

The Myth of Alpheus and Arethusa and Open-Sea Voyages on the Mediterranean—Stellar Navigation in Antiquity

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The article offers a new interpretation of the Greek myth of Alpheus and Arethusa, which it is believed emerged as a description of latitude-sailing between the Peloponnese and Sicily during the Bronze Age. The author discusses the stars which could have assisted navigation on this route. This is followed by a discussion on the ancient practice of determining latitude by observing the altitude of the lower culmination of the last circumpolar star. Some sea-routes are suggested which could have been traversed using the latitude-sailing technique, and the stars that could have been used as navigation aids on such voyages.

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A 2nd–3rd century Greek author Philostratus the Younger wrote a remarkable biography of a Pythagorean wise man named Apollonius. Nearing the end of his career as a travelling prophet, and foreseeing the wish of the emperor Domitian to arrest him, Apollonius decided to go to Rome on his own initiative. Accordingly, he sailed to Corinth, ‘worshipped the sun about midday’, and ‘embarked in the evening for Sicily and Italy’. Due to favourable winds and currents ‘he reached Dicaearchia on the fifth day’ (*VA* VII.10). Here is a genuine ancient testimony about the duration of the voyage from Corinth to Puteoli. Moreover, we know that the voyage probably occurred during summer (*VA* VII.11). After a successful presentation of his case before the emperor, Apollonius was relieved of all charges of sorcery and free to go as he wished. He returned to Puteoli and sailed towards Greece. Once more aided by favourable winds, Apollonius arrived via the Straits of Messina at Tauromenium on the third day. From there he continued his voyage to nearby Syracuse, a starting-point for crossing the Ionian Sea: ‘[Apollonius and his company] put out for the Peloponnese about the beginning of the autumn; and having traversed the gulf [the Ionian Sea] they arrived after six days at the mouth of the Alpheus, where that river pours its waters, still sweet, into the Adriatic and Sicilian Sea’ (*VA* VIII.15).

From this description we can extract the following facts: first, the passage took place in late September, or early November at the latest; next, we have specific references to the start and end points of the voyage; finally, we find that it took six days to complete the voyage. This detailed description allows us to analyse Apollonius’ journey. Firstly, six days is certainly too long for the voyage from Syracuse to the Peloponnese, especially in light of Apollonius’ original journey to Italy. I believe that Philostratus’ expression ‘traversing the gulf’ explicitly refers to the open-sea voyage across the Ionian Sea, rather than to the circumnavigation following the coast-and-island route (Fig. 1). This brings us to the inconsistent duration of the return voyage. Casson (1960: 115) states that the navigator ‘headed for Sicily had the wind behind him only as far as the southern tip of Greece and from that point on he had to tack; conditions were, of course, just the reverse on the homeward journey’.

It is obvious that the voyage *to* Sicily should be longer, not the other way around. Casson (1971: 286; cf. 1951: 140) explicitly states that the north-westerly winds prevailing in that area ‘should have been perfect for such a voyage’. Therefore, it is possible that six days is the total duration of the voyage from Puteoli to the mouth of the Alpheus, which concords well with the four or five days of the outward voyage. According to this interpretation, Apollonius and his company

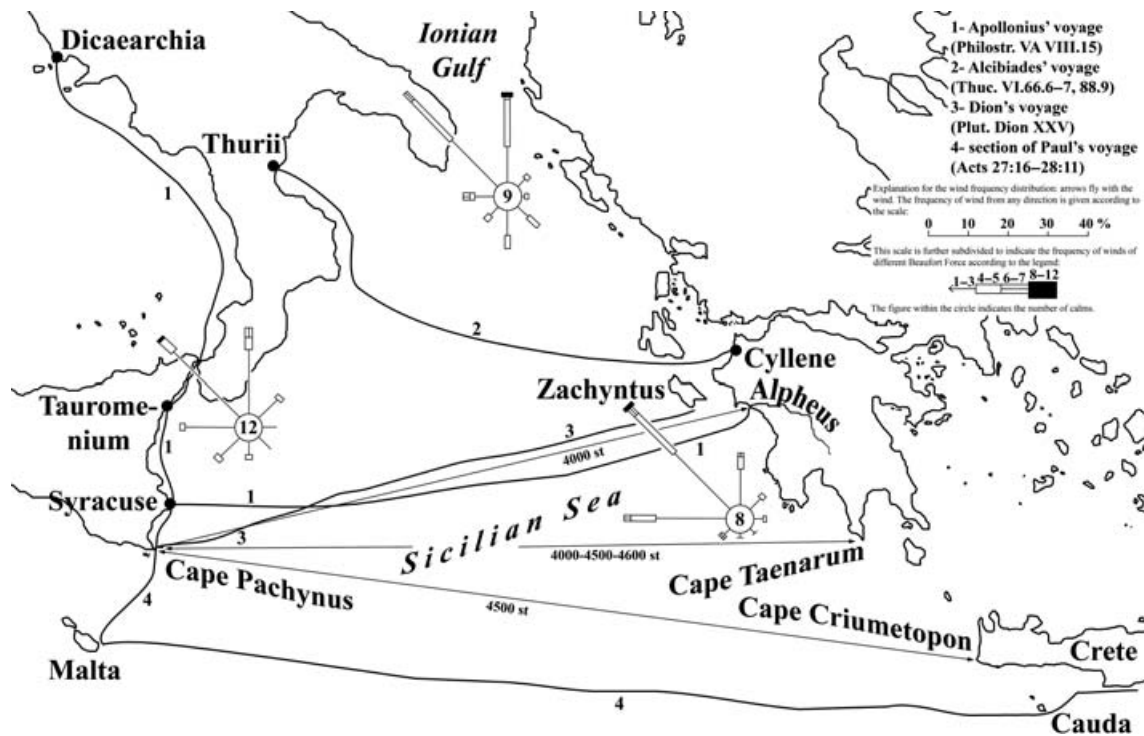


Figure 1. The map shows direct crossings of the Sicilian Sea, as described in ancient literature, as well as assumed distances between Cape Pachynus and Greece; wind frequency distribution for July is depicted according to *Mediterranean Pilot*. (T. Bilić, 2006)

would have travelled for two days from Puteoli to Taormina, an assumed one day to Syracuse, and two or three days to the Peloponnese. It would be extremely unusual for the voyage from Corinth to Puteoli to involve four or five days and that from Syracuse to the mouth of the Alpheus as many as six, especially if we take into account the prevailing winds in the area; a more likely variant is the proposed return trip whereby the whole voyage would have taken six days. The Sicilian city of Taormina is approximately 50 nautical miles north of Syracuse, while the complete distance from Puteoli to Syracuse is approximately 250 nautical miles; with another 300 nautical miles from there to the mouth of the Alpheus. Therefore, the three-day voyage from Puteoli to Syracuse accords well with the similar duration of the voyage from Syracuse to the Peloponnese.

The crossing of the Ionian Sea would take, under ideal conditions, two and a half days. If a ship set off from Syracuse at sunrise, it would arrive at the mouth of the Alpheus during the afternoon of the third day of the voyage; if it set off at sunset, as did Apollonius' ship from Corinth, it would reach its destination at the end of the third night. I believe this is the correct and logical interpretation of Philostratus' description. If I am right, this is

a direct and unambiguous confirmation of an open-sea maritime route between Sicily and the Peloponnese, more precisely, between Syracuse and the mouth of the Alpheus.¹ In any case, whether the whole voyage involved six days, or only the section between Syracuse and mainland Greece, it is obvious that Apollonius followed an open-sea route.

Before we proceed with the analysis of Apollonius' voyage, let us recount one more direct crossing of the Ionian Sea mentioned in ancient literature—Plutarch's description of Dion's voyage from Zacyntus to Cape Pachynus in 357 BC. The crossing was made in 'the middle of summer', when 'the Etesian winds [were] blowing steadily on the seas' (Plut. *Dion* XXIII). The convoy consisted of five ships. Dion's explicit intention was to avoid approaching any dry land, since it was generally hostile to his party. He was especially afraid of the fleet based in Iapygia, so he was sure to carry enough provisions for the whole voyage. Thus equipped, the fleet sailed from Zacyntus out onto the high sea. 'Twelve days they sailed with a fresh and gentle breeze; on the thirteenth, they made Pachynus, the Sicilian cape.' (Plut. *Dion* XXV). Cape Pachynus is the south-eastern tip of Sicily, some 30 nautical miles south of Syracuse.

The duration of the voyage is extremely long, and one wonders why it would take the ships 12 days to cross some 295 nautical miles from Zacynthus to Cape Pachynus (this would make them travel at a speed of about 1 knot, while from Hdt. IV.86 we know that a ship could sail at five times that speed).² The only logical explanation would be that the convoy was somewhat overloaded, which

considerably decreased its speed. We have heard that Apollonius arrived at Puteoli from Corinth in five days, and from Puteoli (or, at least, Syracuse) to the mouth of the Alpheus in six, so 12 days as a normal duration of the voyage is out of the question, especially if we take into account the prevailing winds on the Ionian Sea (see above and note 12; also Tables 1 and 2). Procopius informs us

Table 1. *Wind frequency at Zachyntus (37°47' N, 20°53' E). The prevailing wind during the sailing season is clearly the north-westerly Maestral (marked in bold). Adapted by the author from Mediterranean Pilot, III, 35*

Month	08:00									14:00								
	Percentage of observation from									Percentage of observation from								
	N	NE	E	SE	S	SW	W	NW	calm	N	NE	E	SE	S	SW	W	NW	calm
January	14	14	7	4	8	27	12	13	1	15	13	9	5	8	29	8	12	1
February	18	10	4	6	9	28	11	11	2	20	12	4	9	12	25	8	10	0
March	11	8	2	6	12	23	15	21	2	16	8	4	11	13	20	9	19	0
April	9	10	3	11	17	15	13	17	5	11	6	2	7	17	14	20	22	1
May	7	10	4	8	14	11	11	33	2	5	10	2	8	14	11	12	38	0
June	10	7	5	5	9	6	13	40	5	12	11	2	5	10	4	12	44	0
July	14	9	4	10	5	2	8	46	2	18	8	0	5	4	2	10	53	0
August	11	13	5	11	5	2	7	39	7	15	16	2	8	4	4	6	45	0
September	15	13	2	7	8	9	12	27	7	16	18	1	7	8	8	11	30	1
October	12	7	4	8	13	22	15	15	4	18	9	3	12	13	16	11	17	1
November	13	9	7	9	15	22	13	11	1	13	16	4	8	11	21	8	18	1
December	18	4	10	8	8	33	10	7	2	13	9	12	5	7	35	5	12	1
Mean	13	9	5	8	10	17	12	23	3	14	11	4	7	10	16	10	27	1
Mean (June–September)	12	11	4	8	7	5	10	38	5	15	13	1	6	7	5	10	43	0

