonius (*Claud.* 20.3) suggests a separate mole, an island, in deep water before the entrance.
[134] Tuck 2008, 329.
[135] Tac. *Ann.* 15.18.3.
[136] For the latest discussion of Puteoli/Dikaiarcheia's role vis-à-vis Ostia/Portus in the first century B.C., see Zevi 2005, 38.
[137] Sen. *Ep.* 77.1.
[138] Juvenal (12.75–82), e.g., describes a lame vessel (*trunca puppe*) entering the harbor of Ostia under its own power, passing the "Tyrrhenian lighthouse" (*Tyrrhenam pharon*) and proceeding to the inner basin.
[139] Ammianus Marcellinus (19.10.4), however, writing of the year A.D. 359, states that grain ships were still entering the harbor under full sail (*velificatione plena*). These were likely the smaller grain ships making their way to Portus from Sardinia or Africa.

help of strong oarsmen towed the ships past the lighthouse to their pre-assigned berth, either to a quay within the Claudian harbor or through it to the inner hexagonal harbor where additional wharf and warehouse space was afforded.[140] The ship tied up to the quay nose to, at which point began the din and bustle that typically accompanies the arrival of a large ship—passengers rush to disembark, the crew perform their votive offerings to the god or gods for a safe voyage, the harbormaster or his representative arrives to discuss arrangements and fees with the ship's master and sailing master, the *mensores* (measuring clerks) set up their stations and *saccarrii* (stevedores) crowd the gangway as they offload the cargo of grain. So ends the long passage from Egypt. In a few days the ship and its crew along with a new complement of passengers and a few new crew members will have begun the voyage to Alexandria, there to start the cycle again before the autumn season arrives.

III. CONCLUSIONS

In both literary models and in reality the sailing masters of Greek and Roman commercial vessels were the central figures of the crew in which all navigational knowledge resided. Epic and mythology infused them with heroic skills in reading the clues that nature offered to guide their ships across vast distances and through troubled waters. More historical sources reveal an occupation of low social status that nonetheless required a prodigious set of complex skills and a practical knowledge earned from numerous hard years spent at sea—seamanship, crew leadership, maritime geography, winds, currents, weather prognostication and nautical astronomy, among others. Together these skills and knowledge constituted the "steersman's art," *ta kybernētika*, or the *ars gubernatoris*. Previous chapters have treated some of these topics individually, at least as far as the limited textual record can take us, but the question of how Greek and Roman sailing masters drew upon their skills to solve difficult navigational problems has been stymied by a general want of detailed physical and

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[140] A terracotta plaque of the third century A.D. from the Isola Sacra necropolis depicts a large ship and its sailing master on approach to the Claudian lighthouse from outside the harbor, and before it is a boat with a single rower who appears to be rowing, or perhaps towing the larger vessel, into the Claudian harbor (Meiggs 1973, pl. XXVIb). The artist may have depicted the tow rope in paint. Note the tavern scene directly adjacent on the same plaque.

textual evidence. We have some evidence on the kinds of ships they sailed and the sailing rigs they utilized; some evidence for the degree to which they were familiar with maritime geography; some evidence of how they employed winds for orientation and course maintenance at sea; some evidence of how they used signs in nature to predict weather; some evidence of how they utilized the night sky; and some evidence (though highly ambiguous) for the use of written materials. When we integrate these disparate morsels of evidence into the context of a voyage—one that has a predictable set of parameters, routines and navigational requirements between departure and arrival—then we can begin to get a closer look at what the practice, the *technē*, of ancient navigation was really like. While this chapter offers a reconstruction of a typical voyage of an Alexandrian grain ship of the Roman imperial era—an era that arguably saw the acme of ancient navigational skill and knowledge—the sailing masters of earlier centuries were faced with formulating strategies for dealing with the same geographic, meteorological and technological conditions as their later counterparts.

Chapter 8: *Conclusions*

> All sea voyages have several beginnings and several ends;
> they are never complete.
>
> —Predrag Matvejević[1]

My objective in this study has been to explore and (re)define the character of navigation modes and techniques developed and used by the sailing masters of Greek and Roman merchant vessels. In much of previous scholarship the standard model of ancient navigation has been heavily influenced by attitudes and scenarios expressed in ancient literary *topoi*, and thus the ancient practice came to be viewed as excessively hazardous and fraught with shortcomings: Seafarers purportedly hugged the shore, routinely put in at night, assiduously avoided the open sea, rarely if ever sailed in winter and found themselves helpless and ineffective in weathering storms. Several scholars over the past half century have refuted some of these notions, but the general sentiment continues to linger in academic writing. A critical review and analysis of the scattered literary, historical, epigraphic and archaeological evidence, together with detailed considerations of geography and weather, impels a serious modification to the standard model. These individual lines of evidence unite to demonstrate that both coastal and open-sea sailing were matters of routine, that ships did indeed sail at night, and often, that winter sailing was a common practice for many sectors of shipping, and that many if not most ships could and did weather storms successfully. History, to be sure, is ever forgetful of the successful voyages, but these were more the norm than the exception. These contrary findings and shifts in emphases are not to assert that ancient seafarers were consummate navigators capable of voyaging at will at any time of the year, or that they evolved highly developed systems of navigation. Rather, it is a testament to a competence and experience in traditional methods of non-instrument navigation on the part of Greek and Roman sailing masters. These technicians of maritime movement, whether operating vessels of cabotage or sailing the open sea, generally exhibited an in-depth knowledge of the physical environment, an understanding of their ship's capabilities and

[1] Matvejević 1999, 61.

limitations in various sea states, and a variety of wayfinding skills that enabled them to navigate safely from port to port, sometimes even in winter. In other words, the sailing masters of antiquity are not to be viewed as a minor craftsman who drew upon low-order cognition in the practice of his *technē*, trusting more to luck and habit than skill, but rather as a master-craftsman with a fundamental understanding of how to direct (and how to manage crew members to direct) a highly complex machine between destinations over a large and highly dynamic liquid plain.

The first part of this study exerted some effort in defining the general maritime parameters of the physical environment in order to offer the reader a sense of the scale and complexity of the Mediterranean and Black Sea, as well as a basic understanding of its weather and waters and changing thresholds of visibility (and therefore intervisibility). These important facets of ancient navigation have been grossly undervalued in most studies, even though they ultimately shaped the character of navigation and the navigational strategies that could be formulated within the bounds of technology and skill.

The merchant vessels that were developed in antiquity to work within these maritime environments are represented in the archaeological record, and their names are catalogued by several ancient authors, but examples of the classes and sizes of the ships remain largely elusive due to the fragmentary nature of both kinds of evidence. The most prevalent type of sailing rig for both merchant galleys and purely sail-driven merchant vessels was the square sail, which could be shaped by means of brailing lines to permit vessels to sail not only with following and quarter winds, but also with the aid of an artemon to tack and wear upwind on reaches, as literary accounts and recent experimental voyages have shown. They could attain speeds of 4 or 5 kts or more in following seas, but they appear to have averaged somewhat less.

Evidence of an ancient sailing season is unusually rich throughout the Greek and Roman periods, with variable but unequivocal dates of its closing in autumn and religious festivities associated with its opening in spring. Surprisingly, several documentary sources reveal some level of winter navigation throughout antiquity, particularly in the Eastern Mediterranean. In many if not most instances these risk-takers were the owners and sailing masters of merchant vessels, who, for better or worse, weighed the threat of winter storms against the possibility of earning additional profits, sometimes with disastrous results. The evidence, all told, suggests that in certain regions and times only state-sponsored merchant vessels were actually mandated to remain in harbor during winter as insurance against loss.

These three factors—geography, sailing technology and seasonal weather—played a key role in dictating the trajectories of maritime movement in antiquity. Traditional studies of ancient trade and navigation typically draw straight-line routes between ports to represent maritime connections, but sailing vessels rarely traveled in straight lines. Instead of fixed routes sailing masters chose to sail within seasonal corridors of movement in which conditions were most favorable for efficient forward movement. In the case of the rugged European shore, some corridors offered the convenience of nearby havens for respite from inclement weather and storms. Several of these corridors may be discerned along and between the coasts of both seas from a careful study of literary evidence and physical factors.

The second half of this study consisted of an investigation into the fundamental elements of navigation, namely the ways in which sailing masters accounted for direction, orientation, distance and speed. References to direction in antiquity were always associated with winds. At sea, certain regional winds (such as the etesians) and diurnal winds were among the few means of orientation and course-maintenance. Their regular use by seafarers led to the development of wind roses, a circular diagram of the horizon divided by winds. These served as simplistic, conceptual tools—a sort of 'wind-compass'—for determining direction at sea in the absence of other physical signs such as the sun and stars. There is some evidence that certain winds characterized by their constancy and periodicity may have been employed as 'course-winds,' i.e., favorable winds that were routinely used by seafarers to make regular passages between two points.

For course maintenance seafarers also employed the night sky, particularly during the generally clear skies of late spring, summer and early autumn. Stars, unlike the ever shifting winds, exerted a stable and consistent order to the horizon. The conservative literary *topoi* on the subject—virtually unchanged between Homer and the end of antiquity—focus primarily on the circumpolar stars and the north celestial pole. The altitude of the pole (which was then not represented by a prominent star as it is today) signaled to the most observant a rough latitudinal position on the face of the earth. Whether sailing masters also utilized zodiacal constellations as guides and for course maintenance is difficult to discern in the literary sources, but practical considerations are highly suggestive of such a practice.

The numerous *periploi, stadiasmoi* and *limenai* that have survived have traditionally been interpreted as 'navigational guides' and 'seafaring manuals.' Their droning descriptions of coastal features listed in paratactic order, and the distances between them, seem ideally suited for these purpose, and indeed many scholars have used their format to describe a purely coastal mode of seafaring in antiquity. But a closer internal analysis and an examination of their authorship and readership point instead to a subgenre of geographic writing that would have been of use more to geographers, literate travelers and merchants than to sailing masters. This is not to deny the possibility that sailing masters and their crews produced lists that contained navigational information for the purposes of routine shipboard administration, and that such lists may have served as sources behind *periploi* and *limenai*, but of these there are only passing and ambiguous references in the literary record.

These considerations of the physical environment, sailing technology, the rhythms and patterns of maritime movement and the various techniques and conceptual tools applied to the fundamental requirements of directing a ship at sea inform the background of Greek and Roman sailing masters and the wide variety of knowledge and skills that each was expected to possess. Though of generally low social status, like the rest of the maritime labor class, they were critical in developing and maintaining one of the main economic engines of the ancient world, seaborne trade. It was their navigational capabilities and their command of one of the most, if not *the* most, complex machine the ancient world produced that facilitated far-flung communication, ensured the perennial shipment of foodstuffs, wine, luxury items, passengers and colonizers, and enabled the transfer of culture and ideas throughout the Mediterranean world and beyond. Without their skills and competence it is difficult to imagine the Greek colonizing movement of the Archaic period, Athens' economic strength in the fifth and fourth centuries B.C., the commercial powerhouse of Alexandria in the Hellenistic period, or, ultimately, the meteoric rise of Rome as the nucleus of a tremendously large political and economic organism that by the first century A.D. stretched from Britain to the Indian Ocean, and from Morocco to the far end of the Black

Sea. It was perhaps on the well-trodden sea-paths between Alexandria and Rome—a voyage that involved a long passage through multiple regions, wind regimes and wide open seas—that the *technē* of navigation in antiquity reached its pinnacle.[2] The Elder Pliny may be rightly faulted for assigning credit solely to flax, and its manufacture into sails, for enabling ships to sail to and from the far reaches of the *oikoumenē* (as we saw in Chapter 1): A larger share of the recognition should be given to the sailing masters whose navigational experience, knowledge and skills helped make it all possible.

[2] A comparably long and complex passage, but one with very few literary references and virtually no archaeological evidence in the form of shipwrecks, is that made by Roman merchant vessels between the Bab-el Mandeb and the western and southern coasts of India (a passage of some 1,800 nm) in and after the Augustan period (see page 35 n. 42).

Gains in m³/sec		Losses in m³/sec	
Inflow from the Atlantic	1,750,000	Outflow to the Atlantic Ocean	1,680,000
Inflow from the Black Sea	12,600	Outflow to the Black Sea	6,100
Precipitation	31,600	Evaporation	115,400
Run-off	7,300		
Total	1,801,500	Total	1,801,500

Table 2.1: Water budget of the Mediterranean Sea (after Houston 1964, 39).

Type of wind regime	Repetition of types (%)				Average/Year
	January	April	July	October	
NE, E, SE	30	20	6	27	32
SW, W, NW	25	18	11	17	21
N	10	7	10	8	8
Variable	35	55	73	48	39

Table 2.2: Frequency of wind regimes over the Black Sea (after Sorokin 2002, 53).

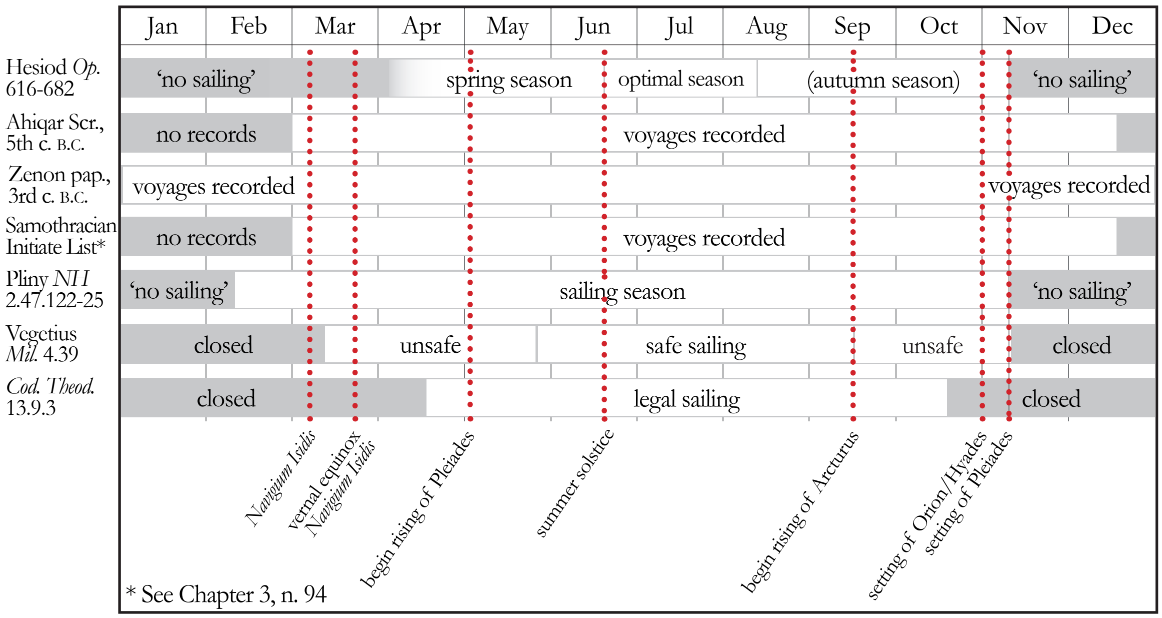


Table 3.1: Main sources on the ancient sailing season and their calendrical benchmarks.

Month	Modern Date	Ionian Ships	Phoenician Ships
Hathyr	18 February - 19 March	3	-
Choiach	20 March - 18 April	3	-
Tybi	19 April - 18 May	3	-
Mecheir	19 May - 17 June	3	-
Phamenoth	18 June - 17 July	4	-
Pharmouthi	18 July - 16 August	4	-
Pachons	17 August - 15 September	5	-
Payni	15 September - 15 October	4	1
Epeiph	16 October - 14 November	3	3
Mesore	15 November - 14 December	4	2

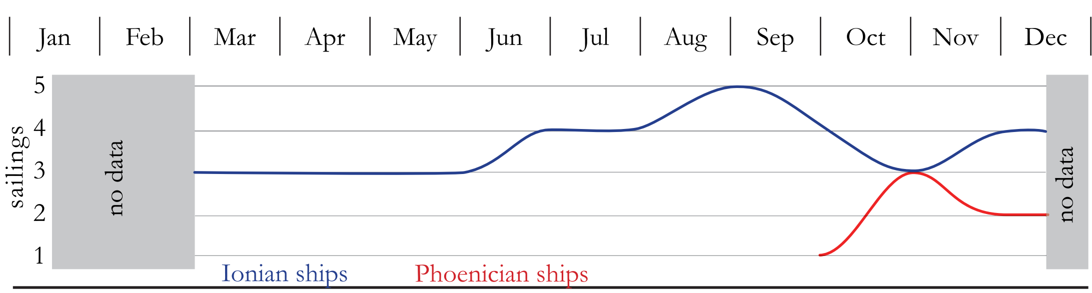


Table 3.2: The sailings recorded in the Ahiqar scroll from the fifth century B.C. (data from Porten and Yardeni 1993).

Source	Work	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW
Homer	*Od.* 5.295	βορέης			εὖρος			νότος			ζέφυρος		
Arist.	*Met.* 363b11	βορέας ἀπαρκτίας	μέσης	καικίας	ἀπηλιώτης	εὖρος	(φοινικίας)	νότος	--	λίψ	ζέφυρος	ἀργέστης ὀλυμπίας σκίρων	θρασκίας
Timos-thenes	*On Harbors* (= Ag-athem. 2.6)	ἀπαρκτίας	βορέας	καικίας	ἀπηλιώτης	εὖρος	φοῖνιξ εὐρόνοτος	νότος	λευκό-νοτος	λίψ	ζέφυρος	ἀργέστης ὀλυμπίας ἰᾶπυξ	θρασκίας κίρκιος
Pseudo-Arist.	ΑΝ. ΘΕΣ.	[ἀπαρκ-τίας]	βορρᾶς	καικίας	ἀπηλιώτης	εὖρος	Ὀρθόνοτος	νότος	λευκό-νοτος	λίψ	ζέφυρος	ἰάπυξ	θρᾳκίας
Pseudo-Arist.	*De Mundo* 4, 394b19	ἀπαρκτίας	βορέας	καικίας	ἀπηλιώτης	εὖρος	εὐρόνοτος	νότος	λιβόνοτος λιβοφοῖνιξ	λίψ	ζέφυρος	ἀργέστης ὀλυμπίας ἰᾶπυξ	θρασκίας κίρκιος
Posid.	*apud* Strab. 1.2.21	--	--	καικίας	ἀπηλιώτης	εὖρος	--	--	λευκό-νοτος	λίψ	ζέφυρος	ἀργέστης	--
Varro	*apud* Sen. *Q.Nat.* 5.16	septemtrio	aquilo	caecius καικίας	subsolanus ἀφηλιώτης	vulturnus eurus	εὐρόνοτος	auster νότος	λευκό-νοτος	africus λίψ	favonius zephyrus	corus argestes	θρασκίας
Luke	*Acts* 27: 12–14	--	--	εὐρ-ακύλων	--	--	--	νότος	--	λίψ	--	χῶρος	--
Pliny the Elder	*NH* 2.45.119	septentrio aparctias	aquilo boreas	caecias	subsolanus apeliotes	volturnus eurus	phoenix	auster notus	libonotus	africus libs	favonius zephyrus	corus argestes	thraskias
Favori-nus	Gell. *NA* 2.22	ἀπαρκτίας septentri-onarius	--	aquilo βορέας	eurus (sub-solanus) ἀφηλιώτης	volturnus εὐρό-νοτος	--	auster νότος	--	africus λίψ	favonius ζέφυρος	caurus ἀργέστης	--
Ptol.	*Geog.* 1.15.6 *et al.*	ἀπαρκτίας	βορέας	--	ἀπηλιώτης	εὖρος	--	νότος	λιβόνοτος	λίψ	--	ἰᾶπυξ	θρασκίας
Dougga Wind Rose	*CIL* 8.4, 26652	SEPTEN-TRIO	AQ-UILO	EURO-AQUILO	uuLTVR-NuS	EURVS	LEVCO-NOTVS	AVSTER	LIBO-NOTVS	AF-RICVS	FAONI	ARG-ESTES	CIRCIVS
Veg.	*De Re Mil.* 4.38	Septentrio Aparcias	Boreas Aquilo	Caecias Eu-roborus	Apheliotes Subsolanus	Eurus Vulturnus	Leuconotus Albus Notus	Notus Auster	Libonotus Corus	Lips Africus	Zephy-rus Subves-pertinus	Iapyx Favonius	Thrascias Circius

Table 4.1: Wind roses of Homer and Aristotle, followed by roses of twelve winds based on Timosthenes' model (compiled by the author).

Source	Work	N	NE	E	SE	S	SW	W	NW
Hipparchus	Parapegma	*ἀπαρκτίας*	*βορέας*	*ἀπηλιώτης*	--	*νότος*	--	*ζέφυρος*	*ἀργέστης*
Egyptians	Parapegma	--	*βορέας*	*ἀπηλιώτης*	*εὖρος*	*νότος*	*λίψ*	*ζέφυρος*	*ἀργέστης*
[Hip-pocrates]	*Hebd.* 3	*ἄρκτιος or ἀπαρκτίας*	*βορέης*	*ἀπηλιώτης*	*εὖρος*	*νότος*	*λίψ*	*ζέφυρος*	--
Andronicus	Horologion in Athens	βορέας	καικίας	ἀπηλιώτης	εὖρος	νότος	λίψ	ζέφυρος	ἀργέστης
Vitruvius	*De arch.* 1.6.5	*septentrio*	*aquilo*	*solanus*	*eurus*	*auster*	*africus*	*favonius*	*caurus*
Pliny the Elder	*NH* 18.76.326-77-339	*septentrio*	*aquilo* *boreas*	*subsolanus* *apeliotes*	*volturnus* *eurus*	*auster* *notus*	*africus* *libs*	*favonius* *zephyrus*	*corus* *argestes*
Columella	*RR* 11.2	*septentrio*	*aquilo*	*eurus (eurinus)*	*eurinus (eurus)*	*auster*	*africus*	*favonius*	*corus*
Favorinus	Gell. *NA* 2.22	*septentrionarius* ἀπαρκτίας	*aquilo* βορέας	*eurus (subsolanus)* ἀφηλιώτης	*volturnus* εὐρόνοτος	*auster* νότος	*africus* λίψ	*favonius* ζέφυρος	*caurus* ἀργέστης

Table 4.2: Roses of eight winds (compiled by the author).

Anemoscopes	**Current Location**	**Findspot**	**Language**	**8 or 12 winds**	**Date**	**Sources/Commentaries**
CIG 14, 1308 = *CIL* 5, suppl. 204	Rome: Vatican Museum	Between Esquiline and Colosseum, near San Pietro in Vinculis.	Bilingual	12	2-3 c. A.D.	Lais 1894, pl. 1; Obrist 1997, 40–1, fig. 2.
oriens ἀφηλιώτης *solanus*; καικίας *vulturnus*; βορέας *aquilo*; *septentrio* ἀπαρκτίας *septentrio*; θρακίας *circius*; ἰάπυξ *chorus*; *occidens* ζέφυρος *favonius*; λίψ *africus*; λιβόνοτος *austroafricus*; *meridies* νότος *auster*; εὐρόνοτος *euroauster*; εὖρος *eurus*						
CIG 14, 906 = *CIL* 10, 6119	Unknown (lost)	Found in the sixteenth century at Gaete (ancient Caieta, south of Rome on the coast).	Bilingual	12	Unknown	Nielsen 1945, 102.
7 faces preserved: *africus* λίψ; *austroafricus* λιβόνοτος; *auster* νότος; *euroauster* εὐρόνοτος; *eurus* εὖρος; *solanus* ἀφηλιώτης; *vulturnus* καικίας						
Pesaro ('Boscovich') Anemoscope	Museo Oliveriano at Pesaro	Flat slab of Luna marble found in 1759 on the Via Appia outside the Porta Capena in Rome. South is up on the face.	Greek (in Latin letters)	12	ca. 200 A.D.	Zicàri 1954, 69–75; Dilke 1998, 110–11, pl. 21, fig. 21; Taub 2003, 149, fig. 4.2 and 179, fig. 5.4.
Wording on the upper face (top to bottom): *totus infra terra(m)* *Brumalis* *Aequinoctialis* *Sol(s)titialis* *Eutropius feci* *totus supra terra(m)* Names of winds on the edge: *Notus* *Libonotus* *Libs* *Zephirus* *Irgastes* *Trascias* *Aparcias* *Boreas* *Cae[cias]* *Apheli[otes]* *Eurus* *Phoenix*						
Sundials						
IG 14, 1308	Rome: Vatican Museum, Lateran collection	Found in 1814 on the Vigna Cassini near the Via Appia in Rome.	Greek	12	Possibly 2 c. A.D.	Peter 1815 (drawing); Gibbs, 1976, 87 and 332 no. 4008G.
Fragmentary: νότος εὐρόνοτος εὖρος ἀφηλιώτης καικίας						
MNR Inv. nos. 40621–40642	Rome: Mus. Nazionale Romano	Unknown	Greek	12	Unknown	Moretti 1956, 69–79; Gibbs 1976, 333 no. 4009.
Two fragments with 6 wind names: *[ἀπαρκτία]ς* βορέας καικίας *ἀφηλιώτ[ης]* *[λιβ]όνοτος* *λ[ίψ]*						
Mausoleum of Augustus	Unknown	Found in 1883 in the Mausoleum of Augustus.	Latin	8	Unknown	Gibbs 1976, 333 no. 4010.
Two Latin wind names extant on this one fragment: *favonius* *africus*						
ILS 8643	Aquileia: Museo Archeologico Nazionale	Discovered in 1878 near the temple of Jupiter at Aquileia.	Latin	8	Early Empire(?)	Grablovitz 1878, 209-25; Kenner 1880, 7–18, figs. 7–10; Gibbs 1976, 326 no. 4002G.
Artisan: *M. Antistius Euporus fecit* *eurus* *auster* *africus* *faonius* *aquilo* *septentrio* *boreas* *desolinus*						

Table 4.3: Greek and Roman anescopes and sundials with wind roses.

Main Wind	Local Wind Name	Peoples/Location	Probable Wind Use	*Barrington Atlas*
βορρᾶς	Παγρεύς	at Mallos (Cilicia). It blows from the at the base of Mt. Pagrika.	Departure	67, A3
	Μέσης	at Kaunos (Caria), NE of Rhodes	Departure	65, A4
	Καυνίας	on Rhodes (but ruffles the harbor of the Kaunians)	Arrival	61, F5, G5
	Ιδυρεύς	at Olbia (Pamphylia)	Departure	65, E4
	Βορρᾶς	at Phaselis (Lycia)	Unknown	65, E4
Καικίας	Θηβάνας	on Lesbos, blows from Thebes above the Eleatic Gulf in Mysia near Adram-mytium; ruffles the harbor at Mytilene.	Departure or Arival	56, D2, E2
	Καυνίας	used “among some”		65, A4
	Βορρᾶς	used “among others”		N/A
Ἀπηλιώτης	Ποταμεύς	in Tripolis in Phoenicia, surrounded by Mts. Libanos and Bapyros; it ruffles the harbor of Poseidoneion (Posideion north of Laodicea?)	Departure	68, A5
	Συριὰνδος	in Issic Gulf and around Rhosos; it blows from the Syrian Gates which the Taurian and Rhosian mountains divide	Departure	67, lower left grids
	Μαρσεὺς	in the Gulf of Tripolis, after a village named Marsos (location unknown)	Departure	N/A
	Ἑλλησποντίας	at Prokonessos, Teos, Crete, Euboea (Capheres) and Cyrene (Apollonia)	Departure or Arrival	57, s.v. 38, C1
	Βερεκυντίας	in Sinope, blowing from places in Phrygia (a Pontic/Phrygian word, according to *LSJ*, s.v.)	Departure	86, F1
	Καταπορθμίας	in Sicily, blowing from the strait (ἀπὸ τοῦ πορθμοῦ)	Arrival?	47, H2
Εὖρος	Σκοπελεύς	at Aigai in Syria (about 30 km due east of Mallos); named after the Rhosian crag (σκόπελος)	Departure	67, B3
	Κάρβας	at Cyrene, named after the Karbanes in Phoenicia (etymology derived from Karpasia in NW Cyprus)	Departure	72, E1
	Φοινικίας	used “by some”	Departure	N/A
	Ἀπηλιώτης	used “by others”	Unknown	N/A
Ὀρθόνοτος	Εὖρος	“some add” this title	Unknown	N/A
	Ἀμνεύς	“others add” this title (locale unknown)	Unknown	N/A
Νότος	*N/A*	“same everywhere”	Unknown	N/A
Λευκόνοτος	*N/A*	“same everywhere”	Unknown	N/A
Λίψ	*N/A*	“named after Libya, whence it blows”	Unknown	N/A
ζέφυρος	*N/A*	“blows from the west”	Unknown	N/A
Ἰάπυξ	Σκυλλητῖνος	at Tarentum, blowing from Scylletium; Iapyx is possibly confused here with the Iapygium promontory near Crotone, southwest of which is Scylletium.	Departure?	45, F4
	Φρυγίας	at Dorylaion (Phrygia)	Unknown	62, E2
Ἰάπυξ (continued)	Φαραγγίτης	at Mt. Pangaion in the northern Aegean, near the coast between Amphipolis and Neapolis. Etymologically tied to φαραγγαῖον, from a ravine or chasm.	departure	51, C3
	Ἀργέστης	“among many”	Unknown	N/A
θρᾳκίας	Στρυμονίας	in Thrace, blowing from the River Strymon	Departure	51, B3
	Σκίρρων	in the Megarid, from the Scirronides rocks	Departure	58, E2
	Κιρκίας	in Italy and Sicily, blowing from Κιρκαίον	Departure	44, D3
	Ὀλυμπίας	in Euboea and Lesbos, named after Pierian Olympus; it ruffles the harbor of the Pyrraians in Lesbos.	Departure	56, C3

Table 4.4: Winds and their local equivalents from the pseudo-Aristotelian treatise *Situations and Names of the Winds*.

Century	Author	Title	Geographical Area	Source
Late 6/Early 5 c. B.C.	**Hanno the Carthaginian**	*Periplus*	Atlantic coast of North Africa	*GGM* 1, 1–14
Early 5 c. B.C.(?)	Himilco the Carthaginian	*Periplus(?)*	Atlantic coast of Europe	Plin. *NH* 2.67.169; Warmington 1929, 31–3
5 c. B.C.	Damastes of Sigeion (Troad)	*Periplus*, or *On the Nations*	Mediterranean, BLack Sea, ?	*FHG* 2, 65–7
5 c. B.C.	Charon of Lampsacus	*Periplus of the Outer Sea*	Outside the Pillars of Heracles	Suda, s.v.; *FHG* 1, 32–5
5/4 c. B.C.	Phileas of Athens	*Periplus(?)*	Mediterranean, Black Sea(?)	Gisinger, Phileas, *RE* 2133–4
5/4 c. B.C.	Andron of Teos	*Periplus*	Black Sea, Mediterranean(?)	*FHG* 2, 348–9
Late 4 c. B.C.	**Pseudo-Scylax**	*Periplus of the Oikoumene*	Mediterranean, Black Sea, Atlantic coast of North Africa	*GGM* 1, xxxiii–li, 15–95
Late 4 c. B.C.	Callisthenes of Olynthos	*Periplus*	Mediterranean, Black Sea(?)	*FGrH* 124 2B: 631–57
Late 4 c. B.C.	Androsthenes of Thasos	*Periplus*	Indus, Arabian Gulf, Persian Gulf	*FGrH* 711 3C: 592–6
Late 4 c. B.C.	**Nearchus of Crete**	*Periplus(?)*	Indus, Arabian Gulf, Persian Gulf	*GGM* 1, 306–69; Arrian, *Indica*
4/3 c. B.C.	Androetas of Tenedos	*Periplus of the Propontis*	Propontis	*FHG* 4, 304
4/3 c. B.C.	Nymphodorus of Syracuse	*Periplus*	Asia, Black Sea(?)	*FHG* 2, 375–81
3 c. B.C.	Nymphis of Heraclea Pontica	*Periplus of Asia*	Asia Minor	*FHG* 3, 13–16
3/2 c. B.C.	Mnaseas of Patara	*Periegesis* or *Periplus*	Mediterranean	*FHG* 3, 149–58; Add. IV, 659
2/1 c. B.C.	Xenophon of Lampsacus	*Periplus*	Atlantic coast of Europe(?)	Gisinger, Xenophon (10), *RE* 9A2, 2051–5
Late 2/Early 1 c. B.C.	**Artemidorus of Ephesus**	*Periplus(?)*	Mediterranean, Black Sea, Erythraean Sea	*GGM* 1, 574–6
Early 1 c. B.C.	**Ps.-Scymnus**	*Periodos(?), Periegesis(?)*	Mediterranean and Black Sea	*GGM* 1, 196–237
1 c. B.C.	Cornelius Alexander Polyhistor	*Periplus of the Pontus Euxine* or *On the Black Sea*	Black Sea	*FHG* 3, 232
1 c. B.C.	Cornelius Alexander Polyhistor	*Periplus Maris Erythraei*	Red Sea, Arabian Gulf, ?	*FHG* 3, 239
1 c. B.C./A.D.	**Menippus of Pergamon**	*Periplus*	Mediterranean and Black Sea	*GGM* 1, 427–514

Table 6.1: Whole or fragmentary *periploi*, and datable lost *periploi*. Those that survive whole or nearly whole are in shaded rows and bold letters.

Century	Author	Title	Geographical Area	Source
1 c. A.D.	**Anonymous**	*Periplus Maris Erythraei*	Red Sea, Arabian Gulf, Indian Ocean	*GGM* 1, 257–305
ca. A.D. 130	**Arrian**	*Periplus*	Black Sea	*GGM* 1, 370–401
1/2 c. A.D.	**Anonymous**	*Stadiasmus Maris Magni*	Mediterranean	*GGM* 1, 427–514
2 c . A.D.	Dionysius of Byzantium	*Anaplus Bospori*	Bosphorus	*GGM* 2, 1–101
3/5 c. A.D.	**Marcian of Heraclea**	*Periplus Maris Externi*	Atlantic coast of Europe, Red Sea, Arabian Gulf	*GGM* 1, 515–62
4 c. A.D.	Protagoras	*Stadiasmus*	Indian Ocean?	Diller 1952, 45
6 c. A.D.	**Pseudo-Arrian**	*Periplus Ponti Euxini*	Black Sea	*GGM* 1, 402–23; Diller 1952, 102–46

Table 6.1 (continued): Whole or fragmentary *periploi*, and datable lost *periploi*. Those that survive whole or nearly whole are in shaded rows and bold letters.

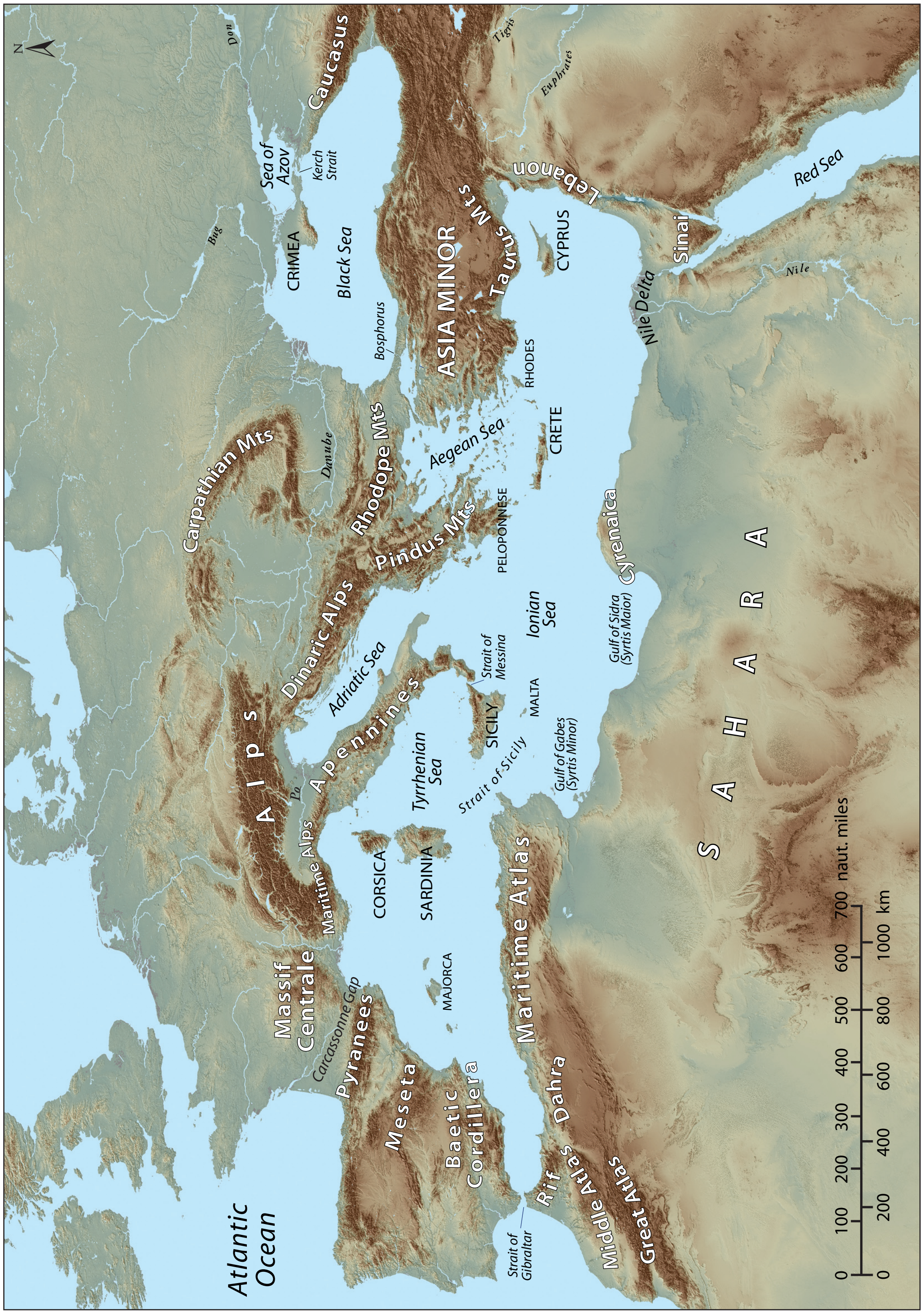


Fig. 2.1. Overview of the physical relief of Mediterranean coastlands and major geographic features.

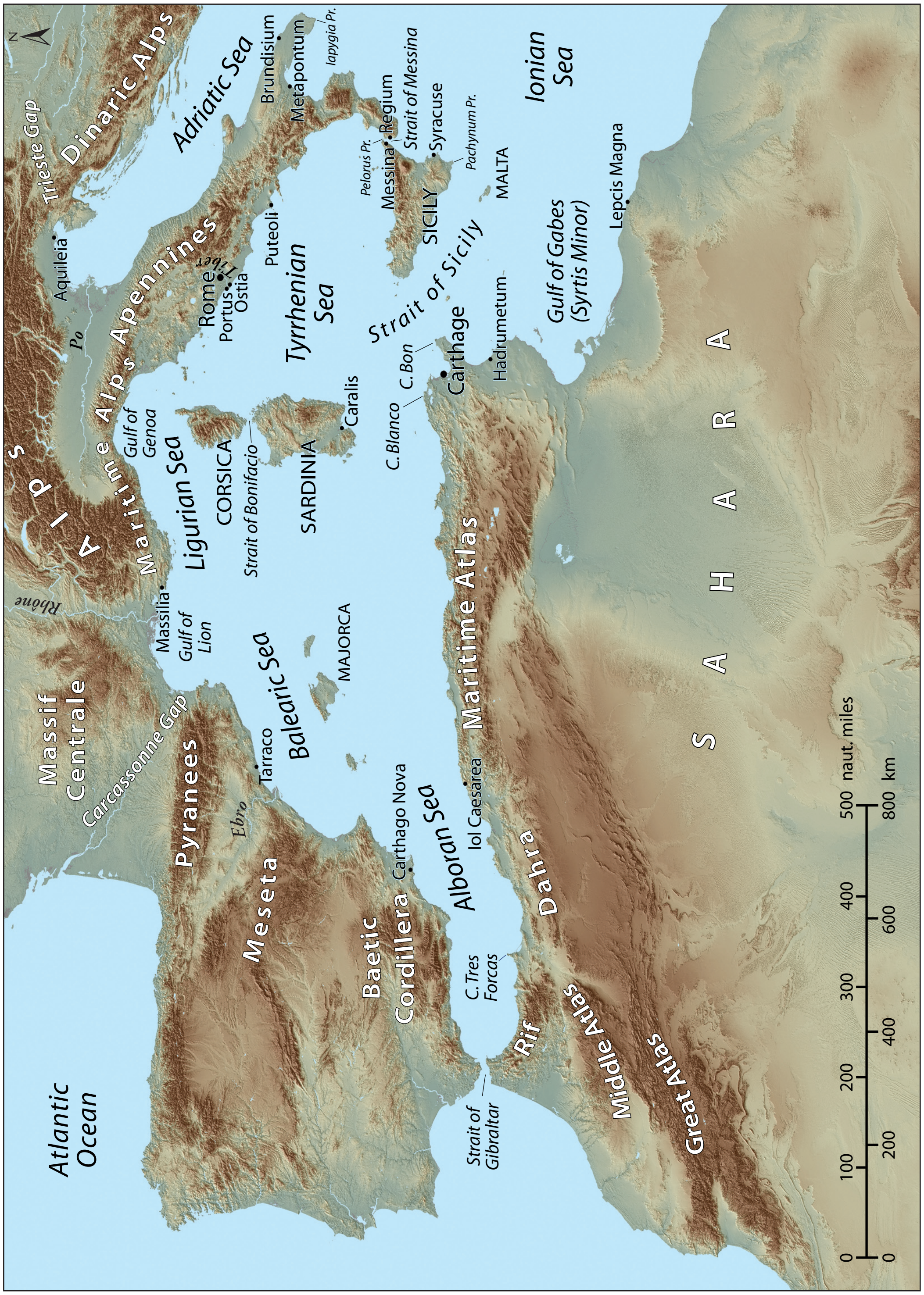


Fig. 2.2. Physical relief of the Western Mediterranean and the main cities mentioned in the text.

Fig. 2.3. Physical relief of the Eastern Mediterranean and the main cities mentioned in the text.

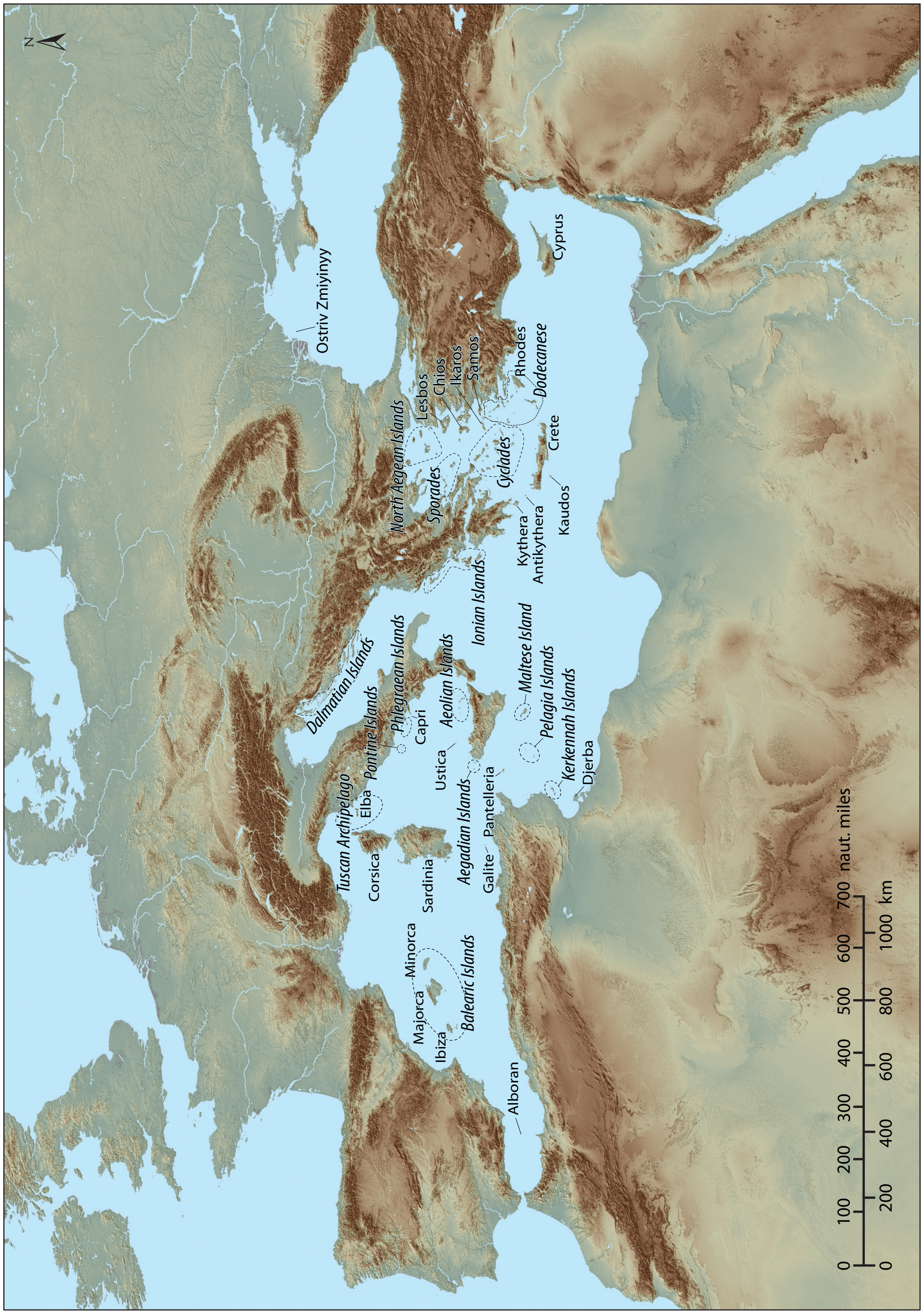


Fig. 2.4. Islands and island groups of the Mediterranean.

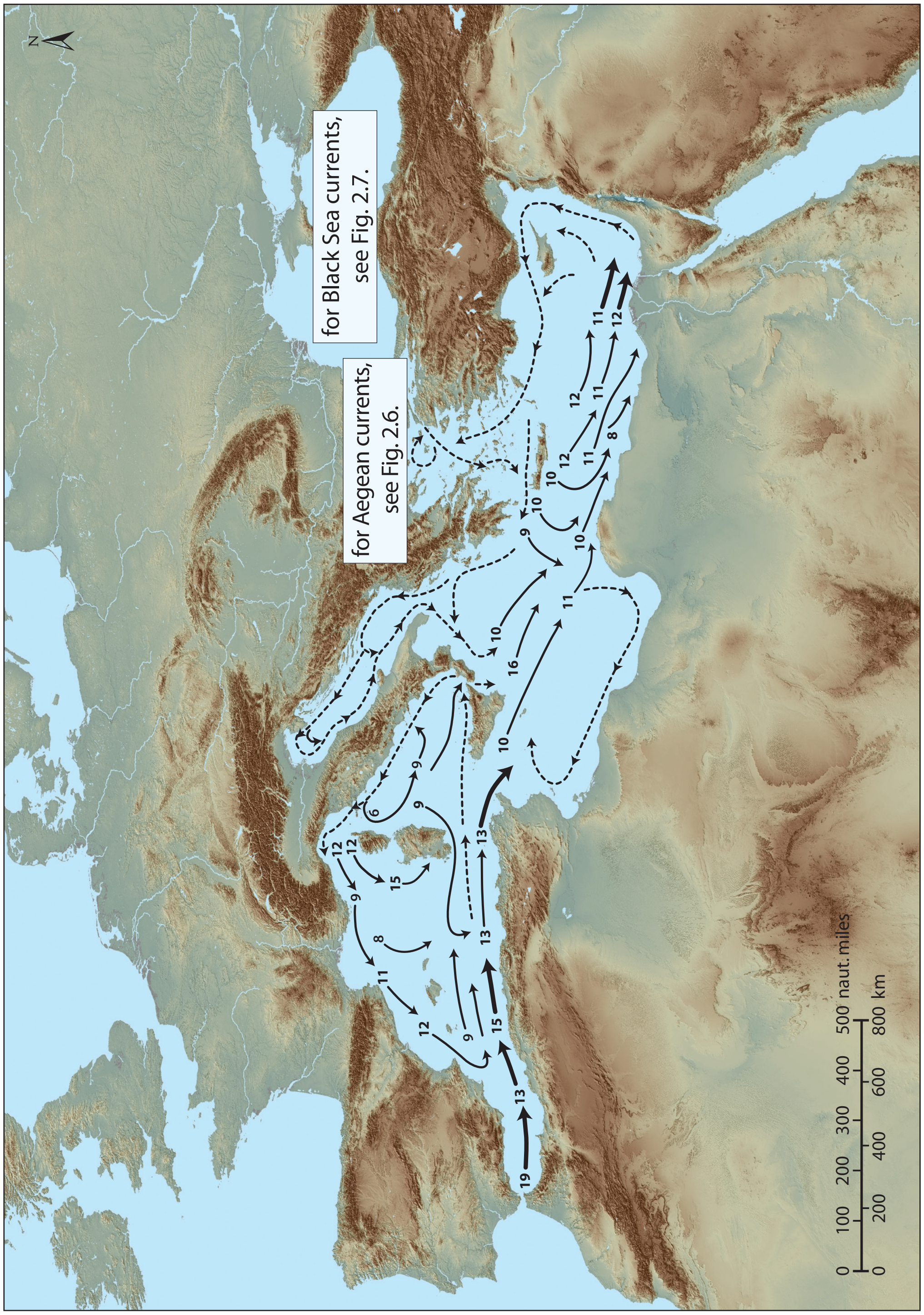


Fig. 2.5. Mediterranean currents in May, June and July. The figures give the rate in nautical miles per day. Thicker arrows indicate greater current consistency. Dashed arrows indicate weak and inconsistent currents (after *MedPilot* V, fig. 3).

Fig. 2.6. Aegean currents during summer (after *NGCC* 1976; Heikell 1998, 23).

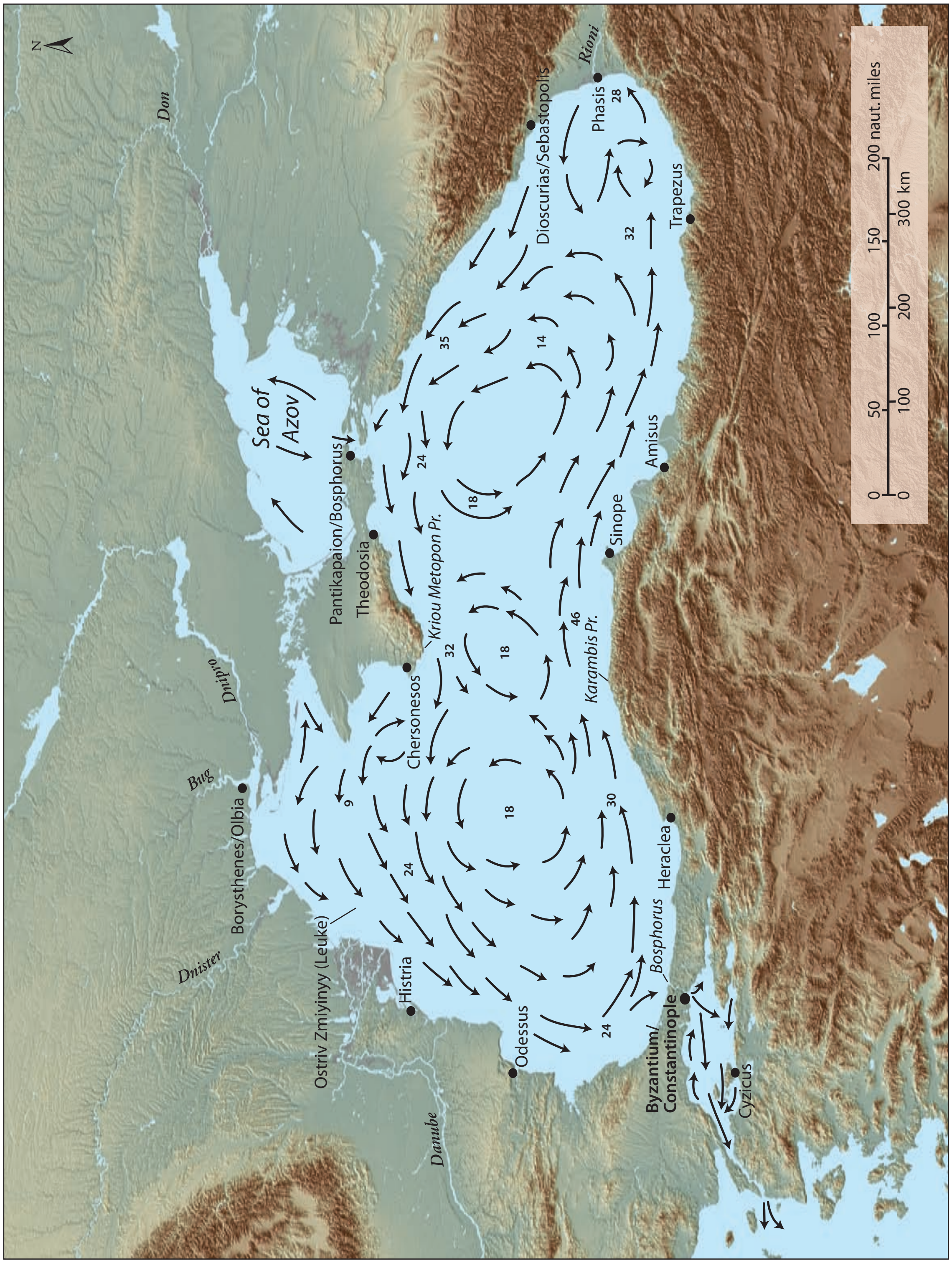


Fig. 2.7. Currents in the Black Sea, Sea of Marmara and Dardanelles. Figures give rate in nautical miles per day based on an annual average (after Sorokin 2002, fig. 2.3 and *BS Pilot* 24, 18–19).