Table 2. *Wind frequency at Syracuse (37°04' N, 15°17' E). The prevailing winds during the sailing season are northerly and southerly (marked in bold). Adapted by the author from Mediterranean Pilot, I, 50*

Month	07:00									19:00								
	Percentage of observation from									Percentage of observation from								
	N	NE	E	SE	S	SW	W	NW	calm	N	NE	E	SE	S	SW	W	NW	calm
January	14	7	4	2	4	12	26	21	10	14	13	6	6	9	17	15	12	8
February	12	11	3	2	8	12	22	18	12	13	15	6	8	14	16	14	10	4
March	14	9	3	5	8	9	22	20	10	10	13	9	11	19	11	15	9	3
April	27	10	4	3	5	10	14	16	11	18	22	6	6	19	9	10	7	3
May	26	16	7	4	7	10	12	10	8	15	17	12	10	26	10	5	3	2
June	31	17	8	5	6	7	8	6	12	12	16	13	16	27	7	2	3	4
July	37	15	6	4	7	5	6	8	12	12	12	9	13	33	11	3	2	5
August	33	12	6	6	5	6	8	9	15	9	15	9	12	39	7	3	2	4
September	22	9	10	7	6	10	11	13	12	9	13	13	13	22	13	5	5	7
October	14	8	7	4	7	15	18	18	9	6	13	10	10	23	13	12	9	4
November	15	6	6	5	6	8	27	19	8	8	10	9	10	15	17	15	10	6
December	13	8	5	2	6	13	26	21	6	5	11	5	6	12	22	19	15	5
Mean	21	11	6	4	6	10	17	15	10	11	14	9	10	21	13	10	7	5
Mean (June–September)	31	13	8	6	6	7	8	9	11	11	14	11	12	30	10	3	3	5

that it was possible, with a favourable wind, to sail from Epidamnus to Rome in five days (*Bell.* VII.18.4).

The first half of this route is over the Ionian Sea, and the whole route is more than twice as long as Dion's voyage (600 nautical miles). Moreover, this route is mainly a coastal one, and we know that coasting 'is more time-consuming than sailing over the open sea' (Casson 1971: 288; cf. 1951: 142). Once again, the duration of the voyage does not reveal the nature of the crossing. 'A fresh and gentle breeze' implies no obstacles in terms of weather conditions, but it could also mean that the wind was not strong enough to provide any greater speed; also, the desire to avoid the enemy fleet suggested a somewhat more cautious voyage, although a speedy transit probably made more sense. 'A well-found ship could cover the 250-odd miles from Zacynthus to the Straits or Syracuse in two days or a little more, sailing at five to six knots' (Dunbabin, 1948: 195). Whatever the case, the direct route between the Peloponnese and Sicily was active in the 4th century BC,³ while the points of reference are more or less the same as in Apollonius' voyage half a millennium later: 'When estimating the distance between the Peloponnese and Sicily, toward the end of the fourth century BC, the points of reference are the mouth of the Alpheus River ... and Syracuse' (Prontera, 1996: 205). Thus Strabo gives the estimate according to which 'the transit from Pachynus to the mouth of the Alpheus is 4000 stadia' (Str. VI.2.1).⁴

Thucydides gives a most unambiguous statement on the subject of open-sea voyages between the Peloponnese and Sicily. He clearly distinguishes two different routes used to cross the Ionian Sea: 'the Ionian sea for the coasting voyage, and the Sicilian across the open main' (Thuc. VI.13.1). First of all, we have encountered here two geographical terms which are not always used consistently: the Ionian Sea and the Sicilian Sea. Thucydides, along with many other classical authors (e.g. Dion. Hal. I.11.2, 3, 13.1, 18.3, 51.2, XX.1.8), associates the name of the Ionian Gulf with the Adriatic or, in an even narrower sense, with the Strait of Otranto and its immediate vicinity (I.24.1, VI.30.1, 34.4, 44.1, 104.1, VII.33.3; cf. Plb. XXXIV.12). Thus Diodorus calls this part of the Adriatic 'the Ionian passage-way' (XV.13.1; cf. Plb. II.14.4, 5), while Ps. Scylax (27, GGM i.34) calls it 'the mouth of the Ionian'. On the other hand, classical authors generally place the Sea of Sicily between the shores of that island and the Peloponnese, stretching all the way to Crete. Thus Thucydides makes it

extend to the shores of Laconia and Cythera (IV.53.3), refers to it as 'the vast main' (IV.24.5), explicitly distinguishing it from the Ionian Sea or Gulf.

Strabo claims that the Sikelian Sea stretches from Sicily and southern Italy to Crete, the Peloponnese, and the Gulf of Corinth, while on the north it reaches all the way to 'the mouth of the Ionian Gulf', that is to say, the Strait of Otranto, thus also clearly distinguishing one from the other (II.5.20). Polybius claims the Ambracian Gulf to be a branch of the *Sikelikon pelagos*, which extends also to Kephallenia, and Iapygia on the north (IV.63, V.3, 5, XXXIV.11.1; cf. I.42, II.14, 16, X.1, XII.4), while Eratosthenes names thus the sea between Sicily and Crete (*HN* III.5.75). Aristotle (*Meteo.* II.1, 354a19–21) describes the seas in a north-to-south and then east-to-west sequence: Pontus, Maeotis, Aegean—turning west,—Sicilian, Sardinian, Tyrrhenian; there is no Ionian here, and it is clear that the Sicilian Sea represents the area between Greece and Magna Graecia. These facts led one modern scholar to conclude that:

as in other examples deriving from the ancient marine terminology, the extension of the *Sikelikon pelagos* as far as the shores of the Aegean must be due to the fact that it is crossed by those actually going to Sicily ... the name is believed to derive from the experience of the high-sea routes, [and] these must have been more frequent than they would appear to have been from the few known episodes regarding this period described in ancient literature' (Prontera, 1996: 205).

We can report a few other instances of direct crossings over the Sea of Sicily. First, there is Alcibiades' flight from Thurii to Cyllene in Elis; he crossed the open sea in 'a trading vessel' (Fig. 1). Alcibiades at first agreed to go with the Athenian ship *Salamina*, sent to escort him back to Athens, but at Thurii he and his fellow-accused changed their minds. Alcibiades, 'now an outlaw, crossed in a boat not long after from Thurii to Peloponnese,' more precisely to Cyllene (Thuc. VI.61.6–7, 88.9). There are other reports of direct crossings dating from the Peloponnesian War: thus we can safely presume that ships transporting corn from Sicily to the Peloponnese took the direct route across the open sea, since the Athenians, who controlled at that time the entrance to the Corinthian Gulf as well as Corcyra, could not prevent them (Thuc. III.86.4); furthermore, some of the Peloponnesian troop-ships bringing relief to Syracuse probably also crossed directly (Thuc. VII.17; cf. VII.4.7, 7.1, 19.3–5). A Corinthian

commander Gongylus probably crossed directly from Leucas to Syracuse, and the rest of the fleet took the same route (Thuc. VII.2.1, 7.1). Some of the troop-ships 'put out into the open sea' for Syracuse 'starting from Taenarus' (Thuc. VII.19.4). The Lacedaemonian commander Gylipus 'rapidly crossed the Ionian Sea to Tarentum', setting off from Leucas, thus sailing in the opposite direction of Alcibiades' voyage, yet probably following the same route over the open sea, since Corcyra was hostile to Spartans (Thuc. VI.104.1). One time the Syracusans sent out 12 ships, one of which went to the Peloponnese, 'while the eleven others sailed to Italy' (Thuc. VII.25.1). Thucydides' statement suggests that the twelfth vessel did not go to the Peloponnese via Italy, and we can safely presume it travelled over the high sea. The rest of the Syracusan fleet sailed to Locri, just in time to meet there a merchant-vessel coming from the Peloponnese and carrying Thespian heavy infantry (Thuc. VII.25.3–4); presumably, they came over the open sea because the Athenians controlled Corcyra.

Probably the earliest reference to the direct crossing of the Sicilian Sea is to be found in Euripides' *Kyklops*. There Silenus describes how as his ship was 'rounding Cape Malea, an east wind blew down on the ship and cast us to land near this crag of Aitna' (18–20). This is, of course, a mythological story, yet it shows that it was possible to imagine the direct crossing to Sicily as early as the time of Euripides. There is also a description of an unsuccessful attempt of a fraud carried out by two Massaliote merchants. They sailed out from Syracuse for Greece, and 'when they were two or three days' voyage from land' one of them tried to scuttle the ship, as he had earlier contrived with his accomplice. 'They must have been nearly across in three days, and apparently making for the mouth of the Corinthian Gulf' (Dunbabin, 1948: 195); their ship 'was coasting not too far from the island of Cephallenia' (Casson, 1960: 117). Yet Hegestratus was caught in the act and jumped overboard, while 'the ship was safely brought to Cephallenia' (Dem. XXXII.4–8). Thus it is evident that the crossings of the *Sikelikon pelagos* indeed occurred, if not regularly, at least exceptionally. Moreover, it is evident from this incident that one could sail from Syracuse to Kephallenia, not far from the Greek mainland, in 'two or three days', which accords well with our earlier estimate for the duration of Apollonius' return trip.