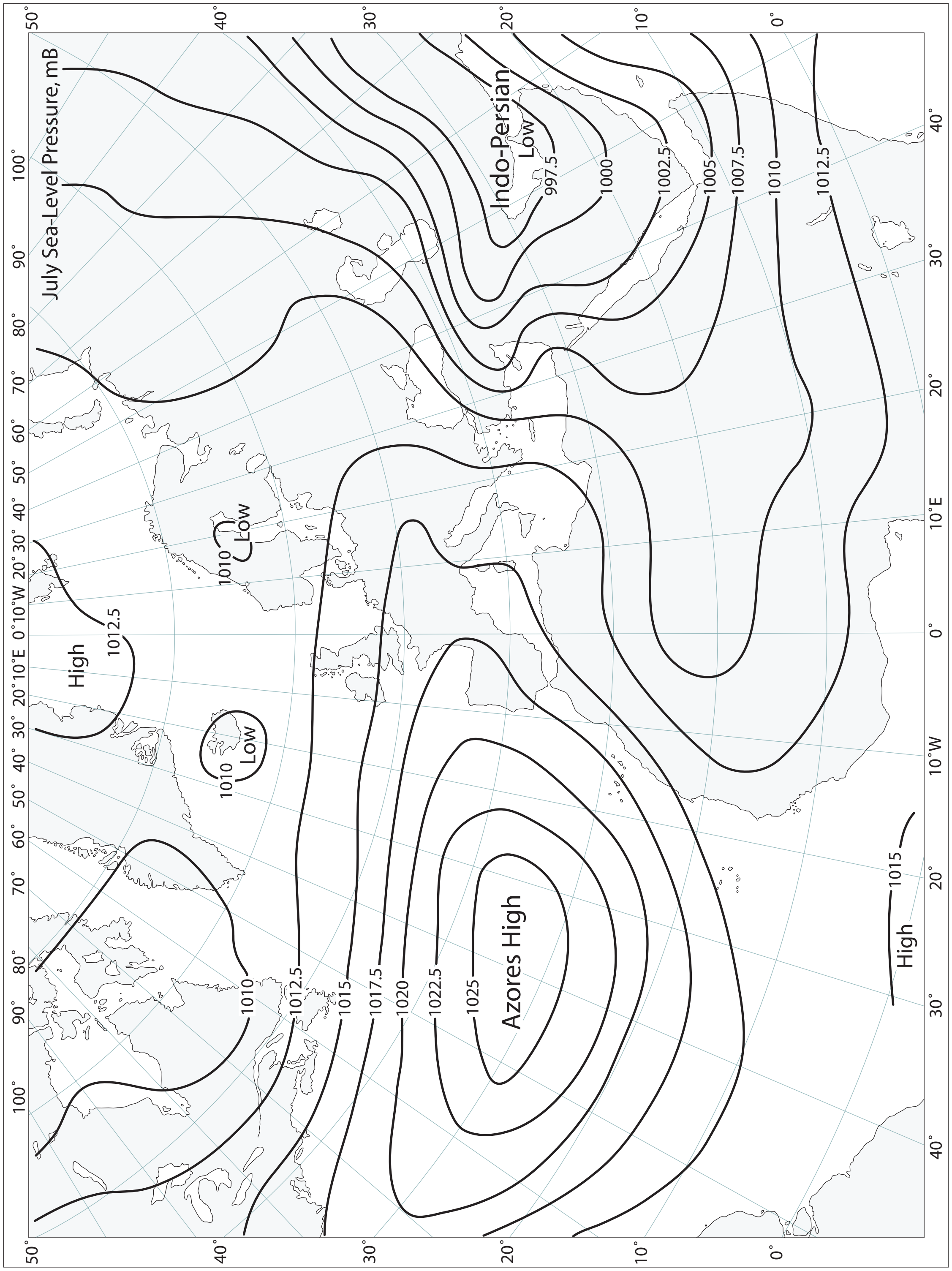


Fig. 2.8. Synoptic weather conditions in July (after *WIM* I, fig. 1.13).

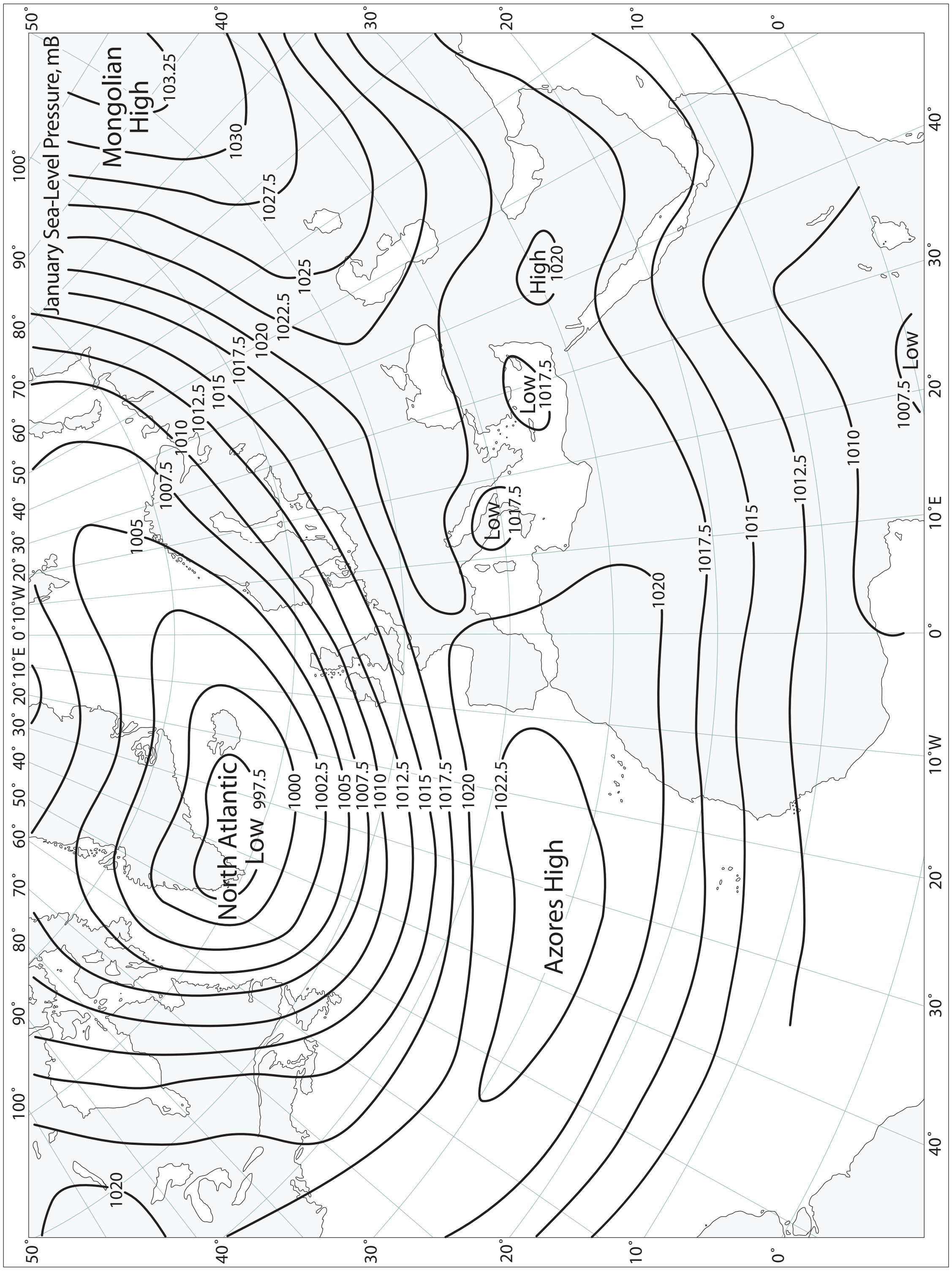


Fig. 2.9. Synoptic weather conditions in January (after *WIM* I, fig. 1.7).

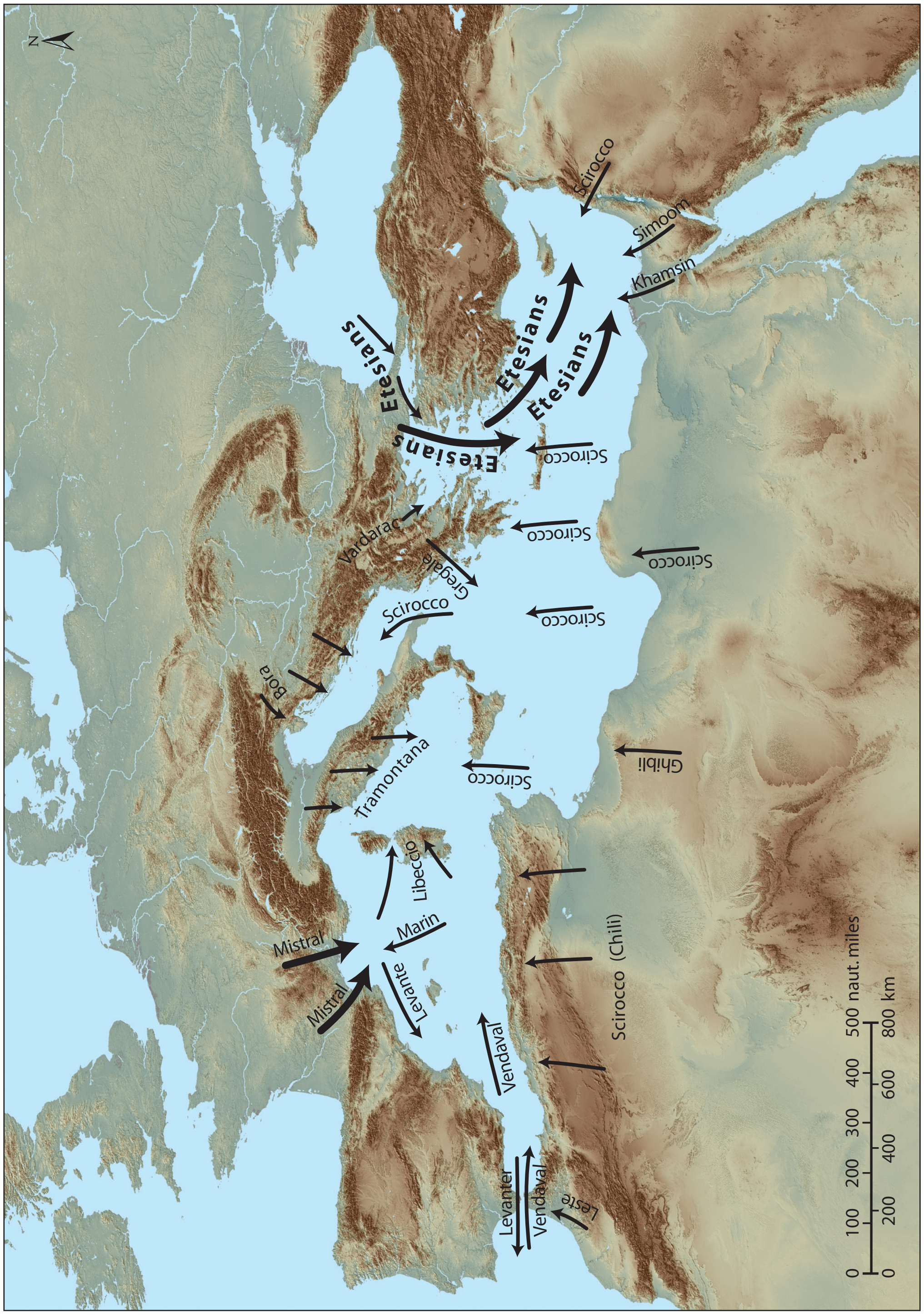


Fig. 2.10. Main regional winds of the Mediterranean (after Reiter 1975, fig. I-C-2; *WIM* I, fig. 1.20).

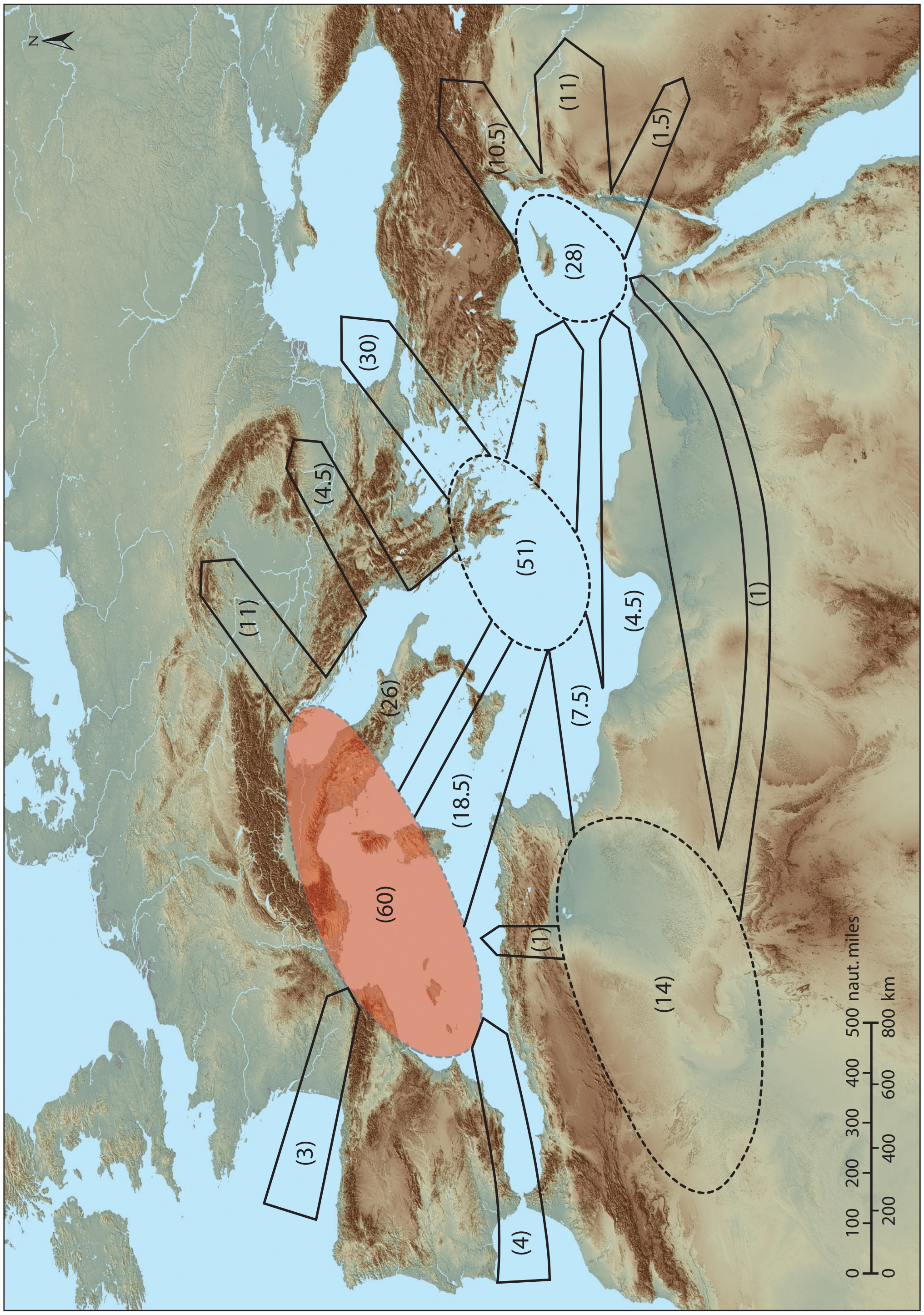


Fig. 2.11. Average direction and annual frequency of depression tracks in the Mediterranean and Black Sea (after *WIM* I: fig. 1.6).

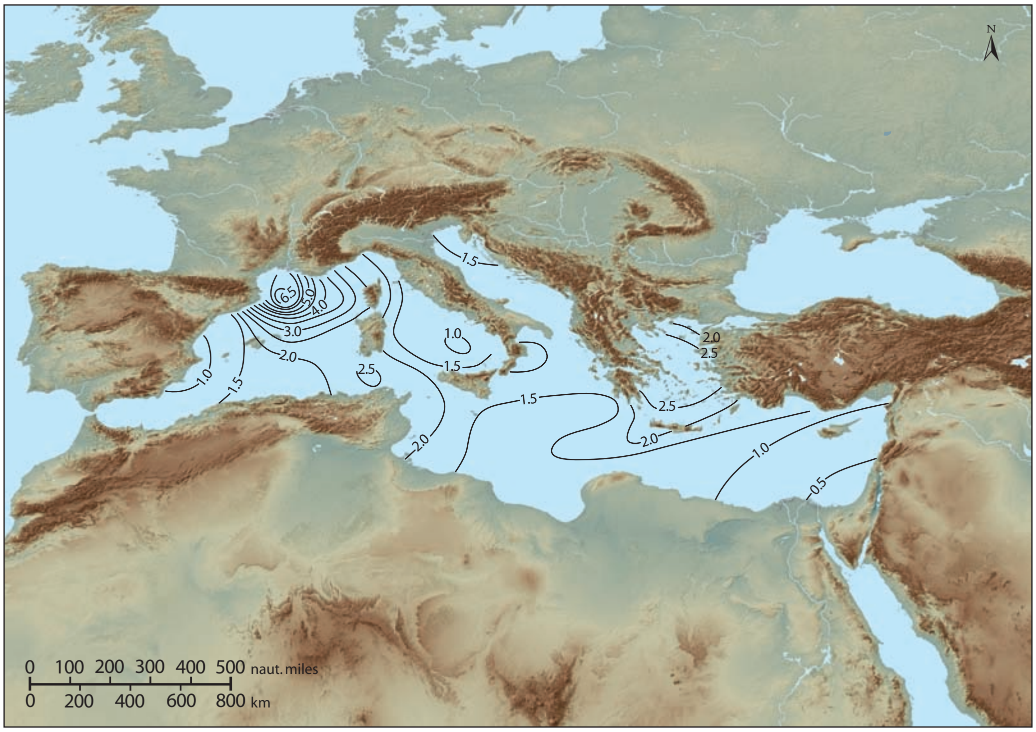


Fig. 2.12. Mean annual percentage frequencies of observations of gales (after *WIM*, 1: figs. 1.25–6).

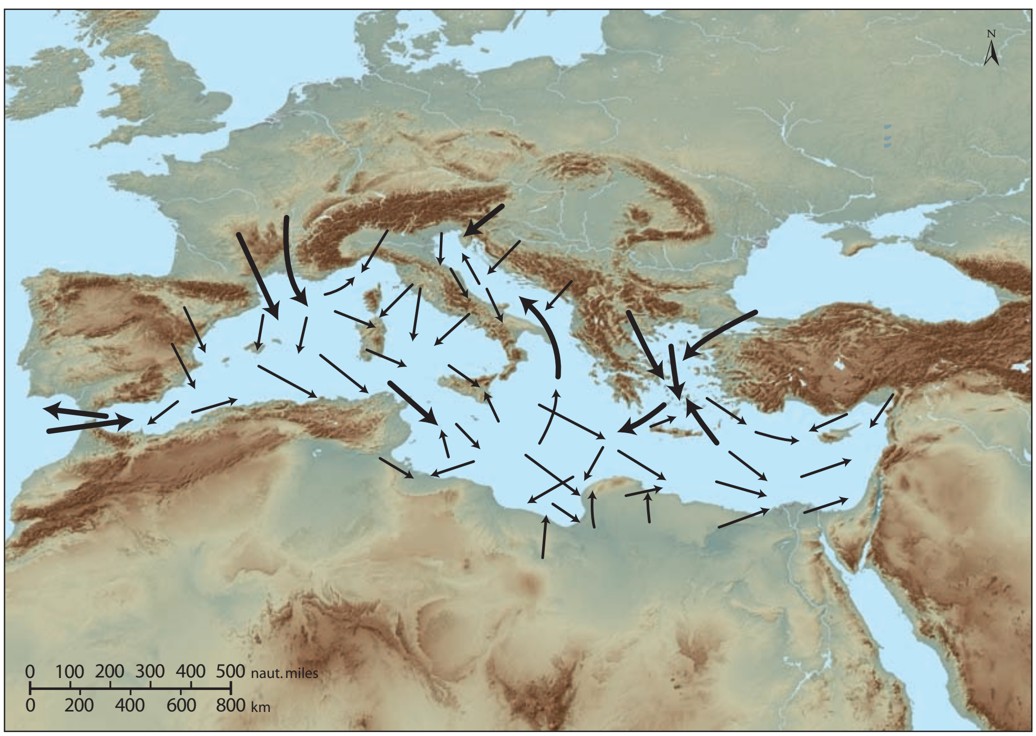


Fig. 2.13. Direction of gales in the Mediterranean. Thicker arrows indicate the greatest frequency of direction (after *WIM*, 1: figs. 1.25–6).

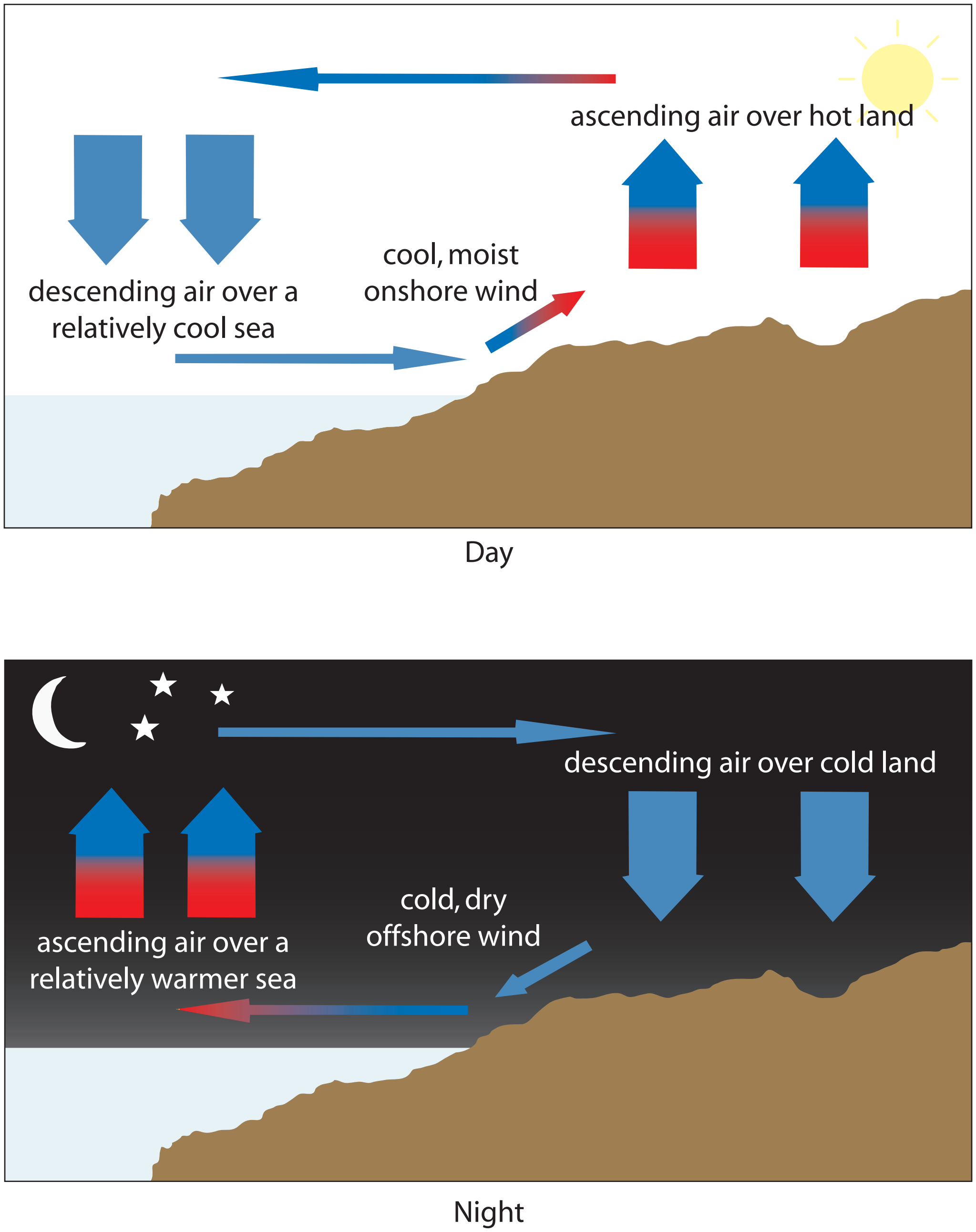


Fig. 2.14. The diurnal wind cycle (illustration by the author).

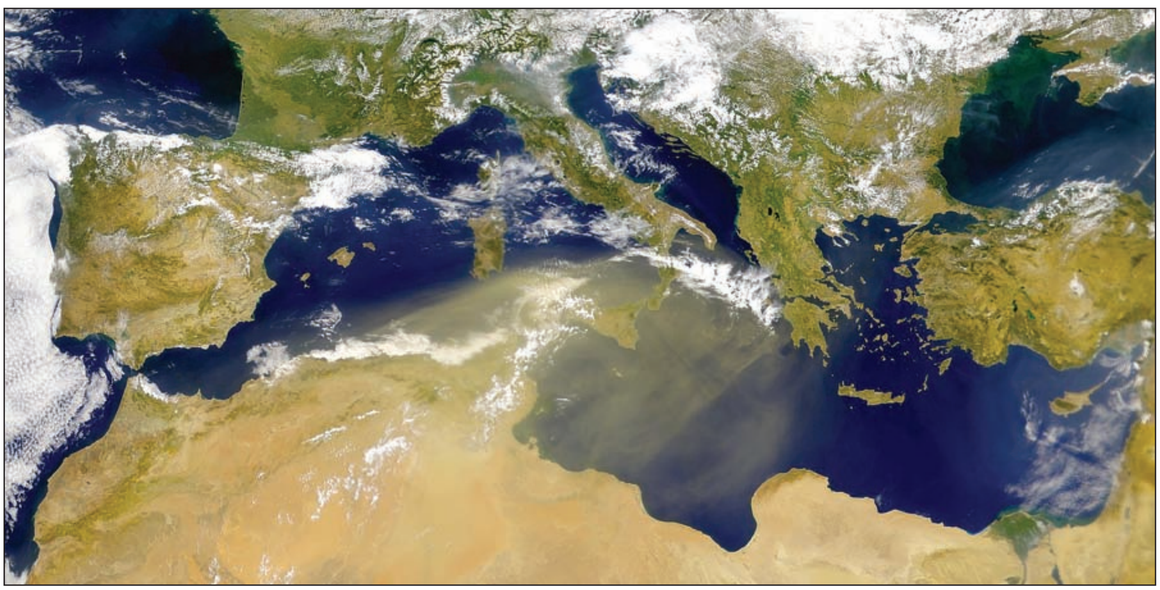
(A)

(B)

Fig. 2.15. (A) Developing weather off Mt. Athos in the Northern Aegean in October, 2003. (B) Strong katabatic wind striking the water in the same vicinity a few minutes later (photos: Dana Yoerger. Reproduced with permission).

Fig. 2.16. Geographic range of visibility. Gray represents areas out of sight of land in optimal conditions (after Chapman 1990, fig. 59).

(A)



(B)

Fig. 2.17. (A) Saharan dust storm over the Eastern Mediterranean in April, 2000. (B) Saharan dust storm over the western and central Mediterranean on July 18, 2000 (SeaWIFS, public domain).

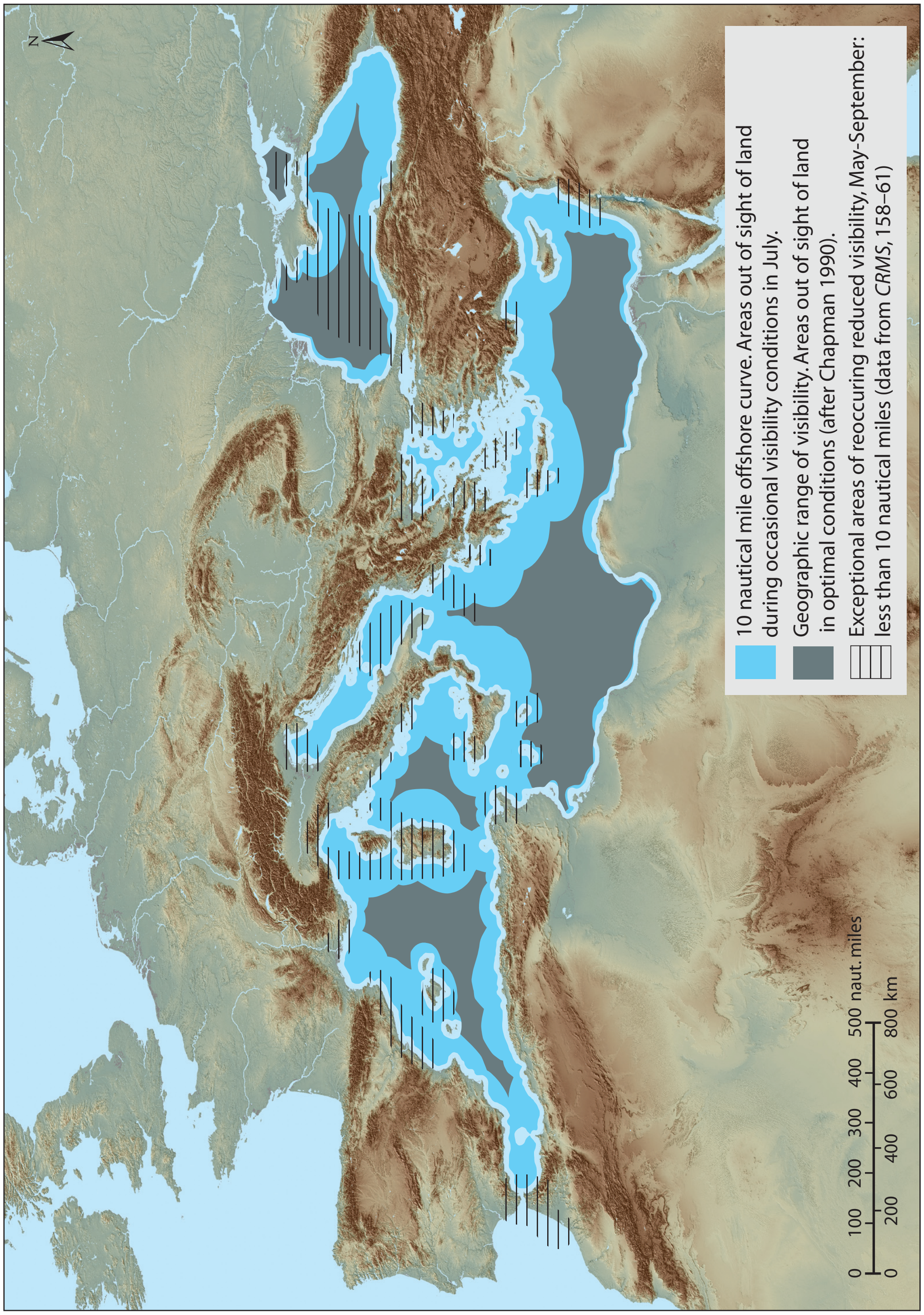


Fig. 2.18. Actual conditions of visibility in the Mediterranean during summer months.

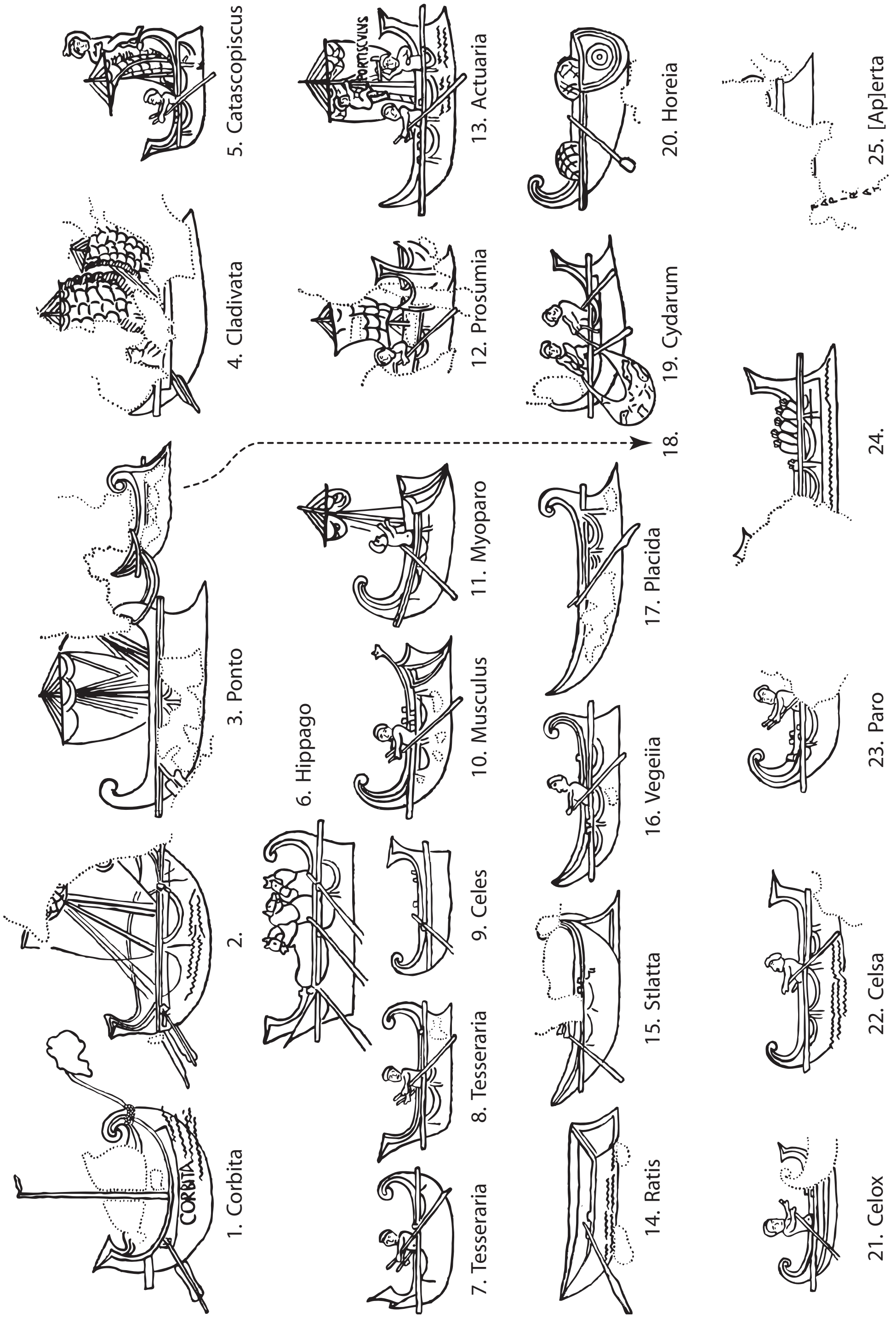


Fig. 3.1. Composite illustration of the Althiburus mosaic from the fourth century A.D. (after Duval 1949, pl. III).

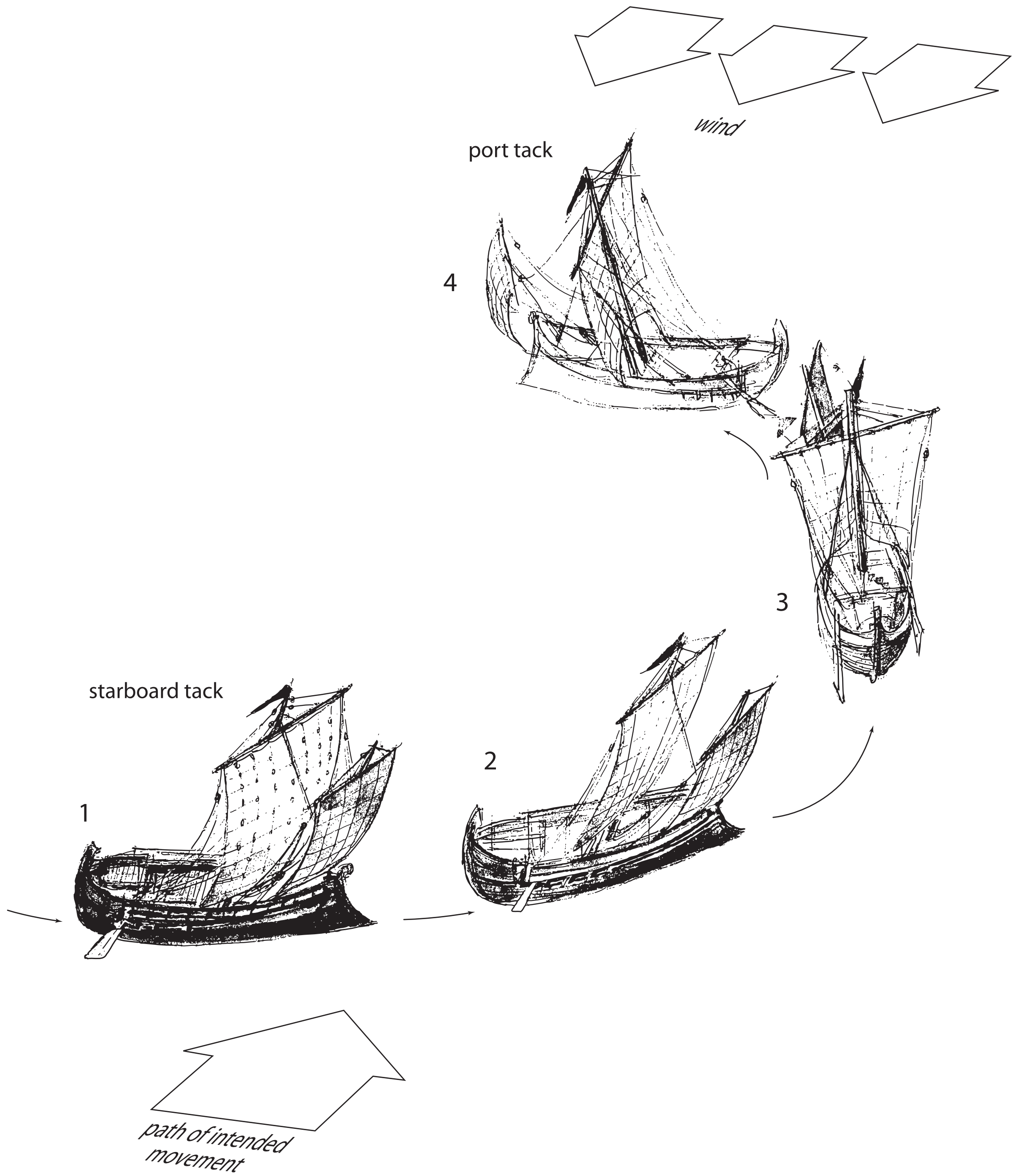


Fig. 3.2. Schematic of a Roman merchant ship tacking from starboard to port (after J.-M. Gassend in Reddé and Golvin 2005, 17).

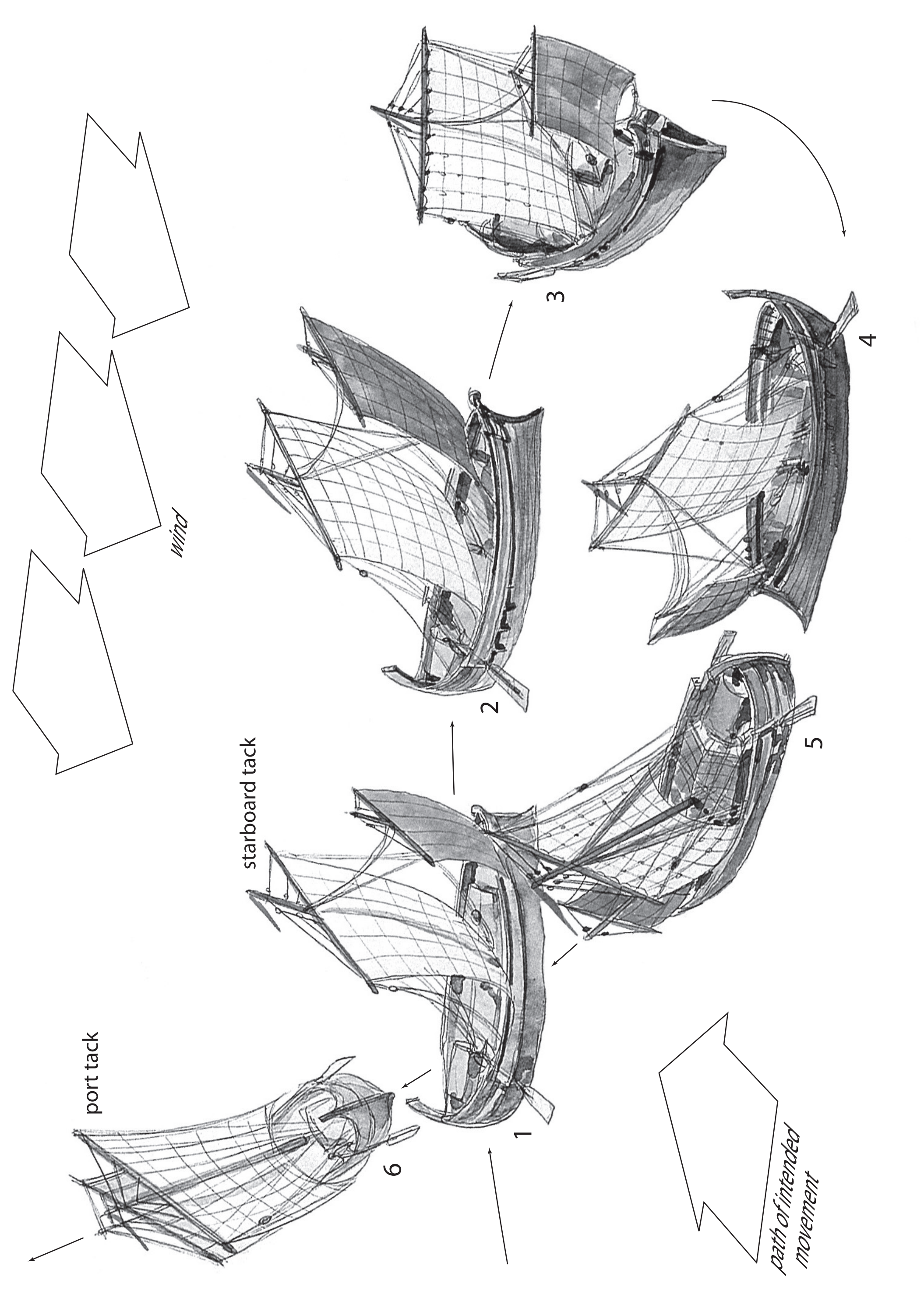


Fig. 3.3 Schematic of a Roman merchant ship coming about on another tack by wearing (after J.-M. Gassend in Reddé and Golvin 2005, 16).

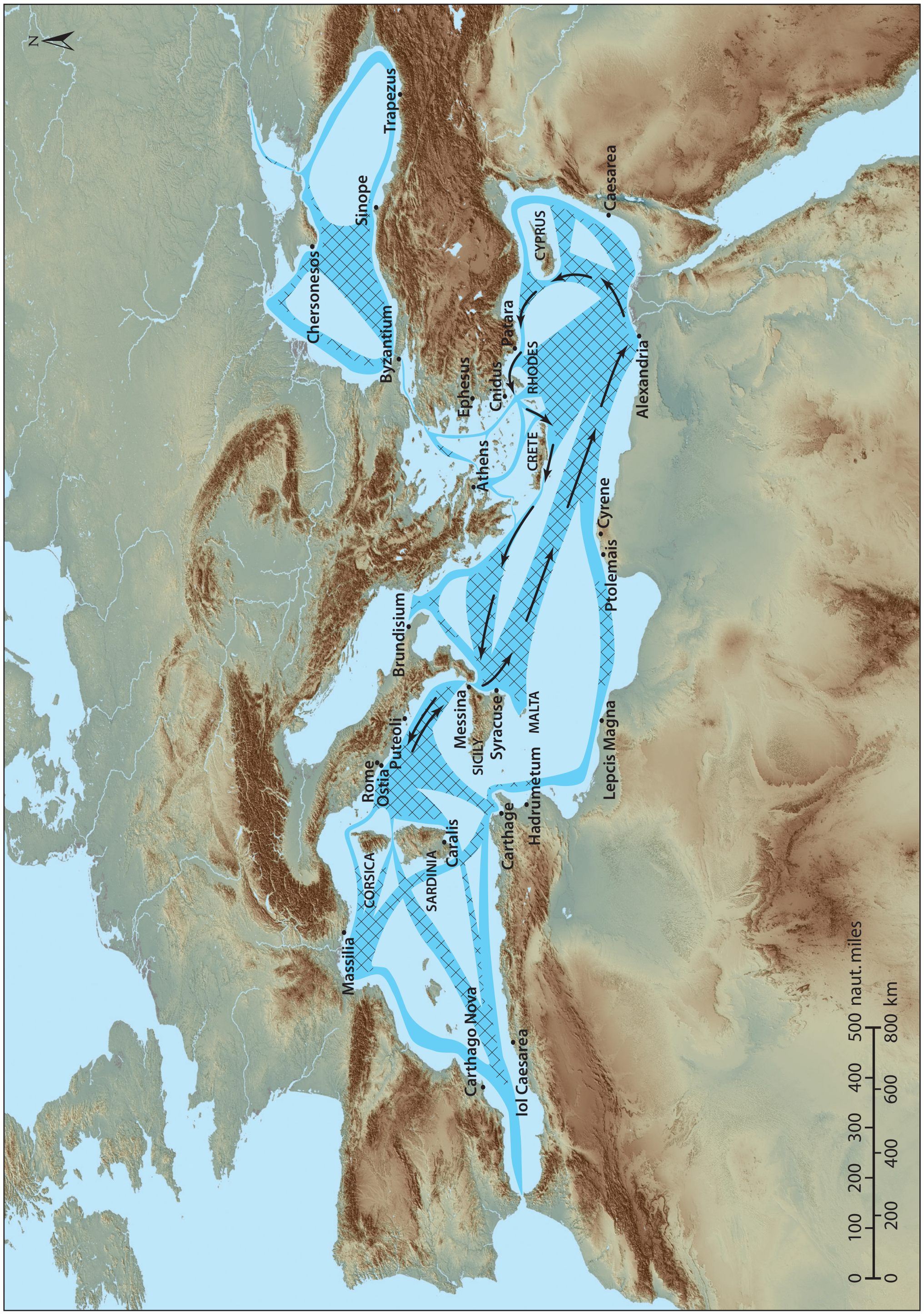


Fig. 3.4. A reconstruction of Greek and Roman maritime corridors. The arrows signify the general counterclockwise maritime corridor used by Alexandrian merchant ships. The diamond pattern represents areas within the corridors that typically are out of sight of land.

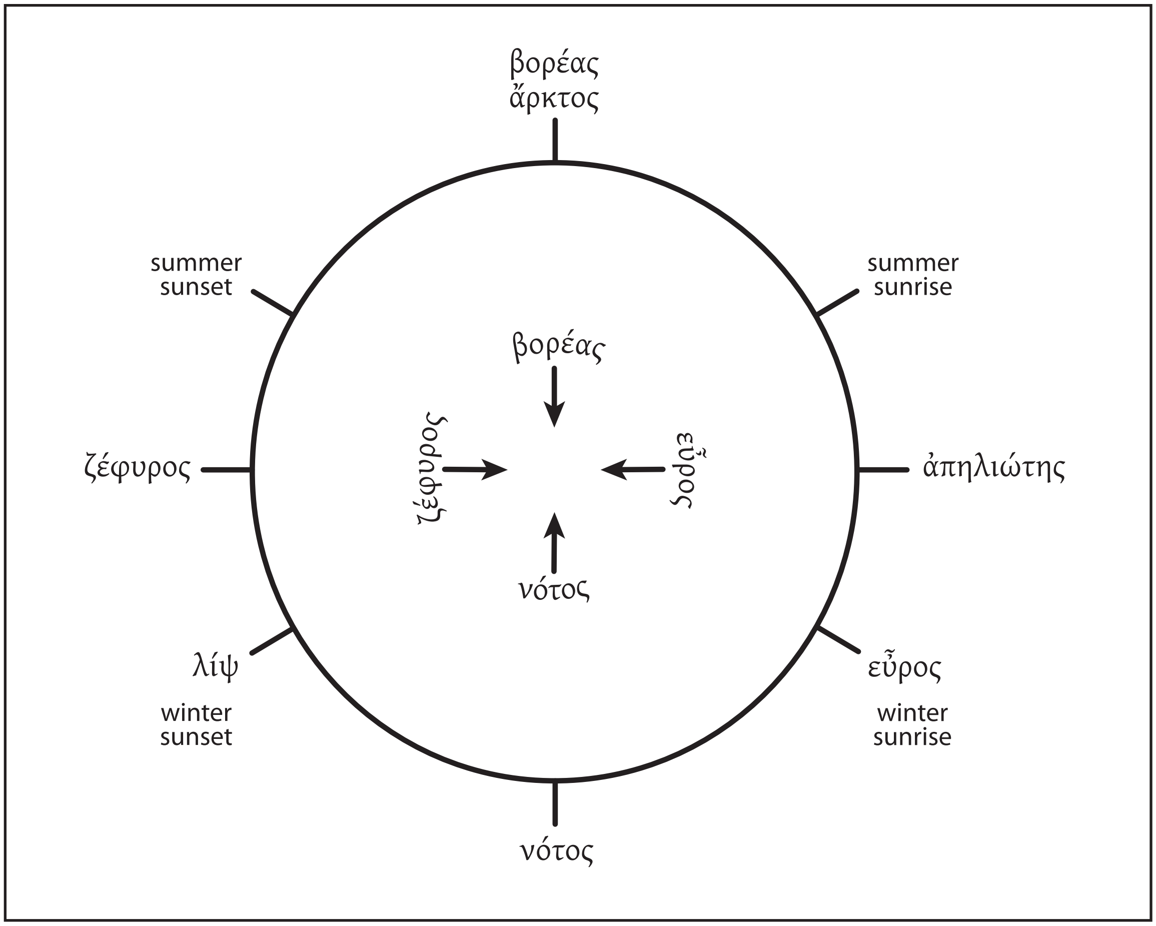


Fig. 4.1. Homeric winds (interior) and the eight-point horizon reference system employed by Classical-period writers (illustration by the author).

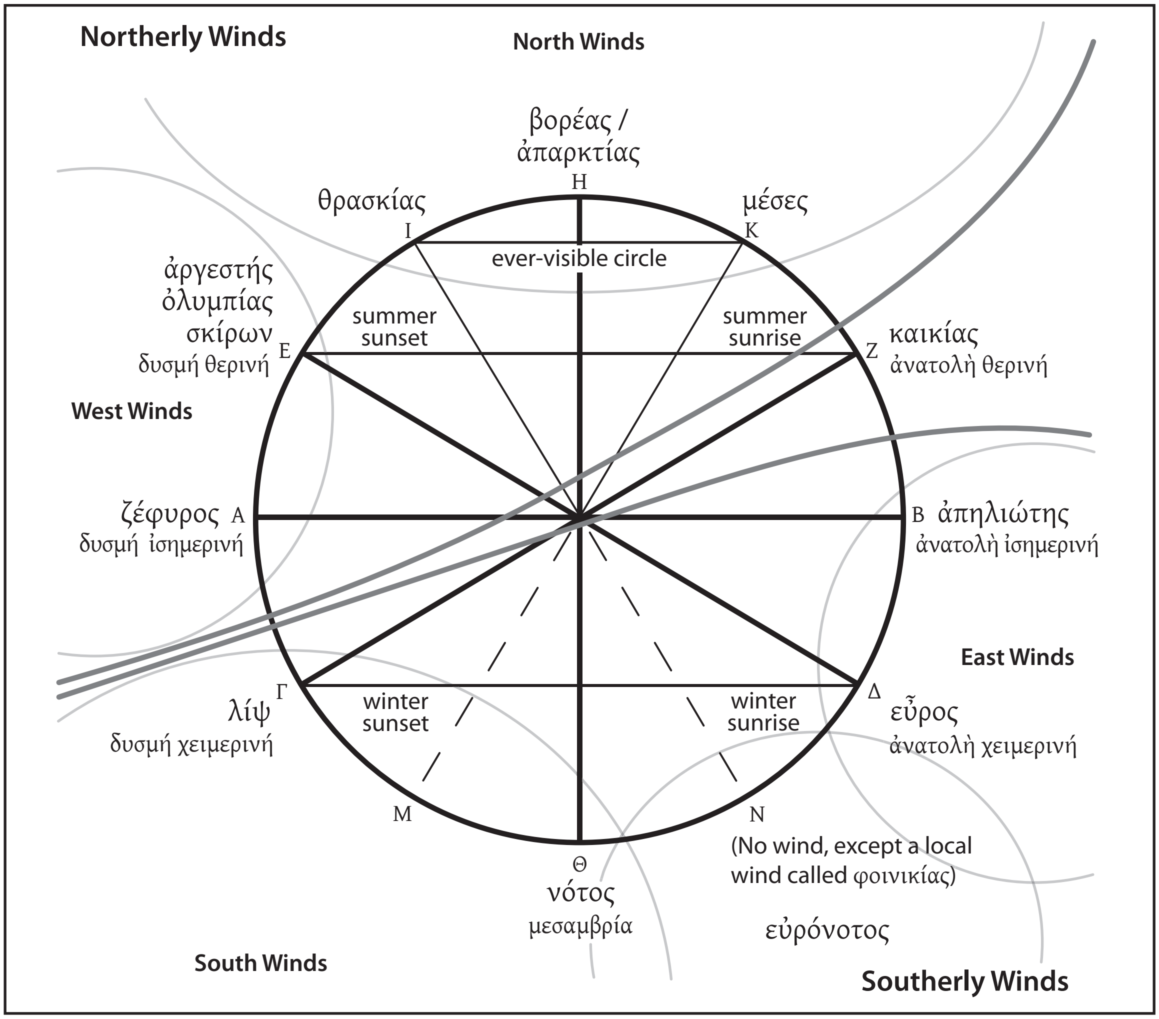


Fig. 4.2. Aristotle's wind rose (*Met.* II.6). Aristotle describes three systems: (a) an 11-point system (with variations), (b) a 4 point system of N, E, S and W, and (c) a dual classification of northerly and southerly winds. The Greek letters represent Aristotle's horizon points as outlined in his text (illustrated by the author; adapted from Kidd 1988, 516 fig. 13).