During the Roman period, the crossing of the Sicilian Sea was a regular occurrence. The famous

Rome-Alexandria route involved the crossing of the *Siculum mare*. We know that the fastest ships could complete the voyage from Puteoli to Alexandria (1000 nautical miles) in nine days 'with the lightest possible breeze', or in six or seven days starting from the Strait of Messina (830 nm; *HN* XIX.1.3). Philo relates how the emperor Caligula advised Agrippa not to take the long and troublesome coastal route from Brundisium to Syria, but rather to 'take the shorter one by Alexandria, and to wait for the periodical winds; for he said that the merchant vessels which set forth from that harbour were fast sailers, and that the pilots were most experienced men, who guided their ships like skilful coachmen guide their horses, keeping them straight in the proper course'. The young prince accepted the emperor's advice and arrived in 'a few days' to Alexandria on an Alexandrian vessel setting off from Dicaearchia (Philo *In Flacc.* V.26–7). Centurion Bassus also arrived 'in a few days' from Italy to Alexandria, taking the same route (Philo *In Flacc.* XIII.109–10). Therefore, the complete voyage from Puteoli to Alexandria involved two weeks at the most; the section covering the Sicilian Sea should not have taken more than two, or at most three, days, which accords well with our estimate for the voyage of Apollonius. Finally, Procopius informs us how the Vandal Geiseric crossed from Zacynthus to Carthage over the open sea, throwing overboard his unfortunate Zacynthian prisoners 'when he reached the middle of the Adriatic Sea' (*Bell.* III.22.18). Justinian's general Artabanes sailed from Kephallenia to Calabria over the Adriatic (the term used by Procopius to denote the sea down to Malta, *Bell.* III.14.16), but a storm threw some of his ships back to the Peloponnese (VII.40.14–16). It is evident that both voyages were conducted over the open sea.

The myth of Alpheus and Arethusa

The key which explains the importance of this route and its reflection in mythology is found in Philostratus' writings. We read that Apollonius arrived in Greece at the mouth of the Alpheus, 'where that river pours its waters, still sweet, into the Adriatic and Sicilian Sea'. The phrase recalls the myth connecting this river with Sicily, more specifically with the islet of Ortygia, just off the coast at Syracuse. On that islet stood, and still stands, the spring of Arethusa, which pours its waters into the Ionian Sea after only a short flow. Let us look into this myth more thoroughly.

Ovid vividly described the association of the nymph Arethusa and the river god Alpheus, her underground flight and his pursuit (*Met.* V.572–641; cf. V.487–508). Pausanias recounted a similar story of Alpheus transforming himself into a river and flowing under or through the sea to intermingle his waters with Arethusa, backing his story with an oracle from Delphi (V.7.2–3, VIII.54.3). There is another story, almost identical to the one involving Arethusa, but this time the object of Alpheus' desire is the goddess Artemis. Because of Alpheus' love, the natives of Letrinoi gave her the appellation Alpheiaea (Paus. VI.22.8–10). Strabo also mentioned that near the mouth of the Alpheus there was a shrine to Artemis Alpheionia or Alpheiusa. An annual feast in honour of this goddess was held in Olympia (VIII.3.12; cf. Demetrius of Skepsis fr. 5 Gaede *ap.* Ath. VIII.346c). Alpheus and Artemis shared an altar in Olympia (Paus. V.14.6; Herodorus *ap.* Σ Pi. O. V.10), and the goddess had her sanctuaries by the banks of Alpheus (Paus. VI.22.9; Str. VIII.3.12; Σ Pi. N. I.3). In concordance with this version of the myth, Σ Pi. P. II.12 (=Σ. Pi. N. I.3) also makes the goddess Artemis the object of Alpheus' desire (cf. Telesilla 717 PMG *ap.* Heph. *Ench.* XI.2). But according to this version, she fled before him on Ortygia, where she had a temple under the name of Alphaea (Smith, 1870: 133–4).

This would appear to be the original story. Pindar addresses Syracuse with a phrase 'Ortygia, abode of Artemis the river-goddess' (P. II.6–7), and this can only be applied to the role of the goddess in the Alpheus-Artemis/Arethusa story. Ortygia itself is dedicated to Artemis, which is clear from Pi. N. I.2–4. Callimachus mentions a temple of Artemis 'in Ortygia' (*Epigr.* 63; he might have had Delos in mind), while Cicero describes a temple of Diana on Ortygia (*Ver.* IV.53.118). In modern literature this temple is referred to as 'the Apollonion'.

Pindar is one of the earliest sources mentioning the myth of Alpheus' passage: 'Ortygia, revered place of reappearing of the Alpheus, the offset of renowned Syracuse' (N. I.1–2). Somewhat earlier the Sicilian poet Ibycus described an under-sea connection of Alpheus and Arethusa, by which a *phiale* thrown into the river at Olympia reappeared at Syracuse (323 PMG *ap.* Σ Theocr. I.117; Dunbabin, 1948: 62–3). The association between Syracuse and Pisatis is further strengthened by the fact that the family of Iamidae from Olympia, whose forefather Iamus was born in the city of Phaesana on the Alpheus, had a part in the

foundation of Syracuse (Pi. O. VI.6, 34). It should be added that the popularity of the myth of Arethusa's flight to Syracuse is sufficiently reflected in the fact that the coins from this Sicilian city generally depict Arethusa's head encircled by dolphins. This scene can be found on the oldest Syracusan coins and it is actually a dominant motif on the coins of this most powerful Sicilian city. The earliest Syracusan coins were minted between 530 and 485 BC (Seltman, 1955: 73–4), so these depictions are roughly contemporaneous with Ibycus and Pindar.

The myth could thus have appeared in the middle of the 6th century BC at the latest, but the fact that the Syracusans use it at the very beginning of the minting of their coins would indicate a much earlier dating. If Hesiod's Hesperid Hesperethusa (fr. 360 M-W *ap.* Serv. *Aen.* IV.484; cf. Σ Clem. Alex. *Protrep.* p. 302.34–303.2 Stählin), 'western Arethusa', later 'separated' into Hesperie and Arethusa (Apollod. *Bibl.* II.5.11; cf. Fulgent. *Mythol.* I.16 for Arethusa as one of the Heliades by the Eridanos) represents an early reference to Arethusa's western provenance, we may 'push back' the origin of the legend as early as the 8th century BC.

The myth of Alpheus and Arethusa and the river's passage from Elis to Ortygia was referred to by a number of classical authors. The list of references is almost endless, but we must mention the following: Ps. Aristot. *De Mirab. Ausc.* 172; Antig. Car. *Mirab.* 140; Verg. *Aen.* III.692–6, *Ecl.* X.4–5; Ov. *Am.* III.6.29–30; Pomp. Mela II.7.117; HN II.106.225, XXXI.30.55; Sen. *Q. N.* III.26.5–6, VI.8.2, *Dial.* VI.17.3; Luc. *Phars.* III.176–7; Stat. *Sily.* I.3.68–9, 2.203–08, *Theb.* I.271–2, IV.239–40; Val. Flacc. VIII.91; Sil. It. XIV.53–4; Philostr. *Epist.* 47, *Imag.* II.6; Serv. *Aen.* III.694, *Ecl.* X.4; Fest. Av. *Descr.* 1164–6; Claud. *De rapt. Proserp.* II.60–61, *In Ruf.* II.9–11, *De cons. Stil.* I.186–7; Amm. Marc. XV.4.6; Auson. *Ordo Urb. Nob.* 11, and various scholia (e.g. Σ Pi. N. I.1, 2, 3, *Od.* III.489, Verg. *Ecl.* X.1, 3, Luc. III.177; cf. *Myth. Vat.* I.166, II.173). However, we must point out one belief, mentioned already by Philostratus, namely, the 'still sweet waters of the Alpheus'. We have already heard from Pausanias that the Peloponnesian river passed through the sea and came to Ortygia presumably unaffected by the salt water. A similar motif of the Alpheus not mixing with seawater is also provided by Nonn. *D.* XIII.323–7, XXXVII.170–73 (cf. VI.339–65, XLII.104–07). The same motif can be found in Lucian. *DMar.* III; Mosch. *Id.* VII; Ach. Tat. I.18.1–2; Philostr. *Im.* II.6; Fulgent. *Myth.* III.12;

Suda α 532, 1449, 3821; Greg. Naz. *Or.* 43.21). Therefore, we can conclude that the classical authors, explicitly or implicitly, believed that the Alpheus passes through the sea unaffected by salt water. Moreover, it seems that it was truly believed that it flowed under or through the sea, which was constantly referred to as the Adriatic—and which we would today call the Ionian—and then emerged on the small island of Ortygia off the Sicilian coast.

Strabo confirmed the existence of this belief and at the same time refuted it. He cites two senior authorities, the historian Timaeus and Pindar, and notes how the Alpheus

flows through the land beneath the sea to the place where the Arethusa rises and flows into the sea ... A certain chalice having fallen into the river at Olympia was cast up by the springs of Arethusa; the fountain too is troubled by the sacrifices of oxen at Olympia. And Pindar, following such reports, thus sings [N. I.1–2]. Timaeus the historian advances these accounts in like manner with Pindar.

Strabo's harsh criticism of this theory immediately follows, concluding it is 'entirely visionary' (Str. VI.2.4). We may add that Polybius refuted Timaeus' assertions (FGrH 556F41b) in much the same way as Strabo did, and he also adds how the Alpheus travels under *the Sicilian Sea* (XII.4d.5–8). We know that this term designates an open-sea voyage, which, in Alpheus' case, is the only possible way to arrive at Syracuse.

We conclude this survey of the Alpheus-Arethusa myth with briefly noting its survival through the ages. The 12th-century author Bernardus Silvestris knew of it (*Cosmographia*, I.3). The 13th century Ebstorf map depicts at Syracuse *Aretusa fl.* and *Alueus fl.*, undoubtedly the Alpheus. In the beginning of the 14th century Dante mentioned Arethusa's transformation (*Inf.* XXV.98). Even in the 15th century Lodovico Ariosto wrote of it (*Orlando Furioso* VI.19). In more recent times, Percy Bysshe Shelley vividly described the chase itself in a poem *Arethusa* (Pisa, 1820), while the depiction of the nymph on Syracusan coins perhaps inspired the idealized portrayal of *La République (Marianne)* on the first French postal stamps in 1849 (Seltman, 1955: 104).

What is the explanation of this myth?

Pausanias, as we have seen, unquestioningly accepted it as a given fact, backing it with the undisputed religious authority of the oracle of

Delphi, while Strabo considered it to be a mythological fancy. Fulgentius, as always, believed it to present an allegory. But these explanations seem to be a long way from the truth. Let us examine the latitudes of the two principal geographic/mythical sites. The islet of Ortygia lies at latitude 37°05' north. The source of the Alpheus River is in Arcadia, at 37°25' north, and it flows into the sea near Olympia in Elis at 37°35' north.⁵ So these two locations, the mouth of the Alpheus and Ortygia, lie at almost the same latitude. This means that the Alpheus continues its course 'beneath' or 'across' the Ionian (Adriatic, Sicilian) Sea almost along the parallel.

A few short preliminary notices are required at this point. It is a known fact that the altitude of the celestial pole is equal to the latitude of the location from the point of observation. Furthermore, the altitude of the culmination of individual stars is equal if observed from points on the same latitude. This information is extremely important in night-sailing and in celestial navigation, as we will find presently (Bilić, 2006: 125).⁶

A ship setting off from the Peloponnese toward Sicily could have used several Elean ports as points of reference. There were several towns in the immediate vicinity of the Alpheus' mouth, for example, the port of Pheia (37°40' north). During the Peloponnesian War, Demosthenes destroyed a merchant-ship harbouring at Pheia 'in which the Corinthian heavy infantry were to cross to Sicily', but the men managed to escape and crossed over in another ship (Thuc. VII.31.1). The second candidate could be Cyllene, which we remember as the ending point of Alcibiades' voyage from Thurii. Pausanias wrote how the Alpheus 'falls into the sea above Cyllene, the port of Elis' (VIII.54.3), although this port was somewhat further north (at 38°05' north; see Str. VIII.3.4). Paus. VI.26.4 added that 'it faces Sicily and affords ships a suitable anchorage', therefore in the same sentence associating Cyllene both with Sicily and marine voyages. He also described how some Messenian exiles sailed from the same Elean port to Rhegium (IV.23.5–6). According to Dionysius Periegetes (347–9, GGM ii.124), Cyllene was the port from which the Pelasgians as well sailed to Italy. Therefore, it was regularly associated with crossings to Italy. A third candidate is the Achaean port of Aegium, for which there is a more direct mythological confirmation. Pausanias mentions how the priests in Aegium (38°15' north) 'take cakes of the district from the goddess [Demeter] and throw them into the sea, saying

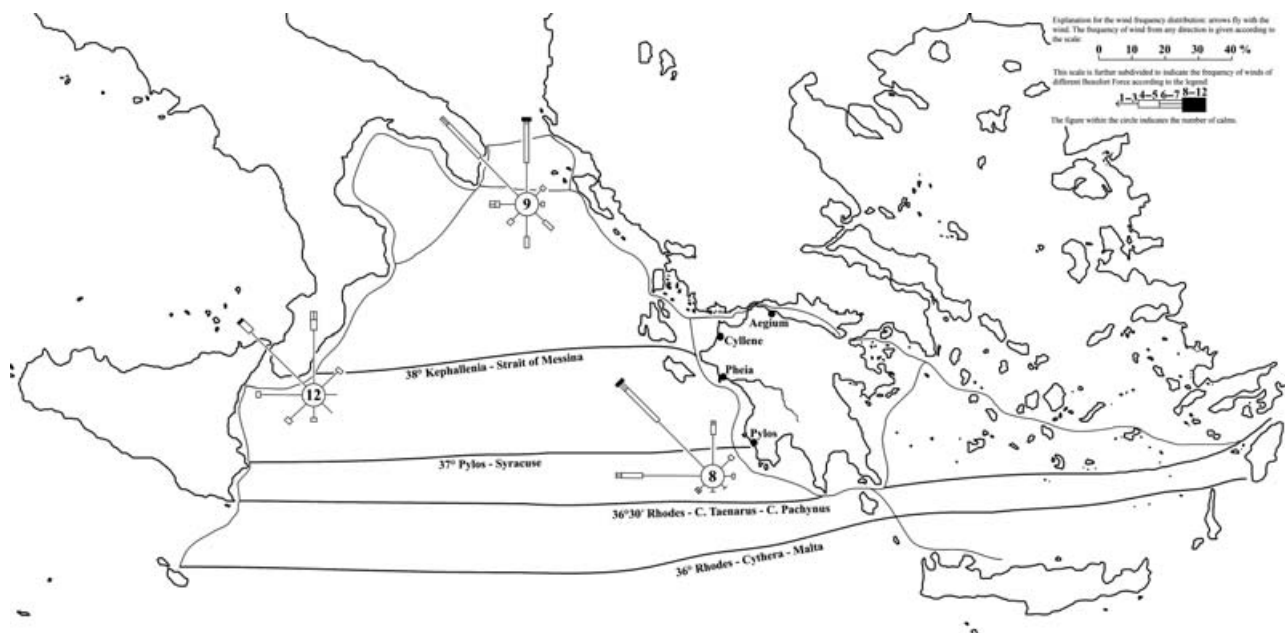


Figure 2. The map shows a reconstruction of marine routes described in the article; a circumnavigation along the coast is also depicted, along with some Peloponnesian harbours associated with sailing to Magna Graecia; wind frequency distribution for July is depicted according to *Mediterranean Pilot*. (T. Bilić, 2006)

that they send them to Arethusa at Syracuse' (VII.24.3). This tradition perhaps describes voyages on the Aegium-Syracuse route. Also worth considering are the Messenian ports of Kyparisia ($37^{\circ}15'$) and Pylos (37°). Between them and Syracuse, one could navigate exactly along the 37th parallel.

If a ship set off for Syracuse from the mouth of the Alpheus River, a coasting voyage would be approximately between 450 and 600 nautical miles long. The ship would have to sail toward the north-west by the Ionian islands and Corfu, if not further north to the Acroceraunian promontory, and then cross the Strait of Otranto. The voyage would continue across the Gulf of Taranto (weather directly from the Iapygian to the Lacinian promontory or along the coast) and further south-west to Calabria and Sicily (Fig. 2). But if one travelled from the Peloponnese by setting off directly west over the open sea, the voyage to Syracuse would only encompass *c.* 300 nautical miles, which is 25–50% shorter. On the other hand, from its very beginning, such a voyage traverses expanses of open sea with no points of reference anywhere. Such a voyage requires celestial navigation (Bilić, 2006: 126).

The easiest and simplest method for an ancient sailor would be to follow the elevation of the pole. In the period in question (*c.* 700 BC), when the most important Greek colonies were firmly

established, not a single brighter star designated the north celestial pole. In that year, the star Kochab was $6^{\circ}46'$ from the pole, while κ *Draconis* was at $5^{\circ}57'$. In 1300 BC, during relatively-intensive contacts between Mycenaean Greece and the future Magna Graecia (Dunbabin, 1948: 1–2; Casson, 1960: 24; Woodhead, 1962: 21–3; Vagnetti, 1996: 109–10, 112), the star κ *Draconis* was nearest to the pole, at a distance of $4^{\circ}40'$, while Kochab was at a distance of $6^{\circ}38'$. Fresa believes that the Greeks sailed between the island of Kephallenia and Magna Graecia by following the altitude of the star Kochab (Fresa, 1969: 253–4), even though it was, as stated, quite distant from the pole. Such a situation persisted until a much later period, when the star Polaris approached the pole. During the time of Pytheas of Massalia (end of the 4th century BC), the pole was positioned so that together with three circumpolar stars (Kochab, Thuban, and κ *Draconis*), it formed a truly regular rectangle. Hipparchus refuted Eudoxus' erroneous belief (fr. 17 Lasserre) of the existence of a fixed pole-star, writing how 'at the pole there is no star at all, but there is an empty space, with, however, three stars close to it, with which the point at the pole forms a square, as Pytheas of Massalia (fr. 1 Mette) also states' (Hipparch. I.4.1). Hipparchus does not directly state which three stars he had in mind, but the aforementioned

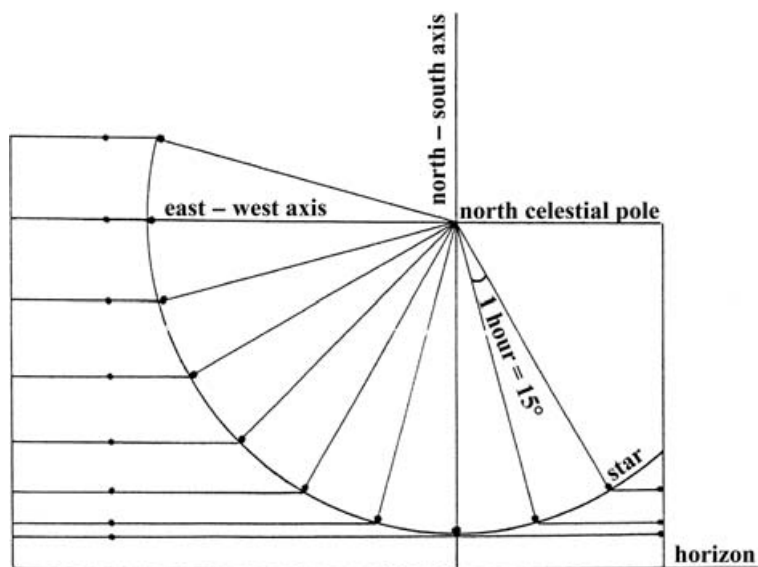


Figure 3. Section of a path of a circumpolar star around the north celestial pole, divided into one-hour intervals. The altitude of the star decreases slowly before, and increases slowly after it's lower culmination. (after Medas, 2000: 257, fig. 90; T. Bilić, 2006)

explanation seems realistic. However, during the period under observation this rectangle was quite irregular.

There is another manner in which the Greeks could have navigated from Elis to Syracuse: by observing the lower culmination of the circumpolar stars. Some further explanations are needed at this point. The circumpolar stars pass over the local meridian twice: once 'above' the celestial pole (upper culmination) and once 'below' (lower culmination). The last circumpolar star is the one that touches the horizon in its lower culmination. Therefore, if a given star is at a distance ϕ from the pole it will touch the horizon at its lower culmination.⁷ Based on these stars, the Greeks could determine the points of equal latitude (Fig. 3).