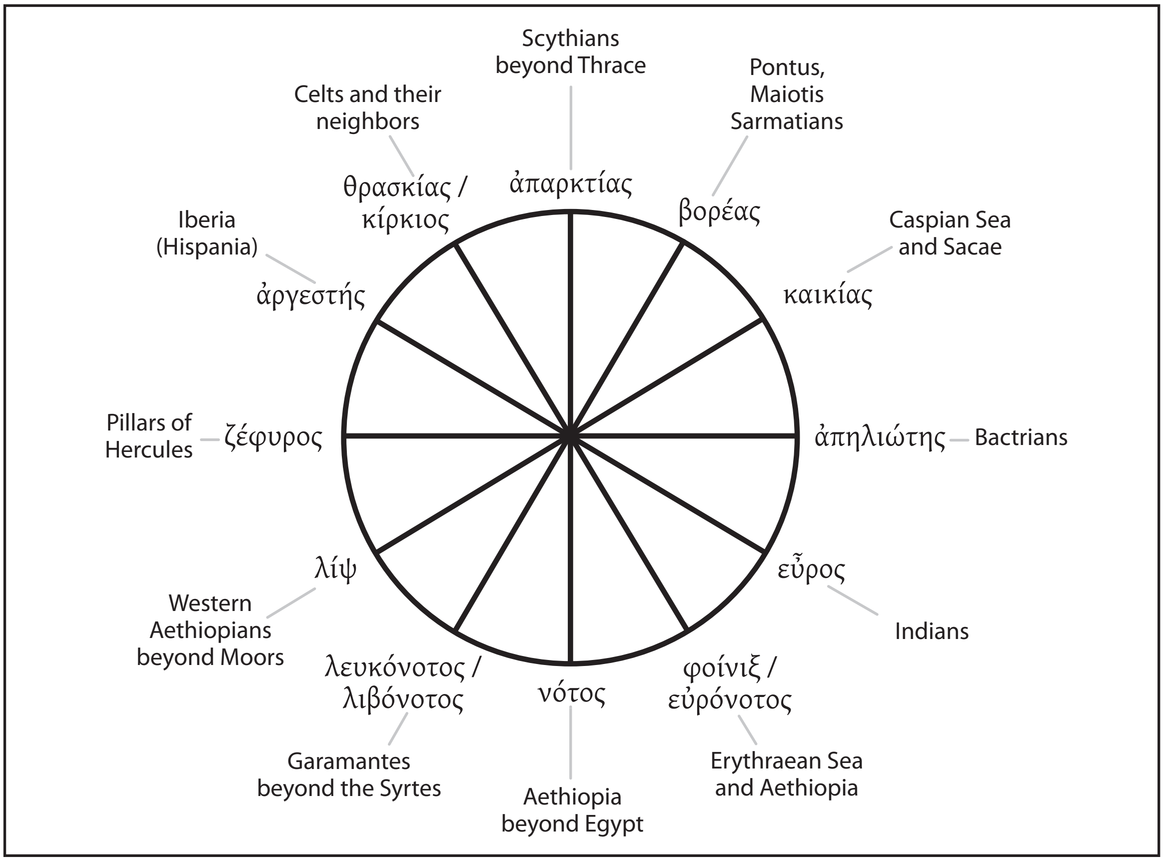


Fig. 4.3. Timosthenes' wind rose *apud* Agathem. 2.6–7 (illustration by the author).

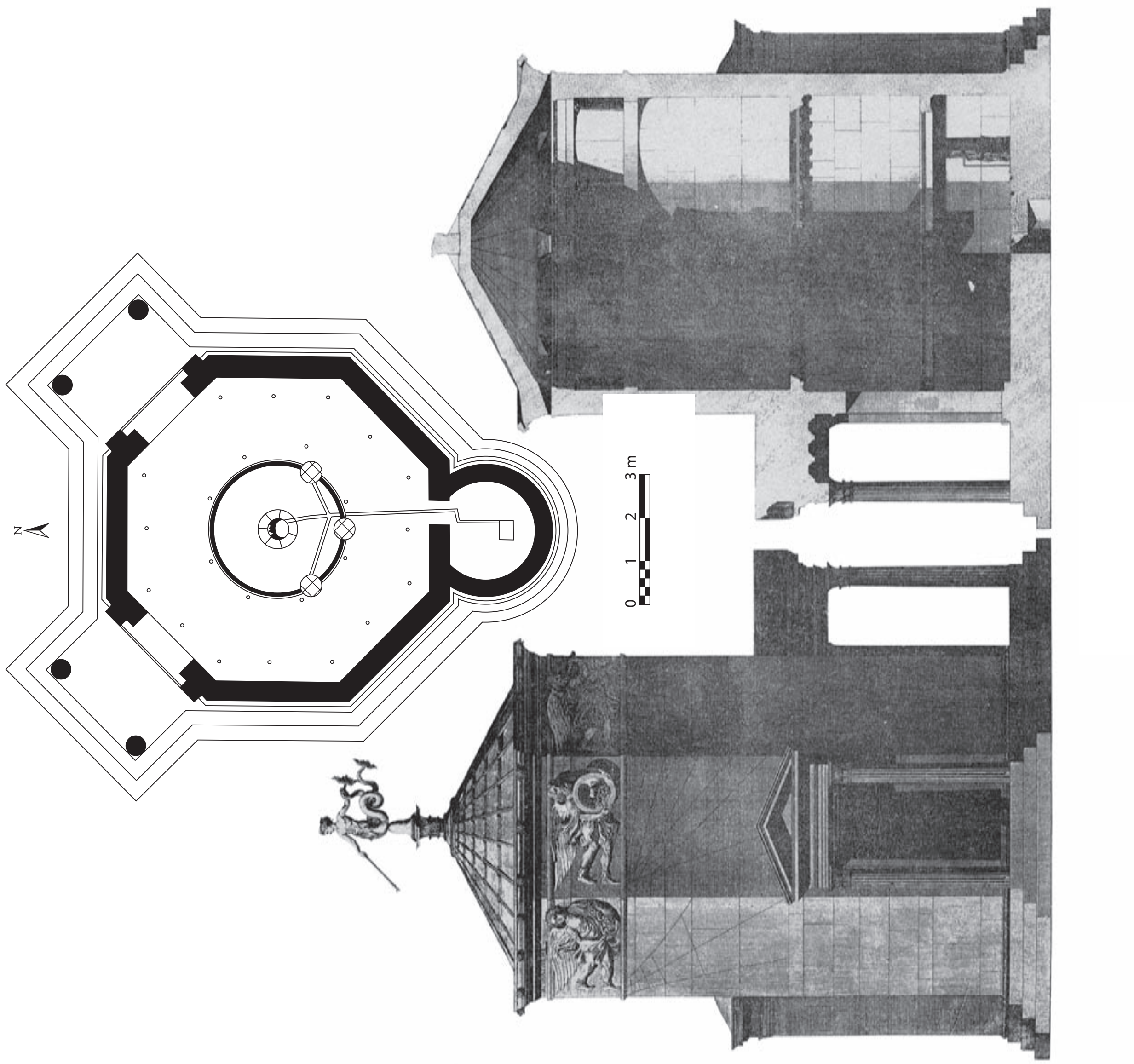


Fig. 4.4. The Horologion of Andronicus in Athens. Plan and reconstructed elevation (plan by the author after Stuart and Revett 1825, pl. 66; elevations from Stuart and Revett 1825, pl. 65).

Fig. 4.5. Exterior view of the Horologion of Andronicus (photograph by the author).

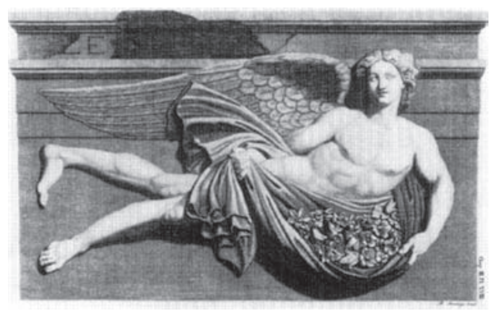
Boreas (N)

Notos (S)

Kaikias (NE)

Lips (SW)

Apeliotes (E)



Zephyros (W)

Euros (SE)

Skiron (NW)

Fig. 4.6. Personifications of the eight winds on the Horologion of Andronicus (from Stuart and Revett 1825, plates 72–5).

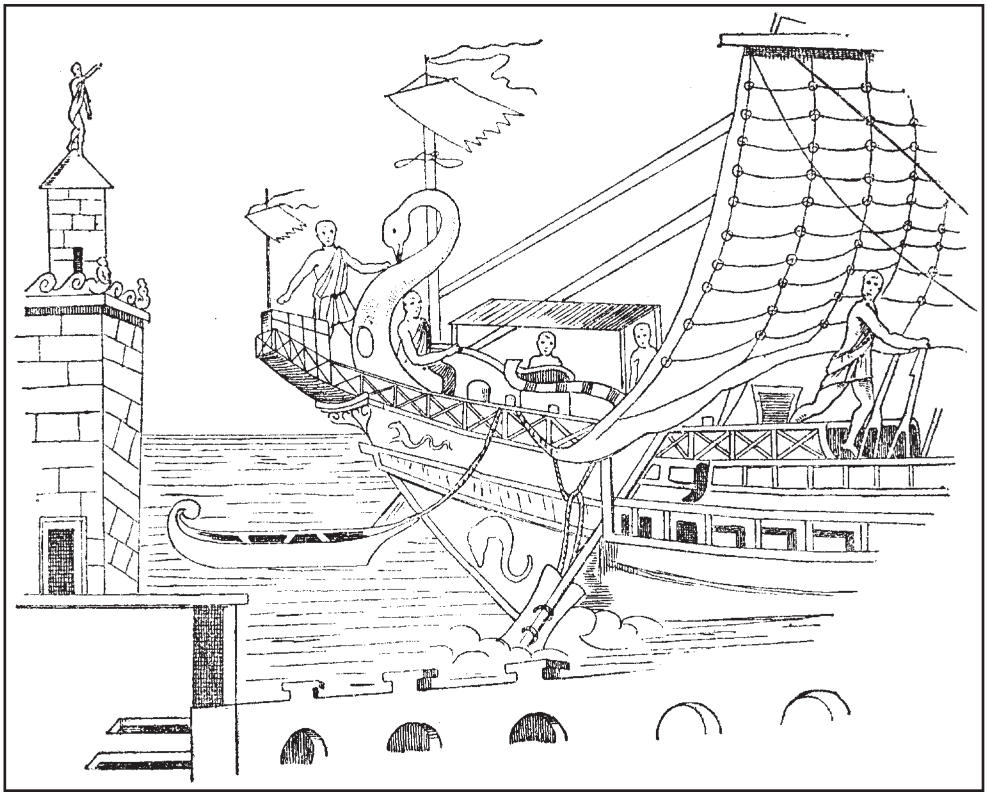


Fig. 4.7. Ship at the entrance of Rome's harbor, from a house mosaic in Rome, third century A.D. (from Köster 1923, Abb. 41).

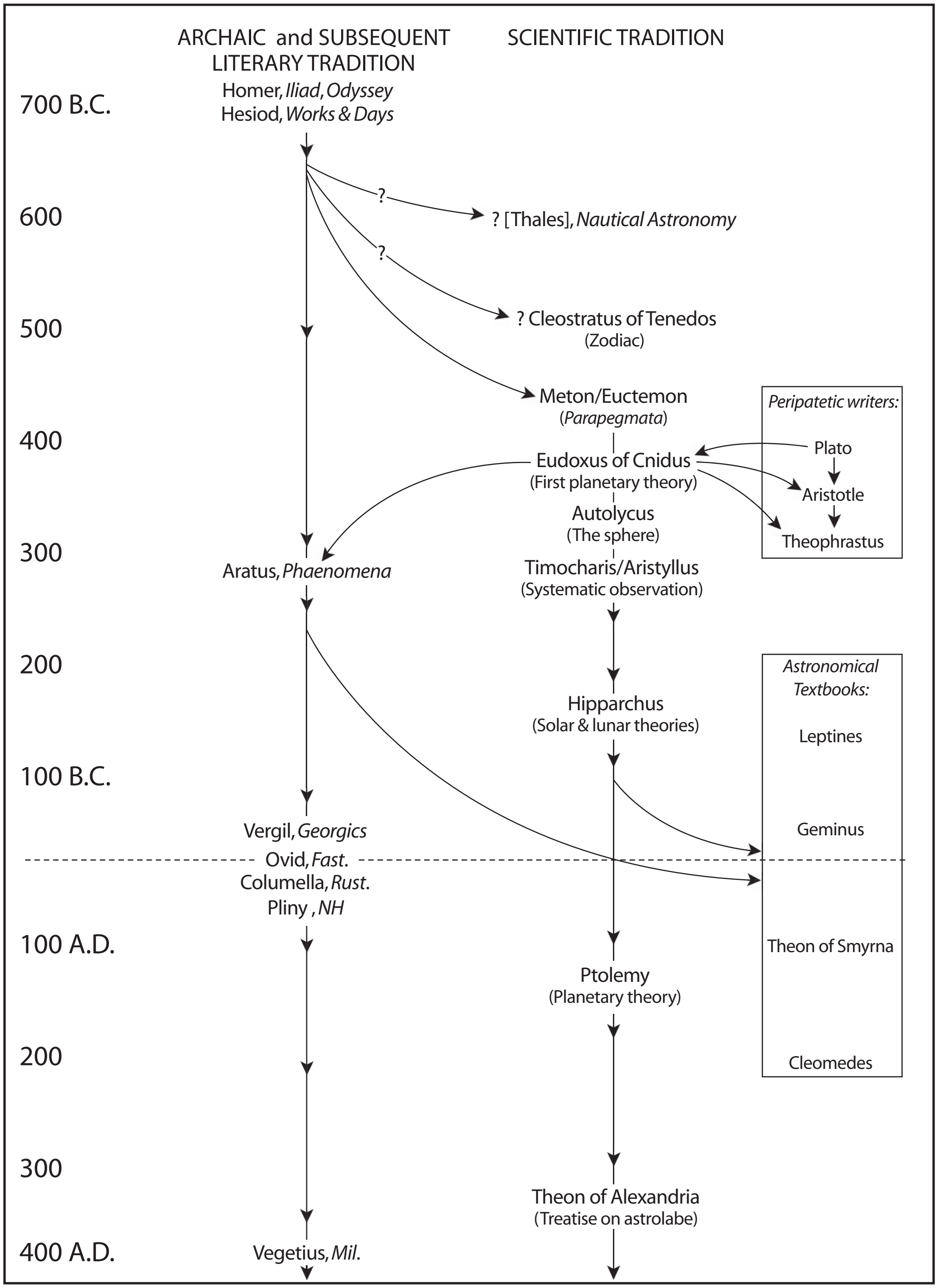


Fig. 5.1. An outline of Greek astronomy. The arrows show connections between traditions and directions of influence (adapted from Evans 1998, fig. 1.5).

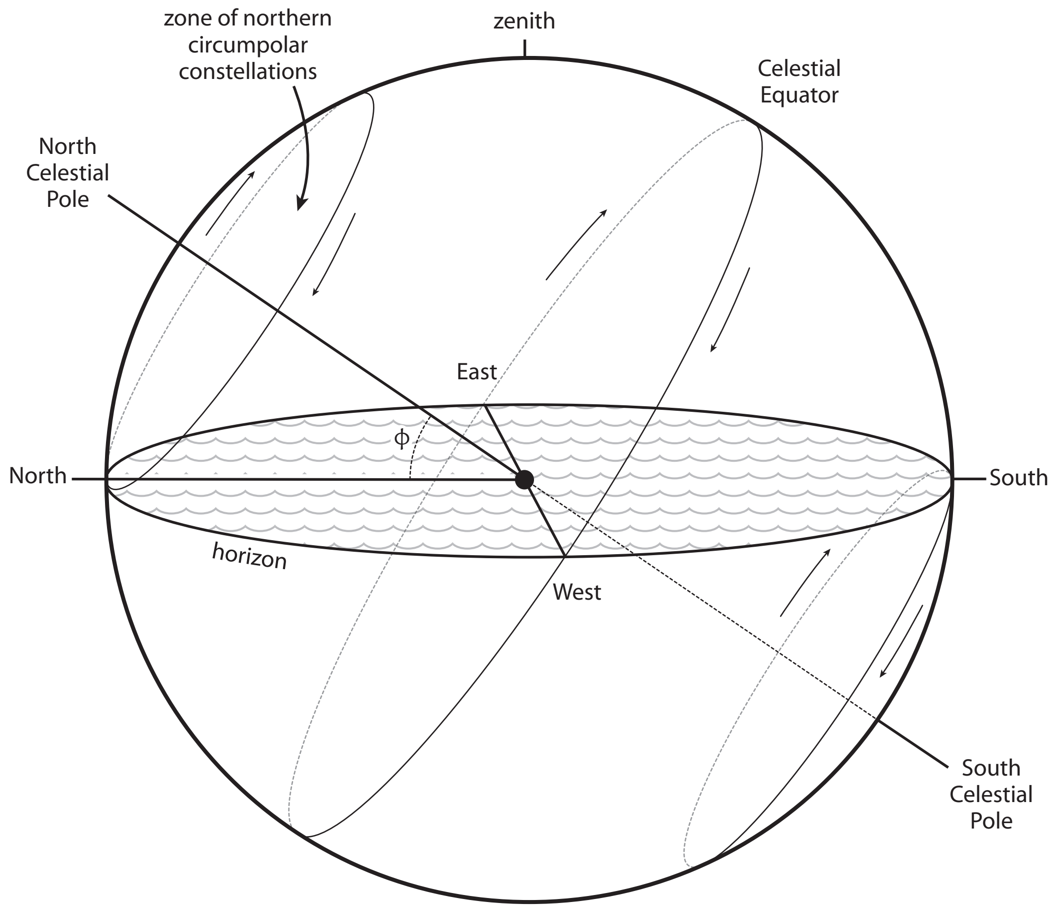


Fig. 5.2. The main features of the celestial sphere (illustration by the author).

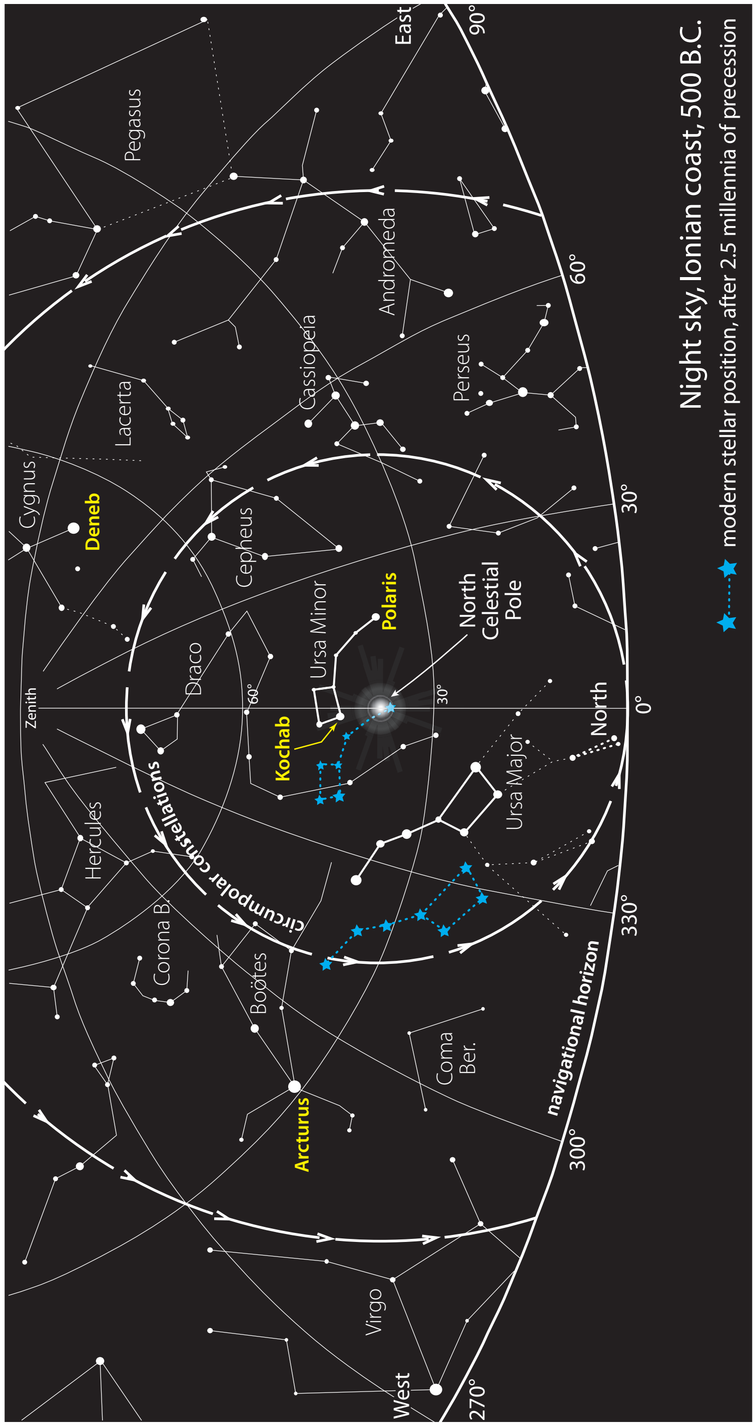


Fig. 5.3. The northern night sky from the Ionian coast, 500 B.C.. Note the movements of Ursa Major and Ursa Minor (in blue dashes) due to the effects of precession over the past 2.5 millennia (illustration by the author).

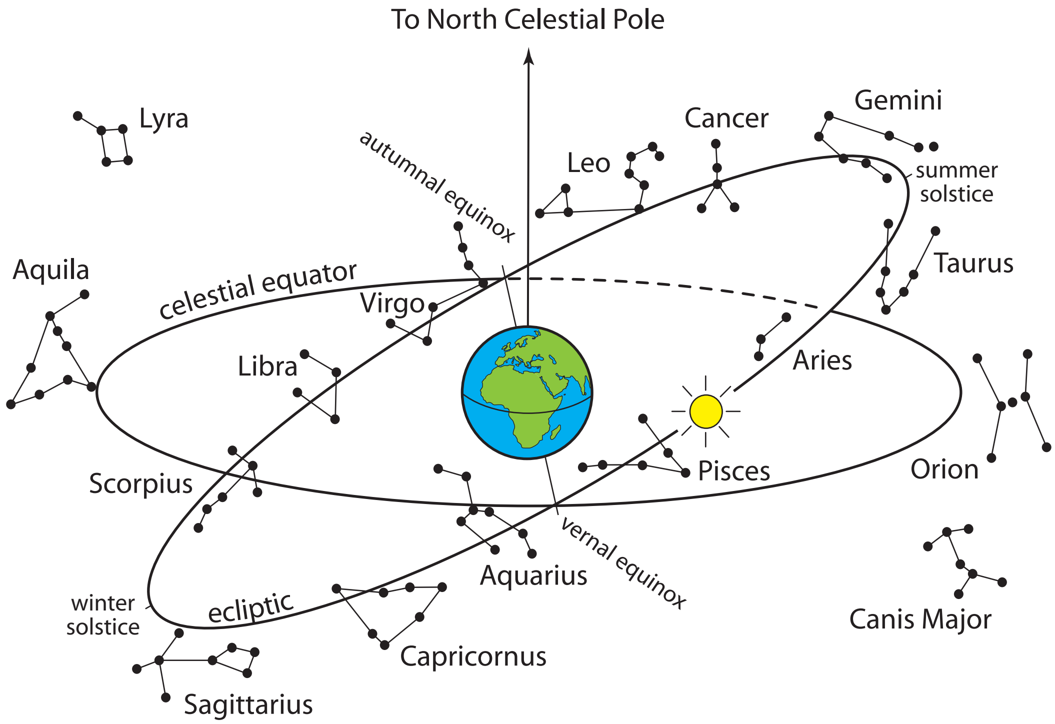


Fig. 5.4. Celestial equator, ecliptic and the Sun's path through the zodiacal constellations (illustration by the author).

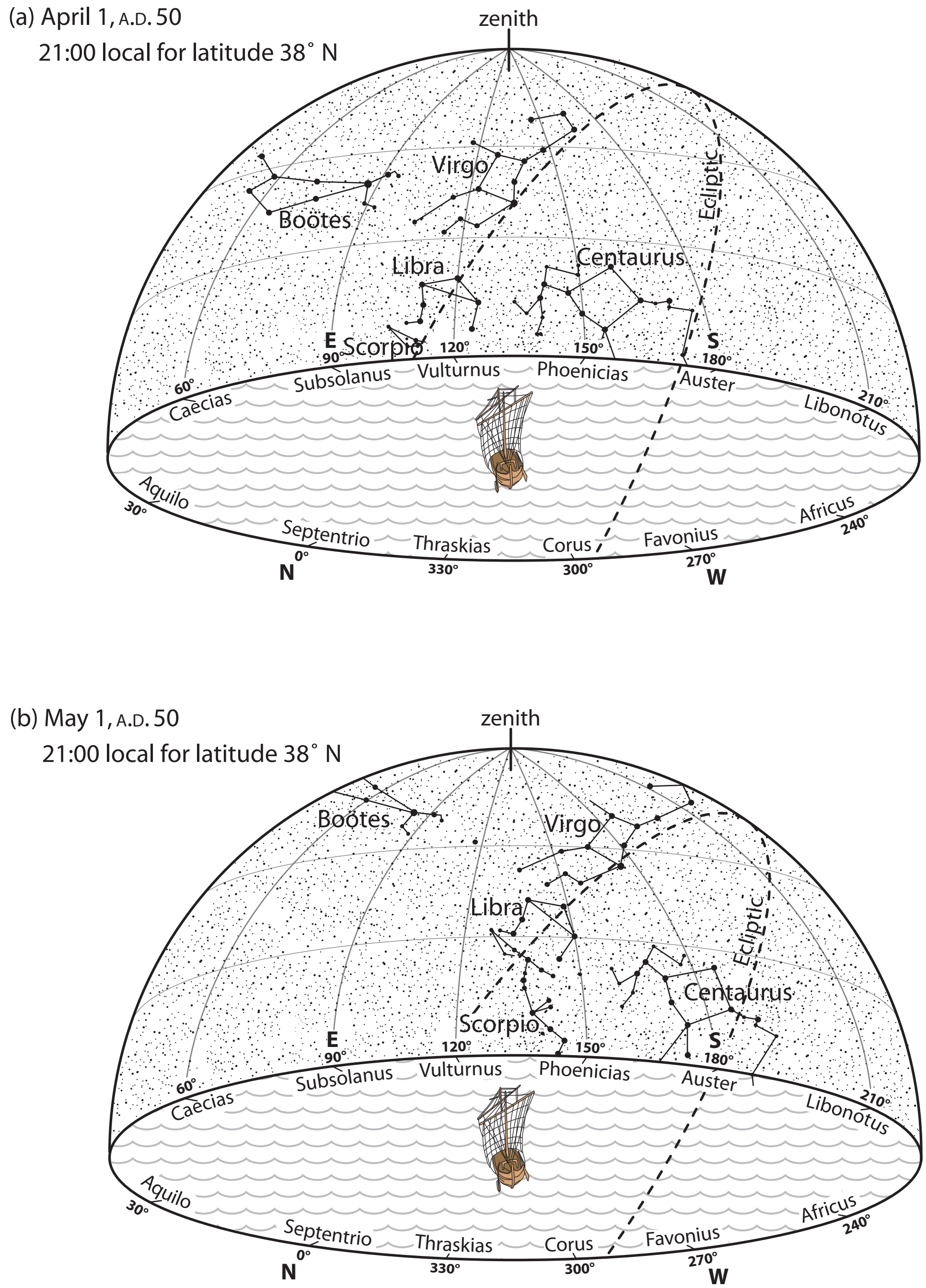


Fig. 5.5. A hypothetical Alexandrian grain ship sailing a mid-sea passage from the Strait of Messina to Alexandria on 1 April (a) and 1 May (b). In both scenarios, the local time is 21:00 in the year A.D. 50 (illustration by the author).