Pytheas of Massalia, when measuring the latitudes of the countries he visited, probably observed the lower culmination of those circumpolar stars whose position at that point was nearest to the horizon; Strabo thus cites Pytheas' (fr. 6c Mette) assertion that 'the farthest country north of the British islands is Thule; for which place he says the summer tropic and the arctic circle is all one' (II.5.8). To be sure, the Greeks understood the Arctic Circle varying for different latitudes. Since Strabo, and probably Pytheas, placed the Tropic of Cancer at 24° north (Str. II.2.2, 5.7, 35, 37), the latitude of Pytheas' Thule would be 66°. That the ancient seafarers calculated the altitude of individual asterisms, for example the Ursa, the celestial pole and the star Canopus is apparent

from Pliny (*HN* II.71.178; cf. *Mart. Cap.* VI.593). He noted the different visibility of Canopus in Italy, Alexandria, Rhodes and on the Black Sea, as well as the different visibility of Ursa in Egypt and on the Black Sea, and so forth. He also mentioned that Ursa Major began to set between Rhodes and Alexandria, which is truly imprecise. Strabo cited Eratosthenes (II.1.19) and Hipparchus (II.5.36), who stated that the paws and end of the tail of Ursa Major in parts of Egypt (Syene, near the Tropic of Cancer) fall below the horizon; so at this latitude this constellation is not circumpolar (Medas, 2000: 245). Pliny further asserts that these data were generally gathered during maritime expeditions. Ptolemy (*Geog.* I.7), citing Marinus of Tyre, mentions Taurus, Pleiades and Canopus, and Diodorus (II.35.2, III.48.1), who mentions the Ursa, also associated similar data with seafaring. Therefore, it is without question that Greek navigators observed the declinations of certain stars (Bilić, 2006: 127–30).

Stellar navigation and the celestial dragon

We have seen that the geographic locations of the Alpheus River and the islet of Ortygia are at similar latitudes, which confirms the mythical links between these two points by the alleged subterranean course of the Alpheus. If this fact is associated with the navigational technique described above using the lower culminations of the last

circumpolar stars, we will see that all that seafarers needed to do in order successfully to navigate the route from Elis/Messenia to Syracuse was to find the last circumpolar star at the latitude of a little over 37° , measure its altitude and follow it during the voyage. This is a simple navigational technique, and the combination of measured altitudes of the targeted stars with the elevation of the pole, which had to be 37° , may have enhanced its success. Which star could have served as a navigational aid during this period?

Observed from latitude $\phi = 37^\circ 10'$, the altitude of the lower culmination of the star Rastaban (β *Draconis*, mag. 2.79, δ 700 BC = $56^\circ 07'$) was $3^\circ 18'$; this means that it was the last circumpolar star visible at this latitude.⁸ So in about 700 BC the ancient Greeks could have navigated between the mouth of the Alpheus River on the Peloponnese and the island of Ortygia at Syracuse with the help of Rastaban (in 1300 BC, during the Mycenaean era, the same star was at $\delta = 57^\circ 26'$, with a lower culmination of $4^\circ 37'$, so it could have served the same purpose, perhaps even better than in subsequent periods). There is some information from classical sources which suggest the use of the constellation Draco in navigation.

In the *Georgics* Virgil shares the following advice: 'Us too behoves Arcturus' sign observe, and the Kids' seasons and the shining Snake, no less than those who over the windy main borne homeward tempt the Pontic, and the jaws of oyster-rife Abydos' (I.204–07). Thus, the poet testifies to the fact that seafarers returning from the Black Sea navigated with the help of the Snake, i.e. the constellation Draco.⁹ These seafarers travelled west to east, probably along the northern coast of Asia Minor, at a latitude of approximately 42° north. Another confirmation of the use of Draco in navigation can be found in the *Argonautica* of Valerius Flaccus. The Argo's pilot Tiphys pacified the Argonauts by explaining how Athena instructed him not to follow those stars which fall below the horizon during navigation, but rather to use as a guide 'he that never hides beneath the forbidden waters as he shines about the pole, the serpent that enfolds the seven stars' (II.61–5). This example is again associated with Black Sea navigation, but not necessarily—Tiphys described his general learning about celestial navigation; he is, in fact, the *first* seafarer on the *first* ship that ever sailed.

Rastaban is a star that forms Draco's right temple. Aratus wrote that 'his [Draco's] mouth and right temple straight confront the end of her [Helice's] tail' (59–60).¹⁰ Aratus (54–62) and Cicero (*ND*

II.107) described Draco's head as consisting of five stars: the eyes (ξ and ν *Draconis*), two brows or temples (β and γ *Draconis*) and a chin (μ *Draconis*). Aratus further wrote that Draco's 'head wheels near where the limits of setting and rising blend' (61–2), and Cicero made a similar observation (*ND* II.108). What does this mean? It means that Aratus (270 BC), Hipparchus (135 BC) and Cicero (1st century BC) believed that Draco's head touched the horizon at the lower culmination observed from the latitudes at which they lived, or that it was this way when somebody from whom Aratus obtained his data conducted astronomical observations.

This was probably Eudoxus of Knidos, who flourished approximately a century prior to Aratus (Knidos is on $36^\circ 50'$ north latitude). Strabo (II.5.14) stated that Eudoxus observed the star Canopus from Knidos and that his observatory was only a little higher than a house (the altitude of Canopus' upper culmination in 370 BC was only $19'$ observed from Knidos). Hipparchus (I.4.8) stated that Draco's head extended from $34 \frac{3}{5}^\circ$ to 37° so that at a latitude of 37° the star Etamin (γ *Draconis*) would be the last circumpolar star. In Hipparchus' time that star would have been $37^\circ 03'$ from the pole:

with reference to the position of the Draco's head, Eudoxus' and Aratus' statements agree with the facts, while Attalus' does not. For Aratus, following Eudoxus, says that it moves on the always-visible circle, using these words [Arat. 61–2]. But Attalus says that it is slightly more southerly than the always-visible circle, so that it goes below the horizon for a short time ... The star at the front of the Draco's mouth is distant $34 \frac{3}{5}^\circ$ from the pole, his southerly eye is 35° , and his southerly temple 36° from the pole. Now the always-visible circle in the neighbourhood of Athens ... is distant 37° from the pole. Hence, it is clear that the head of the Draco moves in the always visible part of the heaven, and has only the left temple on the circle itself, and is not, as Attalus says, further to the south, so as to be below the horizon for a short time and then to rise (Hipparch. I.4.8).

To this we may add that Martianus Capella described the 'drawing' of the Arctic Circle by Astronomy, who used the head of Draco, which 'stretches to the circle of the horizon', as a reference point for the circumference of the Circle (VIII.827; Bilić, 2006: 130–32).

Additionally, Cleomedes, probably drawing from an earlier work of Posidonius, claimed that the head of Draco, especially γ *Draconis*, passes through

the zenith above the Thracian Lysimachia (*De motu circ.* I.8). Since the city was located on latitude 40°40' north, the head of Draco was removed at least 12° (δ γ *Draconis*, the southernmost star in the head, in 100 BC = 52°54') from the zenith, which makes this information truly imprecise. It is very interesting that Hesiod in his *Astronomy* mentioned the constellation Draco (fr. 293 M-W *ap. Serv. Georg.* I.244–5; West 1978: 23). This reference, in a work which 'may have been composed with the needs of farmers or sailors in mind', probably does not 'go beyond any merely utilitarian end' (West 1978: 23), but may have been a part of navigational instructions involving Draco, not unlike its use as described above. Nautical manuals were not unknown to the Greeks, for example the *Nautical astrology* ascribed to Thales or Phocus of Samos (D-K 11A1, B1). Hesiod elsewhere describes Draco as the guardian-serpent of the Apples of the Hesperides (*Th.* 334–5), and we know that this beast was always awake (D. S. IV.26.2; Ov. *Met.* IX.190; Hyg. *Astron.* II.6; Serv. *Aen.* IV.484), and was also immortal (Apollod. *Bibl.* II.5.11). Dragon's epithets imply the circumpolar nature of the constellation, and this is further supported by the existence of one more 'never-sleeping' deathless dragon in Colchis, the guardian of the Golden Fleece (A. R. II.405–07, 1208–09, IV.129; Apollod. *Bibl.* I.9.16; D. S. IV.47.3, 48.3; Ov. *Met.* VII.36, 149, 212–13, *Her.* VI.13, XII.49, 60, 101; Val. Flacc. VII.1656, 536, and especially VIII.54–67 where it is evident that the poet had in mind the constellation Draco as the guardian of the Fleece).

The islands of Delos and Ortygia

We will now turn our attention to one detail encountered in Pindar's verses, where he mentions the islet Ortygia and the goddess Artemis, 'sister of Delos', together. This island is very closely associated with the Goddess of Hunting. There are different accounts of the ancient name of Delos: according to one it was Ortygia, where Leto gave birth to Artemis and Apollo (*Od.* V.123–4; *hApoll.* 16; Pi. *Pa.* VIIb.41–52; Call. *hAp.* 58–9, *Epigr.* 63; A. R. I.419, 537, IV.1704; Lyc. *Alex.* 401–02; *Orph. Hymn. ad Lat.* 5; Nicander fr. 5. Schneider *ap.* Σ A. R. I.419; Σ A. R. I.419, 308a, 537; Steph. Byz., Hesych. s.v. *Dēlos*; Hyg. *F.* 53, 140; Verg. *Aen.* III.124, 143, 154; Ov. *Met.* XV.336; *HN* IV.12.66; Solin. XI.19; Stat. *Theb.* IV.803, V.339, *Silv.* I.2.221; Prop. *El.* II.31.10; Festus *ap.* Paul. p. 194f L.; Nonn. *D.* IX.214, XLVII.463; Serv. *Aen.* III.73, 694, *Ecl.*

IV.10; Isid. *Etym.* XIV.6.21; Anth. Pal. VI.273, IX.550; cf. Σ Callim. *hAp.* 59; Ar. *Av.* 870).

The island of Delos is mentioned everywhere in the context of the birth of Apollo and Artemis, but there are two traditions: according to one, Artemis was born on the islet of Ortygia next to Delos (*hApoll.* 15–16; *Orph. Hymn. ad Lat.* 5–8), which is why she is sometimes called Ortygian. Other sources mention that both were born on Delos, e.g. Pi. fr. 33d; Apollod. *Bibl.* I.4.1; *Attic Scolia* 886 PMG *ap.* Ath. XV.693f; Cic. *Ver.* I.18.48; Hyg. *Fab.* 53; Serv. *Aen.* III.73; Isid. *Etym.* XIV.6.21. After Leto had given birth to her children, Delos ceased to be a floating island and took firm ground in the Cyclades (Call. *Del.* 260; Pi. fr. 33d *ap.* Str. X.5.2, *Pa.* VIIb.49–52; Verg. *Aen.* III.73–7; *HN* IV.12.66; Stat. *Theb.* I.702, VII.182–4; VIII.197–8; Porph. *ap.* Eus. *PE* III.14).

Lucian stressed that the wandering island Delos 'was torn from Sicily', thus linking the two distant islands; Poseidon fastened Delos to the sea-floor so that Leto could give birth (*DMar.* X.1). After Leto's delivery, it was decreed that no dead could be interred or cremated on the island; they were taken to a small island in the immediate vicinity of Delos, Rhenea, which 'in earlier times was called Ortygia' (Str. X.5.5). From this it is apparent that Strabo believed that Ortygia, which was mentioned as the birthplace of Artemis, was different from Delos itself. He identifies Ortygia as Rhenea, an uninhabited island close to Delos, on which there was a Delian necropolis. The same is argued by Diodorus. Giving birth or dying was also prohibited on Delos; those who were near death and expectant women were taken to Rhenea (Thuc. III.104.2; D. S. XII.58.6–7; Paus. II.27.1).

There is, therefore, the island of Ortygia dedicated to Artemis, which lies just off the coast of Syracuse; there is also Ortygia, a small island very close to Delos, and Delos itself, also closely associated to Artemis. Aside from the goddess, and Lucian's assertions, what else connects them? Both locations are on very similar latitude: Delos is at 37°25' north, a little farther north than Syracuse, but still very close. Also, this latitude is identical to that of the source of the Alpheus River, and again very close to that of the river's mouth. Is it coincidental that these two small islands on similar latitude, almost 900 km apart, have the same name and are dedicated to the same goddess? It is more probable that in all of the aforementioned stories, the language of mythology was used to describe the geographical link between Delos, Alpheus and Syracuse.

There is yet another Ortygia. Tacitus mentions how the Ephesians claimed that Artemis and Apollo were not born at Delos, but in their own country, in a grove Ortygia (*An.* III.61; cf. *Σ Pi.* N. I.1). The same grove, associated with the same story, along with the nurse Ortygia present at birth, is also mentioned by Str. XIV.1.20 (cf. Prop. *El.* III.22.15; Herodian. I.289.30 L.). Pliny claims Ortygia to be an ancient name of Ephesus itself (*HN* V.31.115; cf. Steph. Byz. s.v. *Ephesos*; Eustath. Dion. Perieg. 823, GGM ii.362). Ephesus lies at 37°55' north latitude, which seems a little too far north to be compared with the other two Ortygias, although this possibility cannot be entirely discarded. It is a fact that an Ephesus-Delos-Alpheus-Syracuse axis can be perceived. The axis gains in credibility if one considers that Ephesus was the largest hub of reverence to Artemis in ancient times, and the well-known temple of Artemis of Ephesus was located there. The distance from Ephesus to Syracuse, by direct maritime route via Delos, Corinth and the mouth of the Alpheus is approximately 620 nautical miles or 1100 km in a straight line (Bilić, 2006: 134–7).

There is also an Ortygia in Aetolia (cf. Simon. 563 PMG *ap.* *Σ BT Il.* IX.557), after whom all other Ortygias—namely, Ephesian, Delian and Sicilian—are supposed to derive their name (Nicander fr. 5 Schneider *ap.* *Σ A. R.* I.419), and Ortygia near the Euboean Chalcis, possibly identical to the Aetolian one—associated with the *Aetolian* Chalcis (*Σ Il.* IX.557; Dunbabin, 1948: 14, n. 1; cf. *Il.* II.640; Alcman. 11 PMG; see also Klearchos FHG ii 318 *ap.* Ath. XV.701c). Euboean Chalcis is on latitude 38°30' north, while the Aetolian is on 38°20' north, but since we know so little of these locations, I can not say anything more of them. The Ortygia mentioned by Homer (*Od.* XV.404), is not, I believe, identical to any of the aforementioned locations; moreover, it is a purely mythogeographical term associated with astronomical observations (as will be shown elsewhere).

One should add an interesting link between the island of Delos (37°25' north) and the island of Calauria near Troezen in Argolis (37°30'). Pausanias claimed that Apollo and Poseidon exchanged Calauria and Delphi (II.33.2), while Strabo said that Poseidon gave Delos to Leto in exchange for Calauria, while Apollo received Delphi in exchange for Taenarus (VIII.6.14). Perhaps this is an echo of the navigational route from Delos to Calauria, and continuing to Corinth. The favourable navigational position of Delos and its intermediate position between the

West and the East are emphasized by Strabo (X.5.4).

From this data we can draw a conclusion about the maritime route from the Cyclades (or even Asia Minor) via Corinth and the Corinthian Gulf toward the Ionian Sea, ending in Sicily.¹¹ Fresa believes that navigators from Ionia, using the experience of sailing on the Aegean Sea, navigated over the open sea and sailed along the 38th parallel between the island of Kephallenia and the Straits of Messina (Fresa, 1969: 253–4) (Fig. 2). They were aided in this by natural points of orientation. The length of the Kephallenia-Straits of Messina route is 237 nm; but Mt Ainos on Kephallenia is 1620 m high, so based on the equation $D = 2.06(\sqrt{e} + \sqrt{H})$ we can compute that navigators could have seen it at a distance of 82 nautical miles.¹² By the same token, the mountain of Aspromonte, at the very southern tip of Italy (1958 m), could be seen at a distance of 91 nautical miles. Thus, along that route, there remained only 164 nautical miles of open sea (Fresa, 1969: 254). Due to the prevailing northerly winds in the Strait of Otranto, it did happen that ships were blown somewhat farther south from their course (Fresa, 1969: 255) (the prevailing winds in the Ionian Sea are north-western, Casson, 1951: 140; 1971: 272, 286). If we are correct in believing that Greeks navigated using the star Rastaban, then they could have noticed that its altitude decreased if the ship slightly 'veered' to the south, and the same happened to the north celestial pole.

Reconstruction of the routes

Fresa claims that navigators could have adjusted their course with the help of brighter stars of the southern skies observed at their upper culmination (Fresa, 1969: 255–6). Therefore, we can see a third method that could be used by Greek navigators, especially in combination with the aforementioned methods. Confirmation of the use of southern-sky stars in navigation can be found in Lucan, who mentions Canopus in that context (VIII.181–4). The same star is mentioned by Ptolemy, who cites the writings of Marinus of Tyre (*Geog.* I.7). Apollonius of Rhodes (III.744–5), Virgil (*Aen.* III.517), and Aratus (728–31) mention Orion in the context of navigation. If we were to seek a counterpart of the last circumpolar star, then in the south this would be the star that appears on the southern horizon only at the moment of its upper culmination. Taking into account all of the astronomical effects that prevent the observation

of stars precisely at the moment of their touching the horizon, the most prospective candidate is Turais (τ *Carinae*). Thus navigation along the Peloponnese–Sicily route could proceed, in astronomical terms, between the lower culmination of Rastaban and the upper culmination of Turais.

The Greeks could have made the voyage between Kephallenia and the Straits of Messina in two days and two nights travelling at an average speed of five knots. Out of this, roughly 24 hours were on the open sea (Fresa, 1969: 254). It would appear that navigation at night was just as fast as during the day. Since Herodotus explicitly stated that the values given in IV. 86 (see note 2 and above) pertain to the summer months, when days are much longer than nights, one can conclude that travel by night was no slower, and perhaps even slightly faster.

Besides the preceding celestial navigational techniques, there is yet another that the navigators could have used. This involves the observation of zenith stars. The declination of a star that passes through the zenith above a certain location is equal to the latitude of that location. The altitude of the upper culmination of that star is 90° as a result. In other words, if a star in a given epoch has a declination that corresponds to the latitude of the observer's location, it will be at the observer's zenith at the moment of its upper culmination. Thus the latitude can be determined using zenith stars. For example, the very bright star Deneb could have served very well as a zenith star in 1300 BC at a latitude of 37° north, while in 700 BC at 38° north. Similarly, the stars of the constellation Corona Borealis in 700 BC could have marked the range of latitudes between the 37th and 38th parallels. However, there is no confirmation in the writings of the time that navigators in Antiquity used the zenith-star technique. Aristotle stated that the Corona Borealis, observed from the northern temperate zone, is at its zenith when it passes the meridian (*Mete.* II.5, 362b9–12). In 340 BC, the brightest star in Corona Borealis, Alphekka, had a declination of approximately 36°30', so at this latitude it was truly a zenith star, while one hundred years earlier its declination was approximately 37°, so it may have been the zenith star for this latitude. Ptolemy claimed he could name a zenith star for each principal locality appearing on his maps, yet he did not do so because of the changes in their latitudes due to the precession (*Geog.* VIII.2). Thus, it is possible that during the Antiquity the zenith-star method to determine latitude was known, although there is no direct confirmation that it was used in navigation (Bilić, 2006: 137–9).

At this point, the position in navigation has been determined with at least four parameters. For example, if a Mycenaean navigator sailed along the 37th parallel from, say, Pylos¹³ to Syracuse in 1300 BC over the open sea, he would have had accord due attention to the following:

1. He would have had to keep the northern celestial pole to his right at an altitude of 37°.
2. He could have monitored the altitude of the lower culmination of Rastaban, which was 4°27', also on the right side of the ship, on the northern horizon. Worth noting is that in Antiquity only June, July, August and September were deemed suitable for navigation. March, April, May and October were deemed perilous months, while the seas were 'closed' during November, December, January and February (Casson, 1971: 270–71; Bilić, 2004: 241–2; Tammuz, 2005: 145–6, n. 9, 10). This does not mean that there was no sailing at all during these months; what is more, there is a possibility that the sea was 'closed' during winter only for coastal sailing, 'while a journey in open water was relatively safe in summer and winter alike'. Three of four of the dangers of winter navigation enumerated by Vegetius (see note 7) relate to coastal navigation alone, and the fourth—wind, rain, and snow—is much lesser in open water (Tammuz, 2005: 156). This 'closing of the sea', although not equally applicable to open-sea sailing as to coastal, is mentioned here because in the year 1300 BC Rastaban was visible in its lower culmination from September to January, so that during most of the sailing season it was unusable for navigation. But the star ψ *Ursae Maioris* was visible in its lower culmination (altlc 1300 BC = 5°17') from April to September, so it may have served as the last circumpolar star during this time of the year (star θ *Ursae Maioris* may have also served this purpose because in its lower culmination it was visible from March to August; altlc 1300 BC = 5°50').
3. He could have monitored the altitude of the upper culmination of Turais, which was 5°01' from the left side of the ship toward the southern horizon. As in the preceding point, in the summer months some other southern stars could have served better than Turais (visible in its upper culmination from November to April), for example Fomalhaut (visible in its upper culmination from June to October, altuc 1300 BC = 9°55') or β *Piscis Austrini*

(visible from May to October, altuc 1300 BC = $8^{\circ}40'$).