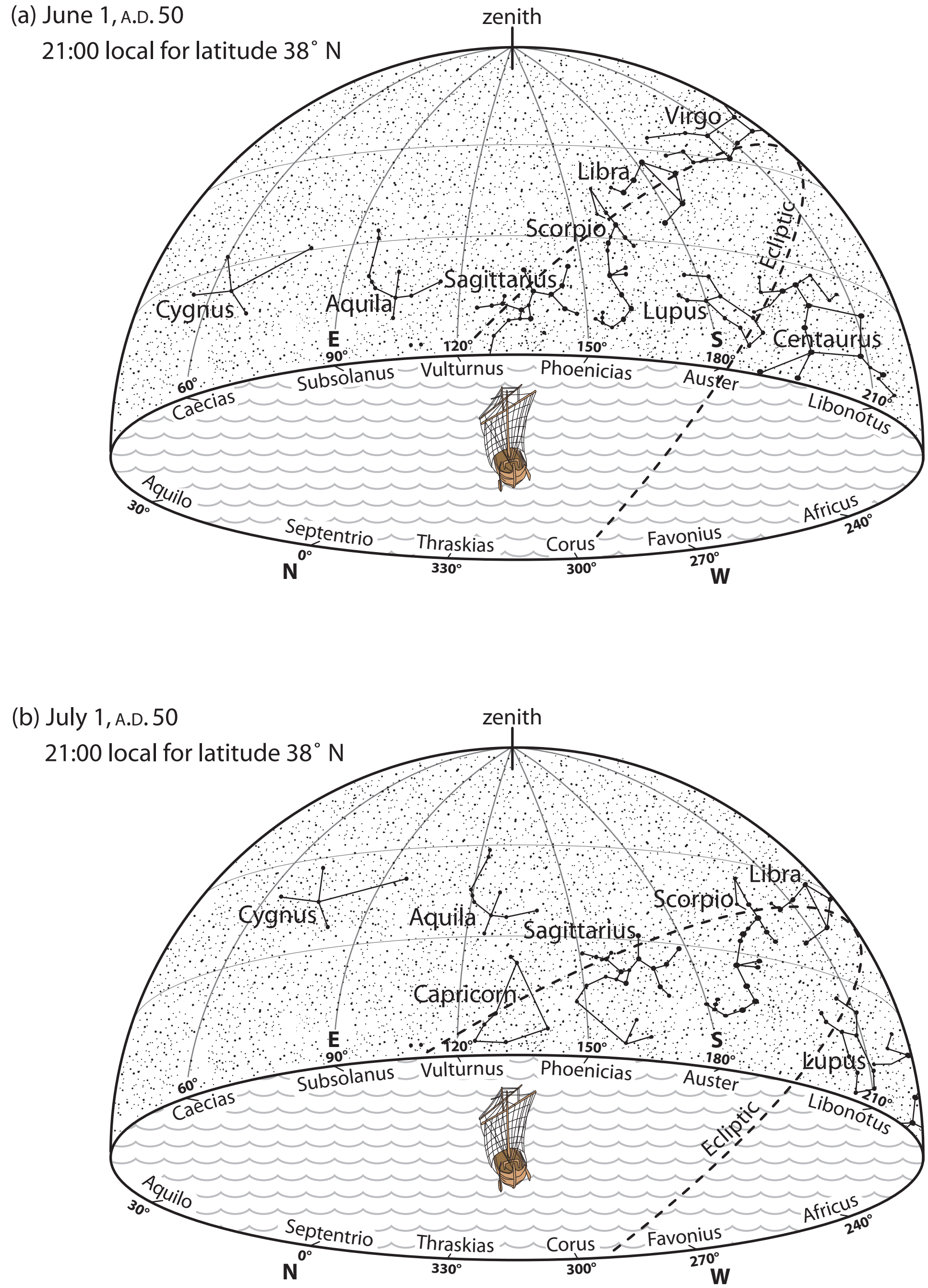


Fig. 5.6. A hypothetical Alexandrian grain ship sailing a mid-sea passage from the Strait of Messina to Alexandria on 1 June (a) and 1 July (b). In both scenarios, the local time is 21:00 in the year A.D. 50 (illustration by the author).

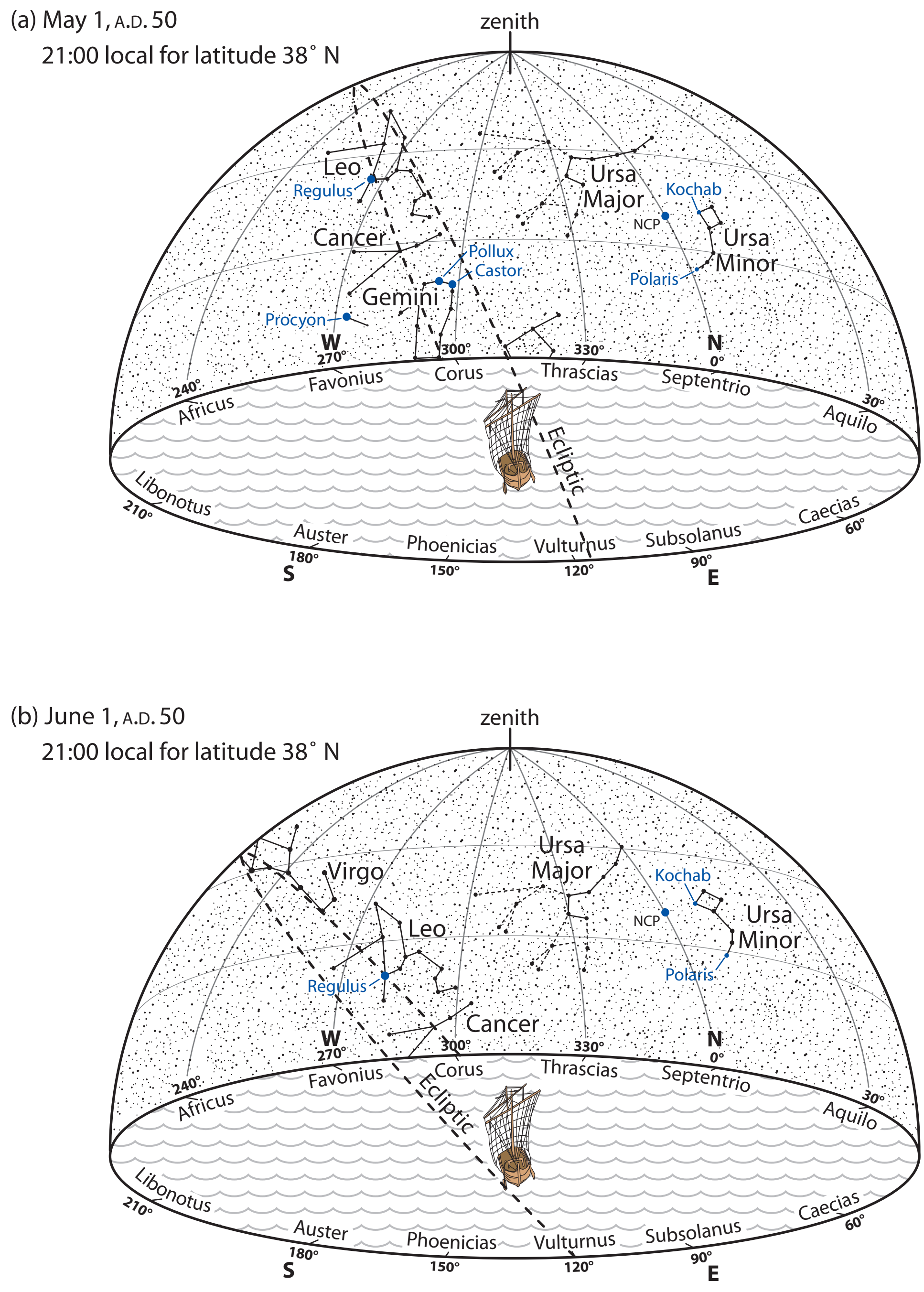


Fig. 5.7. A hypothetical Alexandrian grain ship sailing a mid-sea passage from Crete to Sicily and the Strait of Messina on 1 May (a) and 1 June (b). In both scenarios, the local time is 21:00 in the year A.D. 50 (illustration by the author).

Fig. 7.1. The passage from Alexandria to Rome: the first leg from Egypt to Cyprus.

Fig. 7.2. The passage from Alexandria to Rome: the second leg from Cyprus to the Aegean.

Fig. 7.3. The passage from Alexandria to Rome: the third leg from Asia Minor to the west end of Crete.

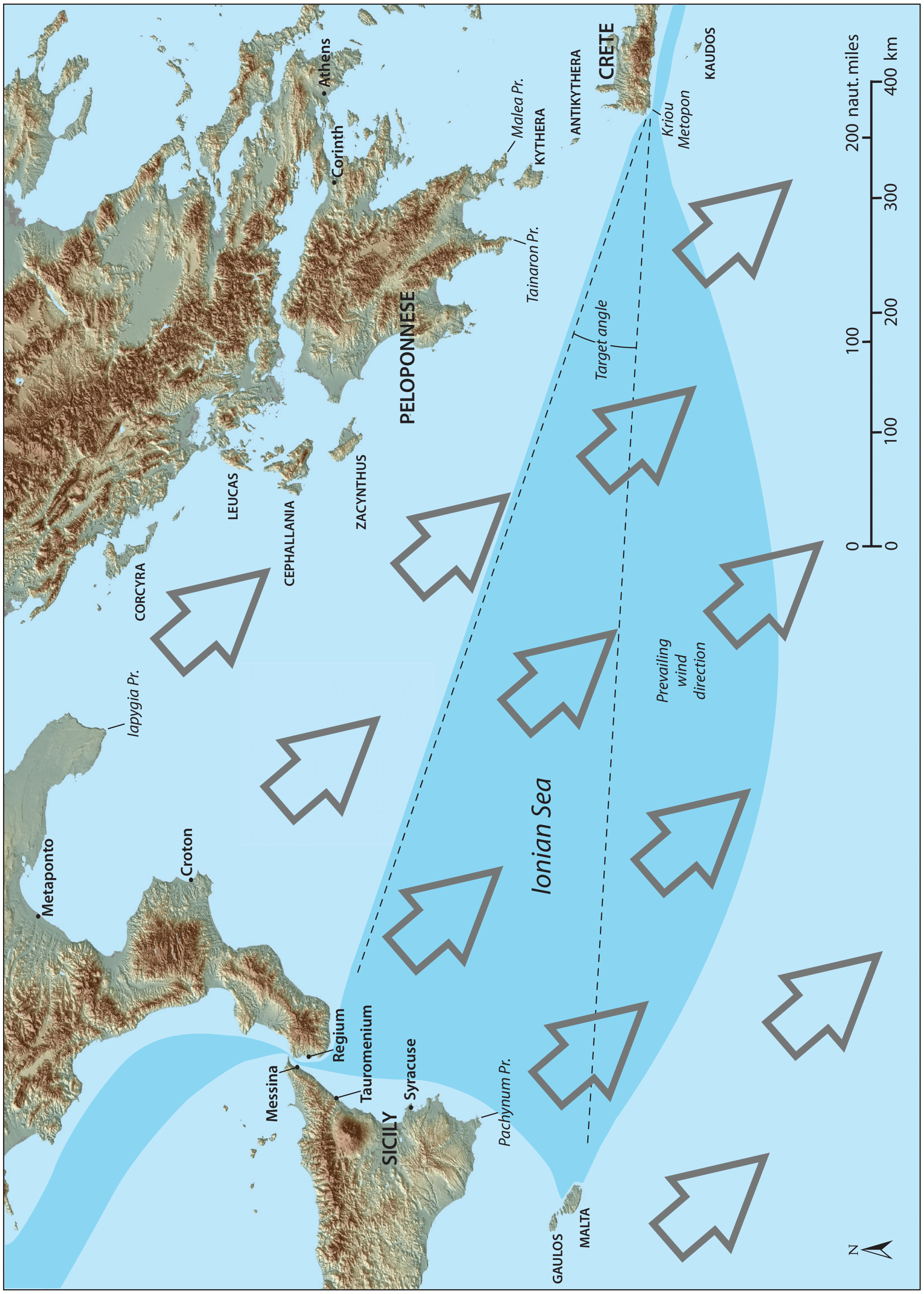


Fig. 7.4. The passage from Alexandria to Rome: the fourth leg across the Ionian Sea.

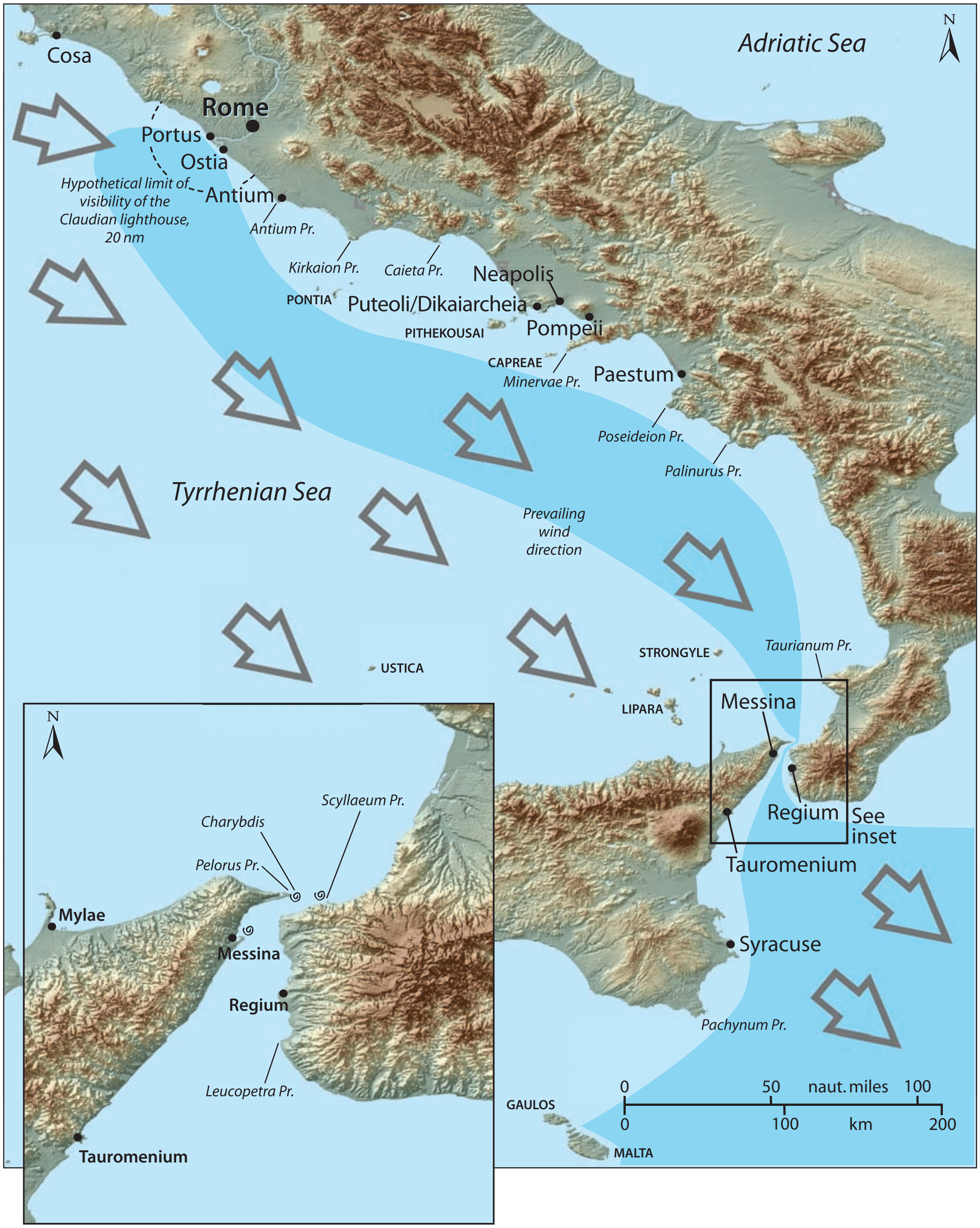


Fig. 7.5. The passage from Alexandria to Rome: the fifth leg from Malta and Sicily to Portus.

Appendix A: *Acts of the Apostles* 27.1–28.13,[1] with an Original English Translation by the Author

27.1 *Ὡς δὲ ἐκρίθη τοῦ ἀποπλεῖν ἡμᾶς εἰς τὴν Ἰταλίαν, παρεδίδουν τόν τε Παῦλον καί τινας ἑτέρους δεσμώτας ἑκατοντάρχῃ ὀνόματι Ἰουλίῳ σπείρης Σεβαστῆς.* 2 *ἐπιβάντες δὲ πλοίῳ Ἀδραμυττηνῷ μέλλοντι πλεῖν εἰς τοὺς κατὰ τὴν Ἀσίαν τόπους ἀνήχθημεν, ὄντος σὺν ἡμῖν Ἀριστάρχου Μακεδόνος Θεσσαλονικέως·* 3 *τῇ τε ἑτέρᾳ κατήχθημεν εἰς Σιδῶνα, φιλανθρώπως τε ὁ Ἰούλιος τῷ Παύλῳ χρησάμενος ἐπέτρεψεν πρὸς τοὺς φίλους πορευθέντι ἐπιμελείας τυχεῖν.* 4 *κἀκεῖθεν ἀναχθέντες ὑπεπλεύσαμεν τὴν Κύπρον διὰ τὸ τοὺς ἀνέμους εἶναι ἐναντίους,* 5 *τό τε πέλαγος τὸ κατὰ τὴν Κιλικίαν καὶ Παμφυλίαν διαπλεύσαντες κατήλθομεν εἰς Μύρα τῆς Λυκίας.* 6 *κἀκεῖ εὑρὼν ὁ ἑκατοντάρχης πλοῖον Ἀλεξανδρῖνον πλέον εἰς τὴν Ἰταλίαν ἐνεβίβασεν ἡμᾶς εἰς αὐτό.* 7 *ἐν ἱκαναῖς δὲ ἡμέραις βραδυπλοοῦντες καὶ μόλις γενόμενοι κατὰ τὴν Κνίδον, μὴ προσεῶντος ἡμᾶς τοῦ ἀνέμου, ὑπεπλεύσαμεν Κνίδον, μὴ προσεῶντος ἡμᾶς τοῦ ἀνέμου, ὑπεπλεύσαμεν τὴν Κρήτην κατὰ Σαλμώνην,* 8 *μόλις τε παραλεγόμενοι αὐτὴν ἤλθομεν εἰς τόπον τινὰ καλούμενον Καλοὺς Λιμένας, ᾧ ἐγγὺς πόλις ἦν Λασαία.*

9 *Ἱκανοῦ δὲ χρόνου διαγενομένου καὶ ὄντος ἤδη ἐπισφαλοῦς τοῦ πλοὸς διὰ τὸ καὶ τὴν νηστείαν ἤδη παρεληλυθέναι, παρῄνει ὁ Παῦλος* 10 *λέγων αὐτοῖς, Ἄνδρες, θεωρῶ ὅτι μετὰ ὕβρεως καὶ πολλῆς ζημίας οὐ μόνον τοῦ φορτίου καὶ τοῦ πλοίου ἀλλὰ καὶ τῶν ψυχῶν ἡμῶν μέλλειν ἔσεσθαι τὸν πλοῦν.* 11 *ὁ δὲ ἑκατοντάρχης τῷ κυβερνήτῃ καὶ τῷ ναυκλήρῳ μᾶλλον ἐπείθετο ἢ τοῖς ὑπὸ Παύλου λεγομένοις.* 12 *ἀνευθέτου δὲ τοῦ λιμένος ὑπάρχοντος πρὸς παραχειμασίαν οἱ πλείονες ἔθεντο βουλὴν ἀναχθῆναι ἐκεῖθεν, εἴ πως δύναιντο καταντήσαντες εἰς Φοίνικα παραχειμάσαι, λιμένα τῆς Κρήτης βλέποντα κατὰ λίβα καὶ κατὰ χῶρον.*

[1] The text is reproduced in Aland et al. 1993. For commentaries on Paul's voyage and shipwreck, see Bryant 1767; Rennell 1827; Smith 1848; Falkoner 1870; Goodspeed 1909; Dibelius 1956; Thurneyssen 1978; Praeder 1980, 1984; Hayward 1982; Coones 1986; Hirschfeld 1990; MacDonald 1999; Meijer 2002; and Alexander 2005, 69–96. For the various views on authorship, see bibliography in Praeder 1984, 683 and MacDonald 1999, 88–9.

13 Ὑποπνεύσαντος δὲ νότου δόξαντες τῆς προθέσεως κεκρατηκέναι, ἄραντες ἆσσον παρελέγοντο τὴν Κρήτην. 14 μετ᾽ οὐ πολὺ δὲ ἔβαλεν κατ᾽ αὐτῆς ἄνεμος τυφωνικὸς ὁ καλούμενος Εὐρακύλων·15 συναρπασθέντος δὲ τοῦ πλοίου καὶ μὴ δυναμένου ἀντοφθαλμεῖν τῷ ἀνέμῳ ἐπιδόντες ἐφερόμεθα. 16 νησίον δέ τι ὑποδραμόντες καλούμενον Καῦδα ἰσχύσαμεν μόλις περικρατεῖς γενέσθαι τῆς σκάφης, 17 ἣν ἄραντες βοηθείαις ἐχρῶντο ὑποζωννύντες τὸ πλοῖον· φοβούμενοί τε μὴ εἰς τὴν Σύρτιν ἐκπέσωσιν, χαλάσαντες τὸ σκεῦος, οὕτως ἐφέροντο. 18 σφοδρῶς δὲ χειμαζομένων ἡμῶν τῇ ἑξῆς ἐκβολὴν ἐποιοῦντο, 19 καὶ τῇ τρίτῃ αὐτόχειρες τὴν σκευὴν τοῦ πλοίου ἔρριψαν. 20 μήτε δὲ ἡλίου μήτε ἄστρων ἐπιφαινόντων ἐπὶ πλείονας ἡμέρας, χειμῶνός τε οὐκ ὀλίγου ἐπικειμένου, λοιπὸν περιῃρεῖτο ἐλπὶς πᾶσα τοῦ σῴζεσθαι ἡμᾶς. περιῃρεῖτο ἐλπὶς πᾶσα τοῦ σῴζεσθαι ἡμᾶς. 21 Πολλῆς τε ἀσιτίας ὑπαρχούσης τότε σταθεὶς ὁ Παῦλος ἐν μέσῳ αὐτῶν εἶπεν, Ἔδει μέν, ὦ ἄνδρες, πειθαρχήσαντάς μοι μὴ ἀνάγεσθαι ἀπὸ τῆς Κρήτης κερδῆσαί τε τὴν ὕβριν ταύτην καὶ τὴν ζημίαν. 22 καὶ τὰ νῦν παραινῶ ὑμᾶς εὐθυμεῖν, ἀποβολὴ γὰρ ψυχῆς οὐδεμία ἔσται ἐξ ὑμῶν πλὴν τοῦ πλοίου. 23 παρέστη γάρ μοι ταύτῃ τῇ νυκτὶ τοῦ θεοῦ οὗ εἰμι [ἐγώ], ᾧ καὶ λατρεύω, ἄγγελος 24 λέγων, Μὴ φοβοῦ, Παῦλε· Καίσαρί σε δεῖ παραστῆναι, καὶ ἰδοὺ κεχάρισταί σοι ὁ θεὸς πάντας τοὺς πλέοντας μετὰ σοῦ. 25 διὸ εὐθυμεῖτε, ἄνδρες· πιστεύω γὰρ τῷ θεῷ ὅτι οὕτως ἔσται καθ᾽ ὃν τρόπον λελάληταί μοι. 26 εἰς νῆσον δέ τινα δεῖ ἡμᾶς ἐκπεσεῖν.

27 Ὡς δὲ τεσσαρεσκαιδεκάτη νὺξ ἐγένετο διαφερομένων ἡμῶν ἐν τῷ Ἀδρίᾳ, κατὰ μέσον τῆς νυκτὸς ὑπενόουν οἱ ναῦται προσάγειν τινὰ αὐτοῖς χώραν. 28 καὶ βολίσαντες εὗρον ὀργυιὰς εἴκοσι, βραχὺ δὲ διαστήσαντες καὶ πάλιν βολίσαντες εὗρον ὀργυιὰς δεκαπέντε· 29 φοβούμενοί τε μή που κατὰ τραχεῖς τόπους ἐκπέσωμεν, ἐκ πρύμνης ῥίψαντες ἀγκύρας τέσσαρας ηὔχοντο ἡμέραν γενέσθαι. 30 τῶν δὲ ναυτῶν ζητούντων φυγεῖν ἐκ τοῦ πλοίου καὶ χαλασάντων τὴν σκάφην εἰς τὴν θάλασσαν προφάσει ὡς ἐκ πρῴρης ἀγκύρας μελλόντων ἐκτείνειν, 31 εἶπεν ὁ Παῦλος τῷ ἑκατοντάρχῃ καὶ τοῖς στρατιώταις, Ἐὰν μὴ οὗτοι μείνωσιν ἐν τῷ πλοίῳ, ὑμεῖς σωθῆναι οὐ δύνασθε. 32 τότε ἀπέκοψαν οἱ στρατιῶται τὰ σχοινία τῆς σκάφης καὶ εἴασαν αὐτὴν ἐκπεσεῖν.

33 Ἄχρι δὲ οὗ ἡμέρα ἤμελλεν γίνεσθαι παρεκάλει ὁ Παῦλος ἅπαντας μεταλαβεῖν τροφῆς λέγων, Τεσσαρεσκαιδεκάτην σήμερον ἡμέραν προσδοκῶντες ἄσιτοι διατελεῖτε, μηθὲν προσλαβόμενοι· 34 διὸ παρακαλῶ ὑμᾶς μεταλαβεῖν μηθὲν προσλαβόμενοι· διὸ παρακαλῶ ὑμᾶς μεταλαβεῖν τροφῆς, τοῦτο γὰρ πρὸς τῆς ὑμετέρας σωτηρίας ὑπάρχει· οὐδενὸς γὰρ ὑμῶν *θρὶξ ἀπὸ τῆς κεφαλῆς ἀπολεῖται.* 35 *εἴπας δὲ ταῦτα καὶ λαβὼν ἄρτον εὐχαρίστησεν τῷ θεῷ ἐνώπιον πάντων καὶ κλάσας ἤρξατο ἐσθίειν.* 36 *εὔθυμοι δὲ γενόμενοι πάντες καὶ αὐτοὶ προσελάβοντο τροφῆς.* 37 *ἤμεθα δὲ αἱ πᾶσαι ψυχαὶ ἐν τῷ πλοίῳ διακόσιαι ἑβδομήκοντα ἕξ.* 38 *κορεσθέντες δὲ τροφῆς ἐκούφιζον τὸ πλοῖον ἐκβαλλόμενοι τὸν σῖτον εἰς τὴν θάλασσαν.*

39 *Ὅτε δὲ ἡμέρα ἐγένετο, τὴν γῆν οὐκ ἐπεγίνωσκον, κόλπον δέ τινα κατενόουν ἔχοντα αἰγιαλὸν εἰς ὃν ἐβουλεύοντο εἰ δύναιντο ἐξῶσαι τὸ πλοῖον.* 40 *καὶ τὰς ἀγκύρας περιελόντες εἴων εἰς τὴν θάλασσαν, ἅμα ἀνέντες τὰς ζευκτηρίας τῶν πηδαλίων, καὶ ἐπάραντες τὸν ἀρτέμωνα τῇ πνεούσῃ κατεῖχον εἰς τὸν αἰγιαλόν.* 41 *περιπεσόντες δὲ εἰς τόπον διθάλασσον ἐπέκειλαν τὴν ναῦν, καὶ ἡ μὲν πρῷρα ἐρείσασα ἔμεινεν ἀσάλευτος, ἡ δὲ πρύμνα ἐλύετο ὑπὸ τῆς βίας [τῶν κυμάτων].* 42 *τῶν δὲ στρατιωτῶν βουλὴ ἐγένετο ἵνα τοὺς δεσμώτας ἀποκτείνωσιν, μή τις ἐκκολυμβήσας διαφύγῃ·* 43 *ὁ δὲ ἑκατοντάρχης βουλόμενος διασῶσαι τὸν Παῦλον ἐκώλυσεν αὐτοὺς τοῦ βουλήματος, ἐκέλευσέν τε τοὺς δυναμένους κολυμβᾶν ἀπορίψαντας πρώτους ἐπὶ τὴν γῆν ἐξιέναι,* 44 *καὶ τοὺς λοιποὺς οὓς μὲν ἐπὶ σανίσιν οὓς δὲ ἐπί τινων τῶν ἀπὸ τοῦ πλοίου· καὶ οὕτως ἐγένετο πάντας διασωθῆναι ἐπὶ τὴν γῆν.*

28.1 *Καὶ διασωθέντες τότε ἐπέγνωμεν ὅτι Μελίτη ἡ νῆσος καλεῖται.* 2 *οἵ τε βάρβαροι παρεῖχον οὐ τὴν τυχοῦσαν φιλανθρωπίαν ἡμῖν…*10 *οἳ καὶ πολλαῖς τιμαῖς ἐτίμησαν ἡμᾶς καὶ ἀναγομένοις ἐπέθεντο τὰ πρὸς τὰς χρείας.* 11 *Μετὰ δὲ τρεῖς μῆνας ἀνήχθημεν ἐν πλοίῳ παρακεχειμακότι ἐν τῇ νήσῳ Ἀλεξανδρίνῳ, παρασήμῳ Διοσκούροις.* 12 *καὶ καταχθέντες εἰς Συρακούσας ἐπεμείναμεν ἡμέρας τρεῖς,* 13 *ὅθεν περιελόντες κατηντήσαμεν εἰς Ῥήγιον. καὶ μετὰ μίαν ἡμέραν ἐπιγενομένου νότου δευτεραῖοι ἤλθομεν εἰς Ποτιόλους…*

27.1 When it was decided that we would sail for Italy, they handed over Paul and some other prisoners to a centurion of the Augustan cohort named Julius. **2** Embarking in an Adramyttian ship about to sail to points along the coast of Asia, we got underway together with Aristarchus, a Macedonian of Thessalonica. **3** On the next day we landed at Sidon, and Julius was kindly disposed to Paul and permitted him to obtain attention by going to his friends there. **4** Putting out to sea thence we sailed in the lee of Cyprus because the winds were contrary. **5** When we had sailed across the sea off the coasts of Cilicia and Pamphylia we made landfall at Myra in Lycia. **6** And there the centurion found an Alexandrian ship bound for Italy and put us on board. **7** Making slow headway for many days and arriving off Cnidus with difficulty, since the wind did not permit us any farther, we sailed in the lee of Crete off Cape Salmone. **8** And coasting along it with difficulty we came to a place called Kaloi Limenai near the town of Lasea.

9 Since much time had passed and the voyage had now become dangerous because the fast[2] was behind them, **10** Paul advised them saying, "Men, I perceive that the voyage will be accompanied with injury and much loss, not only of the cargo and ship, but also of our souls." **11** But the centurion was persuaded by the sailing master and owner rather than by the things Paul had said. **12** And since the harbor was unsuitable for wintering the majority reached a decision to set sail thence, if somehow they could reach Phoenix, a harbor of Crete which faces southwest and northwest, and spend the winter there.

13 When a gentle south wind began to blow, thinking to achieve their purpose, they weighed anchor anchor and began to sail along the coast of Crete. **14** After a short time a tempestuous wind called a *Eurakylon*[3] swept down from the island. **15** The ship was caught up in the wind and unable to beat against it, so we gave way and were borne along. **16** Running in the lee of an islet called Kaudos[4] we were hardly able to gain control of the life boat which they hoisted in, **17** and they used cables for undergirding the ship. Fearing lest they might run aground in the Syrtis they lowered the rigging and were thus borne along. **18** And as we were in the strong grip of a storm they began to jettison the cargo the next day, **19** and on the third day they tossed overboard the ship's rigging with their own hands. **20** When neither sun nor stars appeared for many days, and when the storm pressed hard upon us, all hope of our salvation was now taken away. **21** After they had gone a long time without food, Paul stood up among them and said, "Men, you should have heeded my advice not to sail from Crete in order to avoid this damage and loss. **22** And I advise you now to take courage—there will be no forfeiture of your lives, but only the ship will be destroyed. **23** This very night, an angel of God to whom I belong and whom I serve stood beside me and and said, **24** "Do not be afraid, Paul. You must stand trial before Caesar, and behold God

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[2] The fast: the only fast mandated by Jewish law was the autumnal Day of Atonement (*Lev.* 16:29–34).

[3] *Εὐρακύλων* is a combination of Greek *εὖρος* and Latin *aquilo*. Some manuscripts have *εὐρυκλύδων*; see above, pages 102–3.

has granted to you all those who are sailing with you. **25** So keep your courage, men; for I trust in God, that it will occur in the way it has been spoken to me. **26** On some island we must run aground."

27 On the fourteenth night, about midnight, when we were still being borne through the Adriatic, the sailors suspected that we were approaching some land. **28** Taking soundings they found the bottom at twenty fathoms.[5] Moving on a bit and sounding again they found fifteen fathoms. **29** Fearing that we may run aground against the rocks they threw over four anchors from the stern and prayed for day to come. **30** And as the sailors were attempting to abandon the ship and were lowering the small boat into the sea under the pretense of casting anchors from the prow, **31** Paul said to the centurion and soldiers, "Unless these men stay on board, you yourselves cannot be saved." **32** Then the soldiers cut away the boat's ropes and let it fall away.

33 And while day was about to dawn Paul kept encouraging everyone to partake of their food, saying "You've been living in suspense for fourteen days without food, having taken nothing, **34** so I encourage you eat. This is for your health, for a hair from the head of none of you will perish. **35** After he said these things and had taken bread he gave thanks to God before everyone and, breaking it, began to eat. **36** They were all encouraged and began to eat. **37** Together we numbered 276 lives on board. **38** Having been sated with food they began to lighten the ship by jettisoning the wheat.

39 When daylight came, they did not recognize the land, but they noticed a certain bay with a beach onto which they would steer the ship if they were able. **40** They cast off the anchors and left them in the sea, and at the same time loosened the ropes that held both rudders, raised the artemon to the wind and pointed the ship into shore. **41** But coming upon a place between two seas they ran the ship aground. The prow stuck fast and remained immovable, but the stern broke up under the force of the waves. **42** It was the plan of the soldiers to dispatch the prisoners lest anyone should swim off and escape. **43** But the centurion wished to save Paul and kept them from their intention. He ordered those unable

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[4] Although the toponym has numerous variants in the papyri and manuscripts (see app. crit. in Aland et al. 1993, 512) there is little doubt that it is the small island of Kaudos (Talbert 2000, 60, B3), due south of western Crete's White Mountains.

[5] A fathom measures about two meters.

to swim to cast themselves overboard first and get to land, **44** and the rest would follow next, some upon planks, others upon other things from the ship. And thus it happened that all were brought safely to land.

28.1 Once we were safe we discovered that the island was called Melita [Malta]. **2** The natives showed extraordinary kindness to us…**10** They honored us with many tokens of respect and when we were about to depart they put on board all the things we needed. **11** After three months we were embarked on a ship that had wintered on the island, an Alexandrian ship named *Dioskouroi*. **12** And making landfall at Syracuse we stayed for three days. **13** From there we sailed around and arrived at Regium. A day later a south wind came on and we arrived at Puteoli on the second day…

Appendix B: Lucian, *Navigium* 7–9,[1] with an Original English Translation by the Author

7 *Ὁ ναύκληρος αὐτὸς διηγεῖτό μοι, χρηστὸς ἀνὴρ καὶ προσομιλῆσαι δεξιός. ἔφη δὲ ἀπὸ τῆς Φάρου ἀπάραντας οὐ πάνυ βιαίῳ πνεύματι ἑβδομαίους ἰδεῖν τὸν Ἀκάμαντα, εἶτα ζεφύρου ἀντιπνεύσαντος ἀπενεχθῆναι πλαγίους ἄχρι Σιδῶνος, ἐκεῖθεν δὲ χειμῶνι μεγάλῳ περιπεσόντας δεκάτῃ ἐπὶ Χελιδονέας διὰ τοῦ Αὐλῶνος ἐλθεῖν, ἔνθα δὴ παρὰ* **8** *μικρὸν ὑποβρυχίους δῦναι ἅπαντας. οἶδα δέ ποτε παραπλεύσας καὶ αὐτὸς Χελιδονέας ἡλίκον ἐν τῷ τόπῳ ἀνίσταται τὸ κῦμα, καὶ μάλιστα περὶ τὸν τόπῳ ἀνίσταται τὸ κῦμα, καὶ μάλιστα περὶ τὸν λίβα, ὁπόταν ἐπιλάβῃ καὶ τοῦ νότου· κατ' ἐκεῖνο γὰρ δὴ συμβαίνει μερίζεσθαι τὸ Παμφύλιον ἀπὸ τῆς Λυκιακῆς θαλάττης, καὶ ὁ κλύδων ἅτε ἀπὸ πολλῶν ῥευμάτων περὶ τῷ ἀκρωτηρίῳ σχιζόμενος—ἀπόξυροι δέ εἰσι πέτραι καὶ ὀξεῖαι παραθηγόμεναι τῷ κλύσματι—καὶ φοβερωτάτην ποιεῖ τὴν κυματωγὴν καὶ τὸν ἦχον μέγαν, καὶ τὸ κῦμα* **9** *πολλάκις αὐτῷ ἰσομέγεθες τῷ σκοπέλῳ.*

τοιαῦτα καὶ σφᾶς καταλαβεῖν ἔφασκεν ὁ ναύκληρος ἔτι καὶ νυκτὸς οὔσης καὶ ζόφου ἀκριβοῦς. ἀλλὰ πρὸς τὴν οἰμωγὴν αὐτῶν ἐπικλασθέντας τοὺς θεοὺς πῦρ τε ἀναδεῖξαι ἀπὸ τῆς Λυκίας, ὡς γνωρίσαι τὸν τόπον ἐκεῖνον, καί τινα λαμπρὸν ἀστέρα Διοσκούρων τὸν ἕτερον ἐπικαθίσαι τῷ καρχησίῳ καὶ κατευθῦναι τὴν ναῦν ἐπὶ τὰ λαιὰ ἐς τὸ πέλαγος ἤδη τῷ κρημνῷ προσφερομένην. τοὐντεῦθεν δὲ ἅπαξ τῆς ὀρθῆς ἐκπεσόντας διὰ τοῦ Αἰγαίου πλεύσαντας ἑβδομηκοστῇ ἀπ' Αἰγύπτου ἡμέρᾳ πρὸς ἀντίους τοὺς ἐτησίας πλαγιάζοντας ἐς Πειραιᾶ χθὲς καθορμίσασθαι τοσοῦτον ἀποσυρέντας ἐς τὸ κάτω, οὓς ἔδει τὴν Κρήτην δεξιὰν λαβόντας ὑπὲρ τὴν Μαλέαν πλεύσαντας ἤδη εἶναι ἐν Ἰταλίᾳ.

7 The ship's master, a good man and a kindly conversationalist, told me himself. He said that they had left Pharos under a weak wind and seven days later sighted Cape Akamas [at the western tip of Cyprus]. Then, as the wind blew against them from the west, they were

[1] For the text, see Kilburn 1968, 430-86. For commentaries on the voyage of Lucian's *Isis*, see Casson 1950; 1956; 1994, 159-62; Houston 1987; Janni 1996, 403-23. Husson's (1970) text, translation and commentary are indispensible.

carried abeam as far as Sidon. From there they encountered a great storm and on the tenth day came through the Strait to the Chelidoniae [isles]. **8** There they nearly sank. Having once sailed by the Chelidoniae myself I know how big the waves can get, and how big they climb around that area, especially with a southwest wind whenever it mixes with a southerly. For this happens to be the place where the Pamphylian and Lycian seas run together and where the swell is split in two by the many currents swirling around the headland—there there are sheer and sharp rocks sharpened by the surf—and the breakers echo with a great roar and make the coast a most horrific place. **9** The waves often reach up as high as the promontory itself.

Such were the events the captain said occurred when it was still night and pitch black. But the gods took pity on their cries and showed them a fire from Lycia so that they knew the place. And one of the Dioskouroi showed them a bright light resting upon the mast-top and guided the ship to the left, toward the sea, just as it was about to slam into a cliff. From here, once they had fallen off their straight course, they sailed across the Aegean beating against the etesians. Yesterday, seventy days after departing Egypt, they reached the harbor at Piraeus after being driven so far downwind. They should have kept Crete to starboard, sailing under Malea so as to be in Italy by now.

Appendix C: Synesius, *Epistle* 4,[1] with an Original English Translation by the Author

4.1 *Λύσαντες ἐν Βενδιδείου πρὸ δείλης ἑῴας, μόλις ὑπὲρ μεσοῦσαν ἡμέραν τὸν Φάριον Μύρμηκα παρηλλάξαμεν, δίς που καὶ τρὶς ἐνσχεθείσης τῆς νεὼς τῷ τοῦ λιμένος ἐδάφει. εὐθὺς μὲν οὖν καὶ τοῦτο πονηρὸς οἰωνὸς ἐδόκει, καὶ σοφὸν ἦν ἀποβῆναι νεὼς ἐκ πρώτης ἀφετηρίας οὐκ εὐτυχοῦς· ἀλλὰ φυγεῖν παρ' ὑμῖν ἔγκλημα δειλίας ᾐσχύνθημεν, καὶ διὰ τοῦτο οὔπως ἔτι ἔσκεν ὑποτρέσαι οὐδ' ἀναδῦναι. ὥστε κἂν εἴ τι συμβαίη, δι' ὑμᾶς ἀπολούμεθα. καίτοι τί δεινὸν ἦν ὑμᾶς τε γελᾶν καὶ ἡμᾶς ἔξω κινδύνων ἑστάναι; ἀλλὰ τῷ Ἐπιμηθεῖ, φασί, τὸ μὲν μέλειν οὐκ ἦν, τὸ μεταμέλειν δ' ἐνῆν, ὥσπερ ἡμῖν· τότε γὰρ ἐξὸν σώζεσθαι, νῦν πρὸς ἐρήμοις ἀκταῖς συναυλίαν ὀλοφυρόμεθα, καὶ πρὸς Ἀλεξάνδρειαν ὁρῶντες ὡς οἷόν τε, καὶ πρὸς τὴν μητέρα Κυρήνην, ὧν τὴν μὲν ἔχοντες ἀπελίπομεν, τὴν δὲ εὑρεῖν οὐ δυνάμεθα, ἰδόντες τε καὶ παθόντες ἃ μηδὲ ὄναρ ἠλπίσαμεν.*

ἄκουε γάρ, ἵνα μηδὲ σὺ πάνυ χαίρειν σχολάζῃς καὶ πρῶτόν γ' ὅπως ἡμῖν εἶχε τὰ τοῦ πληρώματος. ὁ μὲν ναύκληρος ἐθανάτα κατάχρεως ὤν· ναυτῶν δὲ ὄντων δυοκαίδεκα τῶν πάντων (τρισκαιδέκατος γὰρ ὁ κυβερνήτης ἦν) ὑπὲρ ἥμισυ μὲν καὶ ὁ κυβερνήτης ἦσαν Ἰουδαῖοι, γένος ἔκσπονδον καὶ εὐσεβεῖν ἀναπεπεισμένον ἢν ὅτι πλείστους ἄνδρας Ἕλληνας ἀποθανεῖν αἴτιοι γένωνται· τὸ δὲ λοιπὸν ἀγελαῖοι γεωργοί, πέρυσιν οὔπω κώπης ἡμμένοι. κοινῇ δὲ οὗτοί τε κἀκεῖνοι πεπηρωμένοι πάντως ἕν γέ τι μέρος τοῦ σώματος. τοιγαροῦν ἕως οὐδὲν ἡμῖν δεινὸν ἦν, ἐκομψεύοντο καὶ ἐκάλουν ἀλλήλους οὐκ ἀπὸ τῶν ὀνομάτων ἀλλ' ἀπὸ τῶν ἀτυχημάτων, ὁ χωλός, ὁ κηλήτης, ὁ ἀριστερόχειρ, ὁ παραβλώψ. ἕκαστος ἕν γέ τι εἶχε τοὐπίσημον. καὶ ἡμῖν τὸ τοιοῦτον οὐ μετρίαν παρεῖχε τὴν διατριβήν· ἐν τῇ χρείᾳ δὲ οὐκέτι γέλως ἦν, ἀλλ' ἐπὶ τούτοι, αὐτοῖς ἀποιμώζομεν, ὄντες ἐπιβάται πλεῖν ἢ πεντήκοντα, τριτημόριόν που μάλιστα γυναῖκες, αἱ πλείους νέαι καὶ ἀγαθαὶ τὰς ὄψεις. ἀλλὰ μὴ φθόνει, παραπέτασμα γὰρ ἡμᾶς ἀπετείχιζε, καὶ τοῦτο ἐρρωμενέστατον, οὐ πάλαι διερρωγότος ἱστίου

[1] Text and translations can be found in Hercher 1965, 639–45 and FitzGerald 1926, 80–91. For commentaries on seafaring aspects of Synesius' voyage between Alexandria and Azarium, see Pando 1940, 20–2; Casson 1952; Casson 1994, 159–62; Meijer 1986; Kahanov 2006. Synesius briefly mentions other voyages, such as between Phykous (Cyrene) and Alexandria ("Pharos") in *Ep.* 51 and between Cyrene and Crete (ending in Alexandria due to storm winds) in *Ep.* 129.

τεμάχιον, σωφρονοῦσιν ἀνθρώποις τὸ τεῖχος τὸ Σεμιράμιδος. ἴσως δὲ κἂν ὁ Πρίαπος ἐσωφρόνησεν Ἀμαράντῳ συμπλέων· ὡς οὐκ ἔστιν ὁπότε ἡμᾶς σχολάζειν εἴασεν ἀπὸ τοῦ δεδιέναι τὸν ἔσχατον κίνδυνον, ὅστις πρῶτον μὲν ἐπειδὴ τὸν παρ᾽ ὑμῖν τοῦ Ποσειδῶνος νεὼν περιεκάμψαμεν, ἄρας ὅλοις ἱστίοις ἠξίου πλεῖν εὐθὺ περιεκάμψαμεν, ἄρας ὅλοις ἱστίοις ἠξίου πλεῖν εὐθὺ Ταφοσίριδος, καὶ ἀπεπειρᾶτο τῆς Σκύλλης, ἣν ἐν τοῖς γραμματείοις ἀποτροπιαζόμεθα. συννενοηκότων δὲ ἡμῶν καὶ ἀνακεκραγότων οὐ πρὶν ἢ ἐν χρῷ γενέσθαι τοῦ κινδύνου, μόλις ἐκβιασθεὶς ἀπέστη τοῦ διαναυμαχῆσαι πρὸς τὰς σπιλάδας. ἐντεῦθεν ἀποστρέψας τὴν ναῦν ὥσπερ ἐκ μετανοίας ἐπαφίησι τῷ πελάγει, τέως μὲν ὡς ἐδύνατο καὶ πρὸς κῦμα παραβαλλόμενος, ἔπειτα δὲ καὶ νότος συνεπιλαμβάνει λαμπρός, ὑφ᾽ οὗ ταχὺ μὲν τὴν γῆν ἀπεκρύπτομεν, ταχὺ δὲ μετὰ τῶν ὁλκάδων ἦμεν τῶν διαρμένων, αἷς οὐδὲν ἔδει Λιβύης τῆς καθ᾽ ἡμᾶς, ἀλλὰ πλοῦν ἕτερον ἔπλεον.

σχετλιαζόντων δὲ ἡμῶν καὶ ἐν δεινῷ ποιουμένων τὸ ἀπηρτῆσθαι τοσοῦτον τῆς γῆς, ὁ Ἰαπετὸς Ἀμάραντος ἐπὶ τῶν ἰκρίων ἑστὼς ἐτραγῴδει τὰς παλαμναιοτάτας ἀράς. «οὐ γὰρ δὴ πτησόμεθα» ἔφη· «ὑμῖν δὲ πῶς ἄν τις καὶ χρήσαιτο, οἳ καὶ τὴν γῆν καὶ τὴν θάλατταν ὑποπτεύετε;» «οὔκ, ἤν γέ τις αὐταῖς χρῆται καλῶς, ὦ λῷστε Ἀμάραντε» πρὸς αὐτὸν ἔφην. «ἡμῖν δὲ οὐδὲ Ταφοσίριδος ἔδει· ζῆν γὰρ ἔδει. καὶ νῦν τοῦ πελάγους τί δεῖ; ἀλλὰ πλέωμεν» ἔφην «εὐθὺ Πενταπόλεως, ἀπέχοντες τῆς γῆς ὅσον μέτριον, ἵν᾽ εἴ τι καὶ χαλεπόν, οἷα δὴ τὰ τῆς θαλάττης (ἄδηλον δὲ δήπου καὶ ἔστι καὶ παρ᾽ ὑμῖν λέγεται), λιμήν τις ἡμᾶς ἐκ τοῦ σχεδὸν ὑποδέξηται». οὔκουν ἔπειθον λέγων, ἀλλ᾽ ἐξεκεκώφητο τὸ κάθαρμα, ἕως ἄνεμος ἀπαρκτίας ἐπαράσσει πολύς, κῦμα ἐλαύνων ὑψηλὸν καὶ τραχύ. οὗτος ἄφνω προσπεσὼν τὸ ἱστίον ἔμπαλιν ὤθησε καὶ τὰ κυρτὰ κοῖλα πεποίηκεν, ἡ δὲ ναῦς ἐγγὺς ἦλθεν ἐπὶ πρύμναν ἀνατετράφθαι. μόλις δ᾽ οὖν αὐτὴν κατεστήσαμεν, καὶ ὁ βαρύστονος Ἀμάραντος «τοιοῦτον» ἔφη «τὸ ναυτίλλεσθαι τέχνῃ», προσδέχεσθαι γὰρ αὐτὸς πάλαι τὸν ἐκ πελάγους ἄνεμον, καὶ διὰ τοῦτο μετέωρος πλεῖν. κατιέναι γὰρ νῦν ἐγκάρσιος, ἐνδιδόντος τοῦ διαστήματος προστιθέναι τῷ μήκει. τοιοῦτον δὲ εἶναι τὸν πλοῦν τὸν ἡμέτερον οὐκ ἂν εἴ γε παρὰ τὰς ἀκτὰς ἐπλέομεν· προσαναπεπλάσθαι γὰρ ἂν τῇ γῇ.