4. Finally, he could have monitored Deneb in its upper culmination, which passed exactly over the observer's zenith at 37° . Deneb's upper culmination was visible during this period from May to October, so it could have served quite well as a zenith star at a latitude of 37° north in 1300 BC (Bilić, 2006: 141) (Figs 2 and 4).

We may consider one more route, safely attested in a more recent period of Greek colonization. It is a well-attested fact that the Rhodians transported vases and other merchandise from their island, the eastern Aegean, and even Phoenicia and Egypt directly to Sicily (Dunbabin, 1948: 228–40; Sakellariou, 1996: 186). That is, these objects did not come to Sicily via Corinth, but rather in ships of Rhodian merchants. This direct trade was most active during the second part of the 7th and in the beginning of the 6th century BC. Rhodes is located between latitudes $35^{\circ}50'$ and $36^{\circ}30'$ north, while Cape Pachynus on Sicily is on $36^{\circ}40'$ north. We have already encountered Cape Pachynus as the reference point in direct crossings of the Sicilian Sea, although associated with Zacynthus.

Rhodian merchants could start from any of their harbours and sail westward along the $36^{\circ}30'$ parallel to the southern coast of island of Thera ($36^{\circ}25'$ north), along the southern edge of the Cyclades, and then past Capes Malea and Taenarus on the Peloponnese ($36^{\circ}25'$ north) to the open sea and on to Sicily, more precisely, Cape Pachynus. We have seen that the ancients knew very well the distance between Capes Pachynus and Taenarus, as well as that between Cape Pachynus and Crete. Moreover, we know that some of the Peloponnesian troopships bringing relief to Syracuse started their crossing from Taenarus (Thuc. VII.19.4).¹⁴ There is another variation on this route, running from Cape Akritas on the Peloponnese ($36^{\circ}45'$ north) and thence to Sicily.¹⁵

Now let us attempt to reconstruct one voyage on this route. A Rhodian navigator who sailed between his island and Sicily in 600 BC would have had to accord attention to the following:

1. He would have had to maintain the northern celestial pole to his right at an altitude of $36^{\circ}30'$.
2. He could have followed the altitude of the lower culmination of ψ *Ursae Majoris*, which was $2^{\circ}58'$, or ξ *Draconis* (altlc 600 BC = $5^{\circ}07'$),

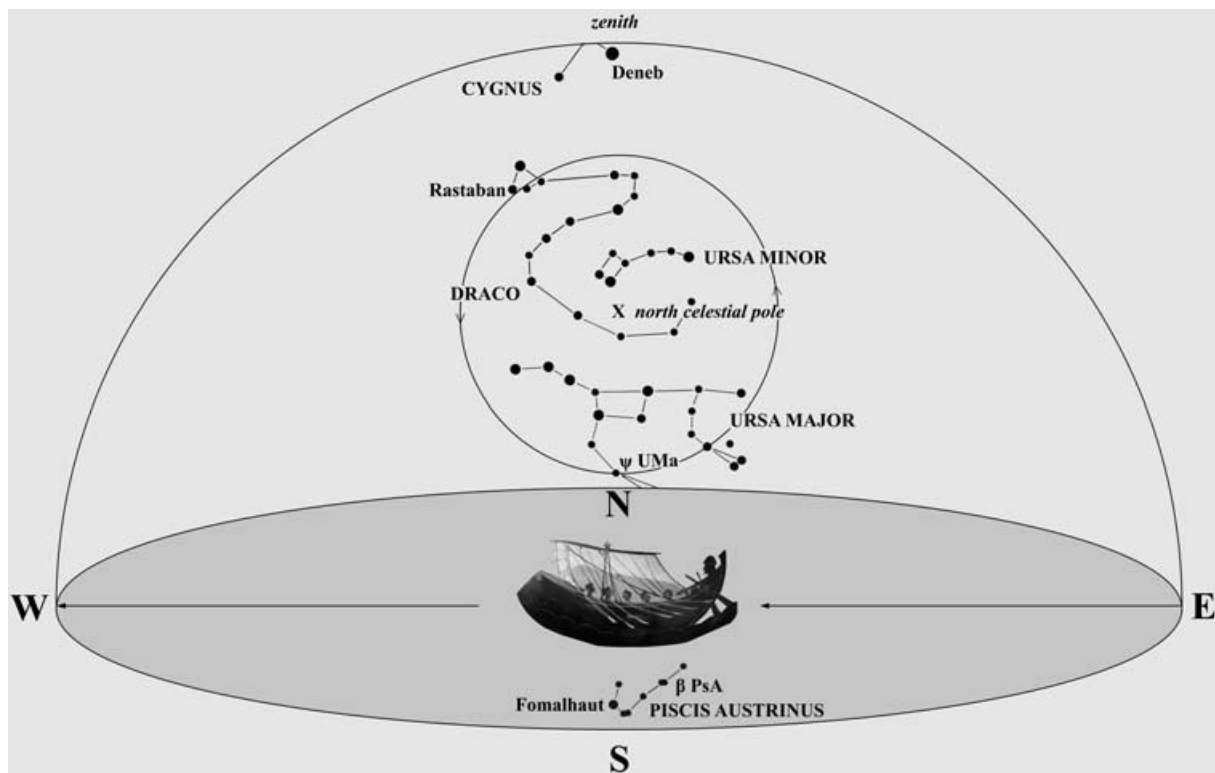


Figure 4. Reconstruction of a voyage on 1 July 1300 BC (01:00 am); the ship is at the intersection of the 18th meridian and the 37th parallel. (T. Bilić, 2006)

also to the right of the ship, on the northern horizon.

3. He could have followed the upper culmination of β *Piscis Austrini*, which was $10^{\circ}33'$, or Fomalhaut (altuc 600 BC = $12^{\circ}16'$) or β *Arae* (altuc 600 BC = $5^{\circ}53'$) to the left of the ship toward the southern horizon.
4. Finally, he could have followed η *Lyrae* at its upper culmination, which passed almost precisely over the observer's zenith at $36^{\circ}30'$ north.

Ψ *Ursae Majoris* was visible at its lower culmination during the sailing season from June to October, ξ *Draconis* from May to September, β *Piscis Austrini* at its upper culmination from June to October, and η *Lyrae* also at its upper culmination from May to September (Fig. 2).

Some indirect confirmation of this hypothetical direct voyage between Rhodes and Sicily can be found in Strabo where he implies that the Strait of Messina and Rhodes are on the same latitude (II.5.14). This suggests that ancient seafarers knew that Rhodes and the southern edge of Sicily were at similar latitude and that navigation along this latitude was thus possible. It is interesting that Ptolemy cited the latitude of 36° both for the

southernmost point of Sicily and for the northern coast of Rhodes (*Geog.* III.4, V.2). Pliny, when he describes measurement of the Earth's size, mentions two routes: the section of the first route we are interested in passes through Rhodes, Astypalaea (near Karpathos), Cape Taenarus in Laconia, and Lilybaeum on Sicily (*HN* II.112.243). Thus it roughly corresponds to routes along the 36th up to $36^{\circ}30'$ parallel. Along with the other evidence, it is safely to presume that the Rhodians thus sailed directly to Sicily.

It would appear that the Greek myth of Alpheus and Arethusa is actually a picturesque portrayal of the practice of latitude sailing between the Peloponnese and Sicily. The very similar latitude of these two sites made such navigation possible. It is further possible that seafarers sailed along this route during the Mycenaean period, which leads to the conclusion that latitude sailing was present on the Mediterranean already during the Bronze Age. This practice made it possible to reduce the time of a voyage by using relatively simple celestial navigational techniques. Of course, the Alpheus River does not flow beneath the Ionian Sea: this is an explanation of the nautical route between the eastern and western Greek worlds rendered in the language of mythology.

Notes

1. Curiously, we find in Livy that the praetor C. Lucretius set out from Neapolis and, after passing the strait [of Messina], crossed to Cephallenia in five days (XLII.48.9). The question is again, did the whole voyage involve five days, or just the section from the Strait to Kephallenia? Since the praetor had a fleet of 40 quinqueremes with him, in this case the latter is more probable. Moreover, the voyage was achieved during winter (XLII.44, 52).
2. 'A ship will generally accomplish 70,000 *orguia* [approximately 5.6 knots if we divide the day in two equal halves] in a long day's voyage, and 60,000 [approximately 4.8 knots] by night.' Aristides claims that 'a vessel, running for a day and a night with a wind from astern—one that whistles, I may add— ... will make ... perhaps better than 1200 stades [4.8 knots]. I have often made this speed myself during a good crossing' (*Orat.* XXXVI.111). Menippus mentions that 'in one day' an ordinary vessel can make 700 stades (2.8 knots if he means 24 hours, but more than 5 if he means just daylight), and a well-made one 900 (3.6 knots or as much as 7; Marcianus of Herakleia, *Epitome periplus Menippe* 5; Casson, 1971: 288, n. 81). The speed of Aemilius Paulus was quite exceptional, since he brought his fleet from Brundisium to Corcyra (somewhat more than 90 nautical miles), starting at sunrise, until the ninth hour, therefore making as much as over 8 knots (Liv. XLV.41; cf. Casson 1951: 146). Casson (1951: 139, 142–4; 1960: 115, 127, 220; 1971: 283, 287–8, 291) states that an ancient ship could make between 4 and 6 knots with the wind, while only 2 or $2\frac{1}{2}$ against it. Even if we take the lowest estimate for the ship's speed, the duration of Dion's voyage still remains strange.
3. We should mention that it took as much as 16 days for Belisarius' fleet to cross 'the Adriatic' from Zacyntus to Aetna. However, they had a wind that 'was very gentle and languid' (Procop. *Bell.* III.13.22). There is one more explanation for such a long voyage. The course from Zacyntus to Cape Pachynus is 257° . We know that the 'Sicilian craft' had trouble with 'a strong South wind' which made their 'swelling sails stand motionless in mid-sea' (Stat. *Theb.* VI.483–4), and we also know that ancient ships had to sail seven points off the wind (Casson 1950: 45). This would allow a ship to sail only on a course more northerly than $258^{\circ}45'$, which would make the sailing from Zacyntus to Cape Pachynus very toilsome. Therefore, with the south wind (or any wind from any point more easterly than 180°), sailing would be problematic; but with the Etesian winds it would not be hard. It is difficult to presume that Plutarch's source would not mention such an unfavourable wind and such a difficult voyage, nor, moreover, that he would insist on mentioning the favourable Etesian winds more or less explicitly in the context of the voyage itself.
4. In the same passage Strabo cites Artemidorus' estimate of 4600 stadia for the distance between Cape Taenarus and Cape Pachynus (cf. VIII.5.1). In Str. II.4.3 we find that the distance from Cape Criumetopon, on the western side of Crete, to Cape Pachynus is 4500 stadia. The same is stated in II.5.20 where we learn that 4500 stadia is also the distance from Cape Taenarus to Cape Pachynus, which is in the same time the extent of the Sea of Sicily, while in VIII.5.1 the distance between