καὶ ἡμεῖς ἀπεδεχόμεθα λέγοντος ἕως ἡμέρα τε ἦν καὶ τὰ δεινὰ οὔπω παρῆν· ἤρξατο γὰρ δὴ μετὰ τῆς νυκτός, ἀεὶ προϊόντος ἐπὶ μεῖζον τοῦ κλύδωνος. Ἡμέρα μὲν ἦν ἥντινα ἄγουσιν οἱ Ἰουδαῖοι παρασκευήν· τὴν δὲ νύκτα τῇ μετ᾽ αὐτὴν ἡμέρᾳ λογίζονται, καθ᾽ ἣν οὐδενὶ θέμις ἐστὶν ἐνεργὸν ἔχειν τὴν χεῖρα, ἀλλὰ τιμῶντες διαφερόντως αὐτὴν ἄγουσιν *ἀπραξίαν. μεθῆκεν οὖν ἐκ τῶν χειρῶν ὁ κυβερνήτης τὸ πηδάλιον, ἐπειδὴ τὸν ἥλιον εἴκασεν ἀπολελοιπέναι τὴν γῆν, καὶ καταβαλὼν ἑαυτὸν πατεῖν παρεῖχε τῷ θέλοντι ναυτίλων. ἡμεῖς δὲ τὴν μὲν οὖσαν αἰτίαν οὐκ εὐθὺς ἐπὶ νοῦν ἐβαλλόμεθα, ἀπόγνωσιν δὲ τὸ πρᾶγμα οἰόμενοι, προσήειμεν ἐλιπαροῦμεν μὴ καταπροέσθαι μηδέπω τὰς ἐσχάτας ἐλπίδας· καὶ γὰρ δὴ καὶ ἐπεῖχον αἱ τρικυμίαι, τοῦ πελάγους καὶ πρὸς ἑαυτὸ στασιάσαντος. γίνεται δὲ τὸ τοιοῦτον ὅταν μὴ τῷ λήξαντι πνεύματι καὶ τὰ παρ' αὐτοῦ συναναπαύσηται κύματα, ἀλλ' ἰσχῦον ἔχοντα τὸ ἐνδόσιμον τῆς κινήσεως ὑπαντιάζῃ τῇ τοῦ πνεύματος ἐπικρατείᾳ, καὶ ἀντεμβάλλῃ ταῖς ἐμβολαῖς. ἔδει γάρ μοι καὶ φλεγμαινόντων ὀνομάτων, ἵνα μὴ τὰ μεγάλα κακὰ σμικροπρεπέστερον διηγήσωμαι. τοῖς οὖν ἐν τῷ τοιῷδε πλέουσιν ἀπὸ λεπτοῦ φασὶ μίτου τὸ ζῆν ἠρτῆσθαι. εἰ δὲ καὶ ὁ κυβερνήτης νομοδιδάσκαλος εἴη, τίνα δεῖ ψυχὴν ἔχειν; ἐπεὶ δ' οὖν συνήκαμεν τὸν νοῦν τῆς ἀπολείψεως τῶν πηδαλίων (δεομένων γὰρ ἡμῶν σώζειν τὴν ναῦν ἐκ τῶν ἐνόντων τὸ βιβλίον ἐπανεγίνωσκε), πειθοῦς ἀπογνόντες ἀνάγκην ἤδη προσήγομεν. καί τις στρατιώτης γεννάδας (συμπλέουσι δὲ ἡμῖν Ἀράβιοι συχνοὶ τῶν ἀπὸ τοῦ τάγματος τῶν ἱππέων) τὸ ξίφος σπασάμενος ἠπείλησε τἀνθρώπῳ τὴν κεφαλὴν ἀποκόψειν, εἰ μὴ ἀντιλήψεται τοῦ σκάφους, ὁ δὲ αὐτόχρημα Μακκαβαῖος οἷος ἦν ἐγκαρτερῆσαι τῷ δόγματι.*

μεσούσης δὲ ἤδη τῆς νυκτὸς ἀναπείθεται παρ' ἑαυτοῦ πρὸς τῇ καθέδρᾳ γενέσθαι. «νῦν γάρ» φησίν «ὁ νόμος ἐφίησιν, ἐπειδὴ νῦν σαφῶς τὸν ὑπὲρ τῆς ψυχῆς θέομεν.» πρὸς τοῦτο αἴρεται θόρυβος ἐξ ἀρχῆς, ἀνδρῶν οἰμωγή, γυναικῶν ὀλολυγή· ἅπαντες ἐθεοκλύτουν ἐποτνιῶντο, τῶν φιλτάτων ὑπεμιμνήσκοντο. μόνος Ἀμάραντος εὔθυμος ἦν, ὡς αὐτίκα περιγράψων τοὺς δανειστάς…

ὁρῶ τοὺς στρατιώτας ἅπαντας ἐσπασμένους τὰς μαχαίρας, καὶ πυθόμενος ἐμάνθανον παρ' αὐτῶν ὡς καλὸν ἐπὶ τοῦ καταστρώματος ὄντας ἔτι πρὸς τὸν ἀέρα τὴν ψυχὴν ἐρυγεῖν, ἀλλὰ μὴ πρὸς κῦμα χανόντας. τούτους αὐτοφυεῖς Ὁμηρίδας ἐνόμισα καὶ ἐθέμην τῷ δόγματι. εἶτα κηρύττει τις ἐξαρτᾶσθαι χρυσίον οἷς ἐστί· καὶ οἷς ἦν ἐξήρτητο, καὶ χρυσίον καὶ ὅ τι ἄξιον χρυσίου. καὶ αἱ γυναῖκες αὐταί τε ἐσκευάζοντο καὶ τοῖς δεομένοις ἁρπεδόνας διένεμον, πάλαι καταδεδειγμένον τοῦτο ποιεῖν, νοῦν δὲ ἔχει τοιοῦτον. φέρειν δεῖ τιμὴν ἐντάφιον τὸν ἐκ ναυαγίου νεκρόν. ὁ γὰρ προστυχὼν καὶ κερδάνας νόμους Ἀδραστείας αἰδέσεται, μὴ οὐχὶ μικρόν τι μέρος ἀποδάσασθαι τῷ χαρισαμένῳ τὸ πολλαπλάσιον…

ὃ δὲ ἐποίει παρὰ πόδας τὸν κίνδυνον, οὐχ ἕτερον ἦν ἀλλ' ὅτι πᾶσιν ἱστίοις ἡ ναῦς ἐφέρετο, ὑποτεμέσθαι δὲ οὐκ ἦν, ἀλλὰ πολλάκις ἐπιχειρήσαντες τοῖς καλωδίοις *ἀπηγορεύκειμεν, τῶν τροχῶν ἐνδακόντων, καὶ ὑφώρμει δέος οὐκ ἔλαττον, εἰ καὶ διαγενοίμεθα ἐκ τοῦ κλύδωνος, οὕτως ἔχοντας ἐν νυκτὶ πελάζειν τῇ γῇ. φθάνει δὲ ἡμέρα, καὶ ὁρῶμεν τὸν ἥλιον ὡς οὐκ οἶδ' εἴ ποτε ἥδιον. τὸ δὲ πνεῦμα ῥᾷον ἐγίνετο τῆς ἀλέας ἐπιδιδούσης, καὶ ἡ δρόσος ἐξισταμένη παρεῖχεν ἡμῖν κεχρῆσθαι τοῖς καλωδίοις καὶ τὸ ἱστίον μεταχειρίζεσθαι. ὑπαλλάττειν μὲν οὖν ἱστίον ἕτερον νόθον οὐκ εἴχομεν, ἠνεχυρίαστο γάρ· ἀνελαμβάνομεν δὲ αὐτὸ καθάπερ τῶν χιτώνων τοὺς κόλπους, καὶ πρὶν ὥρας εἶναι τέτταρας, ἀποβαίνομεν οἱ τὸ τεθνάναι προσδοκήσαντες ἐν ἐσχατιᾷ τινὶ πανερήμῳ καὶ οὔτε πόλιν οὔτε ἀγρὸν ἐχούσῃ γείτονα, σταδίους ἑκατόν που πρὸς τοῖς τριάκοντα κατόπιν ἀγροῦ. ἡ μὲν οὖν ναῦς ἐσάλευεν ἐπὶ μετεώρου (λιμὴν γὰρ ὁ τόπος οὐκ ἦν) καὶ ἐσάλευεν ἐπ' ἀγκύρας μιᾶς· ἡ ἑτέρα γὰρ ἀπημπόλητο, τρίτην δὲ ἄγκυραν Ἀμάραντος οὐκ ἐκτήσατο. ἡμεῖς δὲ ἐπειδὴ τῆς φιλτάτης ἡψάμεθα γῆς, περιεβάλομεν ὥσπερ ἔμψυχον οὖσαν μητέρα, καὶ ἀποθύσαντες ὕμνους τῷ θεῷ χαριστηρίους ὥσπερ εἰώθειμεν, προσεθήκαμεν αὐτοῖς καὶ τὴν ἔναγχος τύχην ὑφ' ἧς παρὰ δόξαν ἐσώθημεν, δύο ἑξῆς ἐπιμείναντες ἡμέρας, ἕως ἂν ἀφυβρίσῃ τὸ πέλαγος.*

ἐπεὶ δὲ ἄπορον ἦν ὁδῷ χρήσασθαι, μηδενὸς ἀνθρώπων ὁρωμένου, πάλιν ἐπετολμήσαμεν τῇ θαλάσσῃ· καὶ ἄραντες εὐθὺς ἀρχομένης ἡμέρας ἐπλέομεν ἐκ πρύμνης ἀνέμῳ πᾶσαν αὐτὴν καὶ τὴν ἐπιγενομένην ἡμέραν, ἧς ἤδη ληγούσης τὸ πνεῦμα ἀπέλιπεν ἡμᾶς, καὶ ἡμεῖς ἠνιάθημεν. ἐμέλλομεν δὲ ἄρα ποθήσειν γαλήνην. ἦν μὲν οὖν τρισκαιδεκάτη φθίνοντος, ἐπῃωρημένου δὲ τοσούτου κινδύνου, μελλούσης εἰς ταὐτὸ συνδραμεῖσθαι τῆς τε συνόδου τῶν ἄστρων καὶ τῶν πολυθρυλήτων τυχαίων, ἃ μηδείς ποτέ φασι πλέων ἐθάρσησε, καὶ δέον ἡμᾶς ἐλλιμενίζειν, οἳ δ' ἐλελήθειμεν αὖθις ἀναδεδραμηκότες ἐπὶ τὸ πέλαγος. ἡ δὲ στάσις ἤρξατο μὲν ἀπὸ τῶν ἀρκτικῶν πνευμάτων, καὶ ὗσέ γε πολλὰ κατὰ τὴν συνοδικὴν νύκτα. ἔπειτα ἠκόσμει τὰ πνεύματα, καὶ ἡ θάλαττα κυκεὼν ἐγεγόνει. τὰ δὲ περὶ ἡμᾶς, οἷα εἰκὸς ἐν τοῖς τοιούτοις, ἵνα μὴ πάθη παραπλήσια δὶς ἀφηγώμεθα, ὤνησέ τι τὸ μέγεθος τοῦ χειμῶνος. τὸ κέρας ἐτετρίγει, καὶ ἡμεῖς ᾠόμεθα προτονίζειν τὴν ναῦν. εἶτα κατεαγὸς μέσον ἐγγὺς μὲν ἦλθεν ἀπολέσαι πάντας ἡμᾶς· ἐπεὶ δὲ οὐκ ἀπώλεσεν, αὐτὸ δὴ τοῦτο καὶ περιέσωσεν· οὐ γὰρ ἦν ἄλλως ἐνέγκαι τὴν βίαν τοῦ πνεύματος, πάλιν δὲ δυσπειθὲς ἦν τὸ ἱστίον καὶ οὐκ εὔτροχον εἰς καθαίρεσιν. οὕτως οὖν παρὰ δόξαν ἀποφορτισάμενοι τὴν ἀπληστίαν τῆς βιαίας φορᾶς ἡμέραν ἑξῆς καὶ νύκτα ἠνέχθημεν, ἧς ἤδη περὶ δευτέραν οὔσης ὀρνίθων ᾠδήν, ἐλάθομεν ἐγχρίμψαντες ἀκαρῆ πέτρᾳ προβεβλημένῃ τῆς γῆς ὅσον εἶναι βραχεῖαν χερρόνησον. βοῆς δὲ γενομένης ἐπειδή τις παρηγγύησεν αὐτῇ γῇ πελάσαι, θροῦς *ἤρθη πολὺς καὶ ἥκιστα ξύμφωνος, τῶν μὲν ναυτῶν πεφρικότων, ἡμῶν δὲ ἐξ ἀπειρίας τὼ χεῖρ᾽ ἐπικροτούντων, καὶ περιβαλλόντων ἀλλήλους καὶ οὐκ ἐχόντων ὅπως χρησώμεθα τῷ πλήθει τῆς χαρᾶς. ἐλέγετο δὲ ὁ μέγιστος αὐτὸς εἶναι τῶν περιστάντων ἡμᾶς κινδύνων.*

ἤδη δὲ ὑποφαινομένης ἡμέρας κατασείει τις ἄνθρωπος χωριτικῶς ἐσταλμένος, καὶ δείκνυσι τῇ χειρὶ τόπους ὑπόπτους καὶ ἑτέρους οὓς ἔδει θαρρῆσαι. καὶ τέλος ἧκεν ἐπὶ κελητίου δισκάλμου, ὅπερ ἐξάψας τοῦ πλοίου μεταχειρίζεται τὸ πηδάλιον, ὁ δὲ Σύρος ἄσμενος ἐξέστη τῆς προεδρίας. ἀναλύσας δὲ σταδίους οὐ πλεῖν ἢ πεντήκοντα τήν τε ναῦν ἐνορμίζει λιμενισκίῳ χαρίεντι (Ἀζάριον οἶμαι καλοῦσιν αὐτό), καὶ ἡμᾶς ἐπὶ τῆς ῥόνος ἀπεβίβασε, σωτὴρ καὶ δαίμων ἀγαθὸς ἀποκαλούμενος. καὶ μετὰ μικρὸν ἑτέραν ὁλκάδα εἰσήλασε, καὶ πάλιν ἄλλην, καὶ πρὶν ἑσπέραν εἶναι, πέντε γεγόναμεν ὑπὸ τοῦ θεσπεσίου πρεσβύτου περισωθεῖσαι φορτίδες, πρᾶγμα ἐναντιώτατον τῷ Ναυπλίῳ ποιοῦντος· καὶ γὰρ οὐχ ὡς ἐκεῖνος τοὺς ἀπὸ χειμῶνος ἐδέξατο. ἐς δὲ τὴν ὑστεραίαν ἄλλοι κατῆραν, ὧν ἔνιοι τῶν προλαβόντων ἡμᾶς ἦσαν ἀπὸ Ἀλεξανδρείας ἡμέραν. καὶ νῦν ὁλόκληρός ἐσμεν στόλος ἐν νεωρίῳ μικρῷ.

4.1 Setting out from Bendideum at early dawn, we had scarcely sailed passed Pharius Myrmex by midday since the ship stuck fast two or three times on the bottom of the harbour. This seemed an evil omen, and it would have been wise to disembark from the ship at the first sign of an unlucky departure, but we were ashamed to be charged with cowardice by you. Accordingly, "It was no longer permitted to tremble or retire."[2] So if something should befall us we shall perish on your account. And yet was it something so terrible that you laugh and we avoid danger? Epimetheus, they say, "could not hesitate, but could repent,"[3] as in our case, for at that time it was possible to save ourselves. But now we lament in unison on desert shores, looking toward Alexandria as much as we can, and towards our motherland Cyrene; we left the one behind us, and the other we cannot reach, having both seen and suffered the things of nightmares.

Listen now, lest you have the leisure to rejoice overmuch, and I will tell you first how the crew was comprised. The ship's master was used up to the point of death. There were twelve sailors in all (the pilot made thirteen), of which more than half, including the sailing

[2] Hom. *Il.* 7.217.
[3] *Trag. Adesp.* fr. 564d.2.

master, were Jews, a banished race, and one not loath to kill out of piety as many Greeks as possible. The rest were farmers who a year ago had not yet gripped an oar. Both groups were alike in being mamed in some part of their body. Indeed as long as nothing terrible afflicted us they jested and called one another not by their names but by their misfortunes, such as Gimp, Rupture, Handy and Squint. Each had some distinguishing defect, which produced for us an endless pastime. In our time of need these were no longer a laughing matter but served as the focus of our wailing. The passengers numbered more than fifty all told, a third of them women, most of them young and fair to the eyes. But don't envy us, for a curtain separated us, and it was exceedingly stout, a recent fragment from a sail. To virtuous men it was the wall of Semiramis. Perhaps even Priapus may have been tame while sailing with Amarantus. It was never possible for us to relax for he failed to keep us free from the most extreme danger. As soon as we rounded the headland near you with its temple of Poseidon we made straight for Taposiris under full canvas. He made an attempt at Scylla, whom we had feared in our grammar exercises. Upon reflecting on this we cried out before finding ourselves in danger. He had scarcely turned away from fighting a sea battle with the rocks when he turned the ship away as though an afterthought, then let us loose upon the open sea. For a time he threw us against the waves, but then a south wind freshened and bore us along; under its force we quickly lost sight of land and encountered those freighters which nave no need of our Libya, but routinely sail another course.

When we wailed of hardship and complained of our position so far from land, Amarantus, pretending to be Iapetus, stood on the stern and hurled the most murderous curses upon us. "We shall certainly not fly," he said, "so how can anyone help you, you who mistrust both land and sea?" And I replied to him, "Not quite, my good Amarantus, at least if someone steers us aright. For us, there's no need for Taphosiris, for we wished to live. And what need is there for the open sea? But let us voyage to Pentapolis, keeping the shore tolerably close by, in order that if there is some difficulty as is want to occur at sea (doubtless unknown, as is said even among yourselves) we can reach a nearby harbor." My talk did not persuade him, but the outcast turned a deaf ear to it, that is until a great northerly wind struck up and piled up the waves before it. This wind struck hard and fast against the sail, pushed it back and reversed its billowing. The ship nearly capsized by the stern. So with difficulty we headed her in. With a thunderous growl Amarantus says, "This is what it is to voyage with skill, for I myself expected these high-seas winds some time ago, and I sailed out to sea on this account. We're going in at an angle now, since sea-room has been added to this leg. But such a maneuver as the one I have taken would not have been possible if were sailing along the coast, for we would have been cast up on land."

We were content with this explanation as long as it was day and dangers had not yet appeared. For it began at night, as the oncoming waves grew ever higher. It was the day on which the Jews make "Preparation," and they reckon the night together with the day during which it is lawful for no one to work with their hands. They honor it completely and do nothing. So the pilot released the rudder from his grasp when he surmised that the sun had left the earth. Laying prostrate he "allowed to trample on him what sailors so desired."[4] But we did not immediately grasp the true reason for it, thinking that he was despairing of our plight. We shook him and begged him not to give up his last hopes just yet. Indeed the largest waves were upon us, since the sea was at war with its very self. Now, it happens that when the wind dies down all of a sudden the waves do not cease, but resound with a rhythmic motion owing to the strength of the wind. And these waves clash and vie against those that are receding. I needed every ounce of flaming language lest I relate the greatest inequities in the most trifling manner. To those who voyage in such straits in a small boat, they say that life hangs by a thread. But if even the pilot is a teacher of the law, what kind of soul must one have? So when we came to the realization that he had let go the rudder (for while we begged him to save the ship he read a scroll from among his possessions) and despaired of persuading him of our dire need we now turned to force. One noble soldier (for with us sailed a number of Arabians from a cavalry division) drew his sword and threatened to behead the man if he didn't take back control of the vessel. But the Maccabean was plainly of the sort to persist in his resolve.

However, in the middle of the night Amarantus persuaded himself to return to his station. "For now," he says, "the law does not apply, since clearly now we are in danger for our lives." On this the din increased as in the beginning, with a wailing from the men and

[4] Soph. *Aj.* 1146.

a shriek from the women; everyone called out to God and cried aloud, recalling their love ones. Only Amarantus was cheerful, thinking that now he would escape his creditors…

I saw all the soldiers drawing their daggers, and upon inquiry learned from them that they thought it dignified to belch out their souls to the breeze on deck, rather than gape them out upon the waves. I considered them the natural descendants of Homer, and I reckoned it true. Then someone heralded that those who have gold should hang it around their neck; and those who possessed it did so, as did those who had anything worthy of gold. The women put on their jewelry and distributed cords to those who needed them, a thing that has been done of old. For it is thought that a corpse from a shipwreck must pay the burial fee…

What brought danger to our feet was nothing other than the fact that the ship was bearing along under all sails, and they could not be shortened. After numerous attempts we gave up trying at the ropes since they were jammed in the blocks. We had a secret fear that if we should survive the surging sea, we would thus draw near to land in the night. But day came first and we saw the sweetest sun I've ever known. The wind grew moderate as the temperature improved. The dew evaporated, which allowed us to work the rigging and handle the sail. We were not able to exchange the sail for another for he had pawned it off. But we took it in like the folds of garments, and in four hours' time we—we who thought ourselves to have already died—disembarked in some far reach of the desert, with neither city nor farm in sight and surrounded by 130 stades of hinterland. So the ship rode at anchor on the open sea because the place lacked a harbor. We had one anchor; the second had been sold, and a third Amarantus did not own. When we reached our dearest earth, we embraced her like a true living mother. And we sent up hymns of thanks to God as is our custom. We added to all this a mention of our good fortune, by which we had been saved contrary to our expectation. We then waited two days until the sea calmed down.

When we were at a loss to find a way out, and with no one in sight, we resolved to set out to sea again. We set sail as soon as dawn broke with a wind from astern all that day and the one after. Then the wind abated and left us, and we grieved. But soon we longed for calm. It was the thirteenth day of the new moon, at time when great danger looms. We were at the threshold of that conjunction of stars and notorious chance events in which no one, they say, is ever full of confidence. We should have remained in that harbor, but we departed again for the high sea. The storm began with northerly winds, and it rained like mad as night came on. Then the winds raged out of control, and the sea mixed and resounded around us. As for us, it was what you would expect in the circumstance, lest we relate all of our suffering a second time. But the magnitude of the storm had an advantage. The yard cracked, and we thought of tightening the ship with ropes. Then the yard broke near the middle and nearly killed us all. But that which did not kill us became the very object of our salvation, for the yard could not bear the force of the wind. Before this, the sail had again become stubborn and was not operating well enough for us to pull it down. Thus, contrary to our every expectation, we had lifted off the insatiate violence of our course and were borne along the next day and night. Now at the second crowing of the cock, unawares we had approached a headland with a jutting spit of earth like a short peninsula. There was a shout when someone reported that land itself was near. A great din arose and with it a severe disagreement. The sailors were shuddering, but we, out of inexperience, clapped our hands, embraced each other and couldn't think of more ways to express our joy. But the present circumstance was said to be the greatest of dangers to have beset us.

Now when day appeared a man in rustic garb signaled us. He pointed out both the safe and dangerous areas. He finally came out in a little two-oared boat which he tied up to our vessel. He then took over the tiller, and our Syrian gave him pride of place. Getting us underway he moved the ship no more than fifty stades and brought us to anchor in a delightful little harbor. I think it was called Azarium. There he disembarked us on the shore. We hailed him as our savior and good angel. After a little while he brought in another freighter, and another still, and before it was evening there were five freighters saved by this heaven-sent old man—the opposite to Nauplius in his actions, for that man did not receive the storm-tossed. On the next day other ships arrived, some of which got their start a day before we departed Alexandria. Now we were an entire fleet in a small naval station.

Glossary

Abaft the beam Astern or to the rear of the midpoint of the ship.

Athwartship From one side of the ship to the other

Beam A timber mounted athwartship to provide lateral strength; the term is also used to indicate the maximum breadth of the hull.

Beaufort scale A 0–12 scale of wind force and sea state, described according to a range of velocity, with 0 being a dead calm and 12 a hurricane: **0**: <1 kt, **1**: 1–2 kts, **2**: 3–6 kts, **3**: 7–10 kts, **4**: 11–15 kts, **5**: 16–20 kts, **6**: 21–26 kts, **7**: 27–33 kts, **8**: 34–40 kts, **9**: 41–47 kts, **10**: 48–55 kts, **11**: 56–63 kts, **12**: >64 kts.

Berth The space allotted to a vessel along a quay or at anchor.

Brace Rope tied to the end of a yard of a square-rigged ship and used for adjusting it.

Brail Lines which stretch from the deck, over the yard, and down the forward face of the sail via brailing rings; used for gathering the sail to the yard and for shaping the leech of the sail for different sailing configurations.

Cabotage Navigation from point to point along a coast for trading purposes.

Clew The lower corner of a square sail, or the after lower corner of a fore-and-aft sail; controlled by sheets.

Close-hauled As close to the wind as a vessel will sail.

Cutwater A stem-post timber that curves forward and downward below the waterline of a wooden vessel, dividing the water as the vessel advances.

Deadeye a hardwood discoid construction through which a lanyard is rove and attached to the stays. Used to loosen and tighten stays.

Diurnal winds Winds which exhibit a periodic alteration of condition with day and night, typically caused by the uneven heating of different surfaces (such as land and sea).

Fairlead A pulley or batten used to change the direction of a rope, forming part of the rigging of a ship.

Fore-and-aft sail Any of various sailing rigs which are not set on yards and which are arranged in a fore-and-aft direction amidships.

Galley A seagoing vessel propelled primarily by oars but also usually outfitted with sails. Also, the name given to the ship's kitchen.

Halyard Lines used for hoisting a spar or sail into position.

Heliacal Occurring near the sun; applied to stars which rise and set concurrently with the sun while still visible.

Keel The main longitudinal timber upon which frames and end posts were mounted; the backbone of the hull.

Keelson An internal longitudinal timber or line of timbers mounted upon the frames along the centerline of the keel. It provided additional strength to the bottom of the hull.

Lee An area that is sheltered or turned away from the wind. . Also, the quarter ore region toward which the wind blows.

Leeward Approaching the quarter toward which the wind blows (opposite is windward).

Lifts Lines that run from the deck to a block near the top of the mast and down to the yard; used for hoisting and lowering the yard.

Log Any device used to determine the speed of a vessel.

Port The left side of the ship when facing forward.

Prow The forward part of a vessel.

Reef To shorten sail by tying in one or more reefs.

Rigging	The various ropes and chains employed in supporting and working the mast, yards and sails.
Starboard	The right side of the ship when facing forward.
Stay	One of several ropes or wires used for steadying the mast. Ancient square rigged vessels employed two, one stretched from the head of the mast to the stern, the other to the bow.
Stem, **Stempost**	A vertical or upward curving timber to which the two sides of the bow attach; they are scarfed to the keel at the lower end.
Stern	The rear or after end of a vessel.
Sternpost	A vertical or upward curving timber to which the two sides of the stern attach; they are scarfed to the keel at the lower end.
Scud	To run before a gale with little or no sail set. Also, low clouds and spray driven by the wind.
Set and drift	The set is the direction toward which a current is flowing, and the drift is its speed. Both are used to compute offsetting influences of the ship's intended course.
Sheet	Rope that controls the tension of the clew, or loose bottom, of a square sail.
Tack	The course of a vessel running obliquely against the wind. Also, one of a series of straight runs that comprise the zigzag course of a ship proceeding to windward.
Telltale	A string or strip of textile that indicates the relative direction of the wind. On sailing ships it is often attached to the shrouds and backstay for ease of reference.
Yard	A long spar to which the head of a square sail is attached.
Way	Movement or passage through the water.
Wear	The act of bringing a vessel onto another tack by turning the head away from the wind until the wind is on her stern, and then bringing the head toward the wind on the other side.

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Abbreviations

BS Pilot 24 = Hydrographer of the Navy. 1990. *Black Sea Pilot. Marmara Denizi, Black Sea and Azovskoye More with Adjacent Coasts of Turkey, Bulgaria, Romania and USSR*. NP 24. 12th ed. Somerset, UK: Hydrographic Department.

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Med Pilot V = Hydrographic Department. 1961. Mediterranean Pilot. Vol. 5, *Coasts of Libya, Egypt, Israel, Lebanon and Syria, the Southern Coast of Turkey and the Island of Cyprus*. 5th ed. London: Hydrographic Department.

SDEEM = Defense Mapping Agency. 1995. *Sailing Directions (Enroute) for the Eastern Mediterranean*. Pub. 132. 8th ed. Bethesda, MD: DMA.

SDPGM = Defense Mapping Agency Hydrographic/Topographic Center. 1991. *Sailing Directions (Planning Guide) for the Mediterranean*. Pub. 130. 5th ed. Bethesda, MD: DMA, HTC.

SSMO, *MMA* = Naval Weather Service Detachment. 1970. *Summary of Synoptic Meteorological Observations: Mediterranean Marine Areas*. Vols. 7-9. Asheville, NC: Naval Weather Service Command.

WBS = Meteorological Office. 1963. *Weather in the Black Sea*. London: Her Majesty's Stationery Office.

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Vita

Dan Davis attended Saydel High School in Des Moines, Iowa from 1983 to 1987. After graduation he attended Iowa State University, where he began studying Classics. He entered the U.S. Navy on active duty on 17 April, 1990. There he served as a deep-sea diver and quartermaster aboard the USS *Petrel* (ASR-14) and USS *Ortolan* (ASR-22). He was honorably discharged in 1994, whereupon he resumed studies in Classics at the University of Iowa in Iowa City. During the summers he participated in archaeological field schools at Caesarea Maritima in Israel (1995) and Ulpia Noviomagus in The Netherlands (1996). He graduated with a B.A. in 1996, and that autumn entered the graduate program in Nautical Archaeology at Texas A&M University in College Station, Texas. While pursuing graduate studies he taught Greek and Latin (1996–1999) and Classical Archaeology (2000) and participated in the Institute of Nautical Archaeology's shipwreck projects in Turkey (1997–1999) and the Republic of Georgia (1999). After earning his M.A. in 2001 he served as the Director of Operations of a non-profit marine archaeological survey firm in Florida. In 2003 he began working full-time for the Institute of Classical Archaeology at the University of Texas at Austin. In 2004 he entered the Ph.D. program in Classical Archaeology at UT. Since then he has worked on ICA projects at Metaponto (Italy) and Chersonesos (Ukraine), and has collaborated with Dr. Robert Ballard of the University of Rhode Island on deepwater surveys and shipwreck excavations in the Black Sea.

Permanent address: 6603 Hart Lane, Austin, TX 78731

This dissertation was typed by the author.