- Capes Taenarus and Pachynus is given as 4000 stadia (Fig. 1).
5. It should be noted that already in Antiquity there was contradictory data on the source, course and mouth of the Alpheus; see Plb. XVI.17.5–6; Str. VIII.3.12; Paus. VI.22.6, VIII.44.3–4, VIII.54.1–3; *Suda* α 1448.
 6. The tables that provide the altitude values of several ‘candidates’ for the last circumpolar star at specific latitudes in different periods; examples of the southern stars that navigators may have observed, as well as stars that may have served as zenith stars at latitudes between the 35th and 38th parallels; finally, the culmination times of individual stars, the time of sunrise and sunset at individual dates, in order to see which stars were visible on those dates, can be found in Bilić 2006: 149–51.
 7. A distance equal to the latitude of the observer; polar distance $p = 90 - \delta = \phi$, where ϕ = latitude, δ = declination of the star, i.e. its distance from the celestial equator. Actually, due to various astronomical phenomena (atmospheric refraction, extinction of light and elevation of the horizon), it is impossible to observe the stars unless they are a few degrees above the horizon (see note 8). The visibility of the stars in general was a very important factor in navigation; in fact, the closing of the seas during the winter was more a matter of visibility than the severity of storms, although they should not be underestimated. ‘A much greater incidence of cloudiness obscures the sun by day and the sky by night, making navigation difficult [during the winter months]’ (Casson 1971: 271–2; also 1960: 220). Thus Vegetius enumerates the dangers of winter sailing, listing on the first place the poor visibility caused by scant daylight, long nights and dense cloud cover, and only mentions the winds, rain and snow in the last place (*De re mil.* IV.39).
 8. The following rule was taken into consideration: due to extinction the lowest altitude of stars that enables their visibility must be a value in degrees that is equal to their magnitude; thus, if a star is magnitude 3, it cannot be visible if it is not at least 3° above the horizon (Aveni, 2001: 106; Šprajc, 1991: 49). Schaefer (2002: 320) applies somewhat different values for extinction (mag. 0, ext. angle 1°30′; 1 ÷ 2°; 2 ÷ 2°48′; 3 ÷ 4°12′; 4 ÷ 6°36′; 5 ÷ 13°30′ for an extinction coefficient of 0.25 magnitudes per airmass), which may be used to correct the visibility of some of the last circumpolar stars (one should also account for the refraction, which adds some 36′ in altitude for a star on the horizon, 30′ for a star 30′ above the horizon, 25′ for a star with an altitude of 1°, and as little as 18′ for a star 2° above the horizon; also, when a star is, for example, 18′ below the horizon, it appears to be above it, because the refraction adds it as much as 40′; Šprajc 1991: 48).
 9. That Virgil had in mind the constellation Draco when referring to the Snake, and not the Hydra or some other ‘serpentine’ constellation, is clear from *Georg.* I.244–5; the Snake is the constellation Draco ‘coiled’ around the north pole of the ecliptic in the immediate vicinity of the north celestial pole and the Ursae.
 10. Left, according to Hipparch. I.4.4.
 11. Even though the Corinthian Canal had not been dug at that time, the Greeks were known to carry ships over the Isthmus of Corinth between the city’s two ports, Lechaion and Kenchreai (e.g. Thuc. III.15.1, VIII.7.1, 8.3–4; Aristoph. *Thes.* 649; Plb. IV.19, V.101; Str. VIII.2.1; cf. for other examples of such practice Hdt. VII.24; Thuc. III.81.1, IV.8.2; Plb. VIII.36; D. S. IV.56.3; Casson, 1960: 80; Fresa, 1969: 253). Corinth is at 37°55′ north, the same as Ephesus.
 12. Where D is the distance from which the object is seen in nautical miles, e the height of the observer (in this case negligible), and H the height of the object itself.
 13. Pylos was not chosen simply because it is on the ‘right’ latitude. It was almost certainly used as a point of reference in crossings over the Sicilian Sea, although in a much later period, which is evident from the following fact. The Athenian control of the entrance to the Corinthian Gulf and Corcyra was not sufficient to block shipments of wheat from Sicily to the Peloponnese during the Archidamian War. In order to suppress this trade, made possible only by direct crossings of the Sicilian Sea, Demosthenes seized Pylos in 425 BC (Thuc. IV.3–5, 41.2), while Nicias captured Cythera the next year (IV.53–4). We know that Athenians wanted ‘to prevent the exportation of Sicilian corn to Peloponnese’ (III.86.4), and the occupation of these two points made the blockade of Laconia more effective. This wheat, due to Athenian control of the mouth of the Corinthian Gulf and Corcyra, could only come directly over the open sea, and Pylos and Cythera must have been final destinations of those direct sailings. The Elean harbours could not be used for this purpose, as suggested by Dunbabin (1948, 195), because at that time the Athenians held both Cephallenia (Thuc. II.30.2) and Zachyntus (II.9.4).
 14. The fact that Taenarus and Pylos are mentioned as reference points in crossing the Sicilian Sea is of the utmost importance. We know that three cities bearing the name of Pylos existed in the western Peloponnese, and that the word *pylos* probably originally designated ‘the door of the Otherworld.’ At an early point in Greek mythology the entrance to the Otherworld was obviously placed in the western Peloponnese (Nilsson, 1932: 87–8, 203–04). Hence the battle in which Heracles wounded Hades probably occurred at the gates of the Otherworld, located at an early period in Pylos, whether the Elean, Messenian, or Triphylian one (see Bilić, 2007: 19 for references and a wider discussion on this subject). Therefore, we can safely presume that the gates to the Otherworld existed on the western shore of the Peloponnese. On the other hand, Greek mythology placed one of the most frequented entrances to Hades on Taenarus. Hence both Pylos and Taenarus were in the same time entrances to Hades and reference points for crossings to Sicily. Since we know that it was possible to approach Hades by a ship, which is exactly what Odysseus had done (*Od.* X.501–02, XI.1–21; cf. Serv. *Aen.* VI.532, who maintains that ‘the infernal regions lie under the earth’ and ‘it is possible by seafaring to reach the Antipodes’), and that the entrance to Hades was placed in the furthest west, beyond the shores of Okeanos (*Od.* X.508, XXIV.11–12), we can safely presume that points of departure for Sicily and West in general were at one point, presumably very early, designated as the entrances to the Otherworld. A similar conclusion is reached by Ballabriga, 1986: 34, who emphasizes the role that Pylos had as ‘the first stage of the western navigation’, and calls it ‘the door of the West’.
 15. We should add one more possibility. Casson (1960: 234; also 1950: 48–50; 1971: 297) claims that Roman grain-route from Alexandria to Ostia or Puteoli led from the Egyptian capital to the southern coast of Asia Minor, then westward to Rhodes, continuing along the southern shore of Crete (cf. Lucian. *Navig.* 9) ‘and then, with continuous tacking ... to Syracuse on Sicily, with perhaps a stop at Malta *en route*’. This route is implied in Paul’s voyage to Rome, which involves the famous shipwreck on Malta. Paul’s ship sailed along the southern shore of Crete (*Acts* 27: 7), but was caught in a

terrible storm and tossed around the Adriatic (we would say the Sicilian) Sea for fourteen days (*Acts* 27: 27). Finally, the ship was wrecked on Malta (*Acts* 28: 1) (Fig. 1). This incident does not, of course, imply any regular marine route touching Malta; but the Alexandrian ship that took Paul aboard three months later and brought him to Syracuse was on her regular route (*Acts* 28: 11–12). The north-western cape of Crete (Spatha), also the island's northernmost point, lies at 35°40' northern latitude. Malta, approximately 460 nm to the west, lies between 35°50' and 36°05' north (including the island of Gozo in the immediate vicinity). We can describe the whole route along the 36th parallel thus: from Rhodes (whose southernmost point lies at 35°50' north), and Karpathos (whose northernmost point lies at 36° north, taking into account the nearby small island of Saria), to the southern extremity of the island of Cythera below the Peloponnese (36°10' north), thus sailing north—not south—from Crete, and then beyond, along the 36th parallel, across the open sea up to Malta (this route should be taken with some reserve due to the unfavourable winds; Casson, 1950: 48–9; see also Isserlin, 1955 for the opposite view). Thus, by using the right stars, latitude sailing is again possible. From Malta it is simple to sail on to Sicily (Bilić, 2006: 144) (Fig. 2). When we read of a famine in Rome in 39 BC because 'the merchants of the East' could not deliver their grain due to Sextus Pompey's control of Sicily (App. *BC* V.8.67), we may safely conclude that those merchant-ships followed the open-sea route between Rhodes and Sicily, whether sailing south or north of Crete, since it would be easy for them to proceed to Brundisium, if they were intended to cross the Strait of Otranto. The open-sea route between Rome and Alexandria (Tac. *Hist.* IV.51) and back (Philo *In Flacc.* XV.125, *Leg.* XXIX.190; Joseph. *AJ* XIV.14.2, *BJ* I.14.2–3) was occasionally also in use during the winter months, although the references indicate for the latter the crossing of the Ionian, not the Sicilian Sea.

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