Klaus Geus, Martin Thiering (Eds.)

Features of Common Sense Geography

Implicit knowledge structures in ancient geographical texts

Antike Kultur und Geschichte

LIT

Chapter 3

Ancient mariners between experience and common sense geography

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Abstract

Although no first-hand information from ancient mariners have been preserved, their legacy to classical Greek geography has been so important that it is still possible to recognise the structural impact of the material gathered from their implicit knowledge upon the patterns of presentation of space. The kind of tacit knowledge they had acquired appears very similar to that of the later Micronesians, studied by Hutchins. It was based upon durations rather than distances, and upon an original perception of orientations and directions. Thanks to that knowledge, based upon the repetition of experience through generations and apprenticeship, they were able to sail the blue sea without maps or instruments. This paper will address the issue whether – or within which limits – the mental construction of limited linear sections of space may have opened the way to the construction of some coherent presentation of space, a mental map in the fullest sense.

In a well-known paragraph, Strabo[1] establishes the direction and length of the passage between Rhodes and Alexandria and balances Eratosthenes' calculations with ancient mariners' experience:

> "The passage between Rhodes and Alexandria by north wind is about 4000 stadia; sailing along the coasts is twice this distance. Eratosthenes says that, this distance is the mere mariners' conjecture of some, while others avow distinctly that it amounts to 5000 stadia; he himself, from observations of the shadows indicated by the gnomon, calculates it at 3750."

'Mariners' were often scorned by ancient writers, when they were authors of travel narratives, but used to be considered as a main piece of evidence, when they were anonymous and a consensus came into being from a long-lasting verified experience of

[1] 2.5.24, C 168–169 = Erat. fr. II B 28 Berger: ἔστι δ᾽ ἀπὸ Ῥόδου [C 169] δίαρμα εἰς Ἀλεξάνδρειαν βορέᾳ τετρακισχιλίων που σταδίων, ὁ δὲ περίπλους διπλάσιος. ὁ δ᾽ Ἐρατοσθένης ταύτην μὲν τῶν ναυτικῶν εἶναί φησι τὴν ὑπόληψιν περὶ τοῦ διάρματος τοῦ πελάγους, τῶν μὲν οὕτω λεγόντων, τῶν δὲ καὶ πεντακισχιλίους οὐκ ὀκνούντων εἰπεῖν, αὐτὸς δὲ διὰ τῶν σκιοθηρικῶν γνωμόνων ἀνευρεῖν τρισχιλίους ἑπτακοσίους πεντήκοντα.

sailing routes. It is obvious that the intuitive, empirical perception of space by seafarers had a sustainable impact on the intellectual construction of maps by geographers. This is the point of departure of this paper, that is, the assumption that implicit or tacit knowledge structures have been used in ancient times to form cognitive maps for orientation. And by that, we can compare these models with modern maps and orientation systems.

Unfortunately, no ancient mariner has survived to inform us about the way he was sailing, how he could find the right route to destination. The last resort left to us is to trace their usage by ancient geographers, who have assembled a huge corpus of information from the mariners' experience, putting it to their own use. Even the so-called *periploi*, sometimes thought to have been something like the modern "Sailing Directions", were actually armchair products (González Ponce 1993; 1996; 1997; Dunsch 2012; Prontera 2013). They underline the importance of the sailing experience in the making of Greek geography (Arnaud 1993; 2005; 2011; Kowalski 2012), and the existence of a common sense geography of Greek mariners before and apart its intellectual reconstruction by geographers. Apparently, this deeply influenced the structure of Greek geography: not only the structure of description (the vision of a ship sailing around the known world), but also the image of the Earth. In order to understand the ancient mariners' presentation of space as a retro-active analysis of the ancient geographers' one is necessary. Although framed and composed by their own notions, rules and biases, the latter's depended upon the former and echoes it at least to a certain extent.

Hellenistic geography has built up an integrated system based upon geometry in its original sense: measurements of the known world calculated mainly according to distances between places expressed in a single unit and in at least approximate directions. Earth and sea at any scale had then turned to be commensurable? The consensual adoption of this system took at least two centuries thereafter. To reach this purpose it had to rely upon a huge set of information mainly gathered from more informal and systematic approaches. These had nevertheless been the origin of a common memory of sailed space, which has been inserted into later geographical works, but still provides a readable enough image of a previous common sense geography: the mariners' one.

The modern way of sailing is entirely based upon a mathematical approach of the route called 'orthodromy'. The sailor knows the exact location of his place of departure (A), and that of his destination (B) as known from dead reckoning systems. He then calculates the right track, expressed in degrees from the North, and the distance to his destination. The combination of direction and distance from destination, by means of instruments, allows him to locate the ship as being on or off the track, and to rectify it in order to make the actual route coincide with the intended track. This is orthodromy. The task is more difficult with ships under sail which have to cope with unfavourable winds (see Hutchins 1996a for an interesting example of piloting in Micronesian cultures where seafarers do not use nautical instruments; Thiering this volume). This way of sailing relies upon a precise technological background, made of a set of instruments invented during the Middle Ages, whose employment created, from the 12^{th} century on, an increasingly mathematical skill of officers (Petti-Balbi 1996). The compass gave directions. The log was a simple line unwound behind the ship. Knots were disposed at fixed intervals along the line. The number of knots left behind the ship during a certain lap of time, given by an hourglass, allowed to estimate with little approximation the ship's speed (this is similar to the *etak* system in Micronesian cultures in which the distance is measured by time segments, not metrical systems). Once the speed and the time spent sailing was made ascertained, it was possible to calculate the distance the ship had covered. Both orientation and distance made the ship's position on a map at least roughly accurate. It also allowed to draw maps. The nautical maps appeared in the Latin West during the 12^{th} century (Gautier-Dalché 1995). They were drawn after a combination of collected distances and directions. The later notorious *Compasso de navegare* was one of these collections. The astrolabe, map, compass, log and hourglass were the set of tools one needed to practice modern sailing. None of them is mentioned by ancient sources.

This new *ars navigandi* did not take long before becoming standard in the history of sailing on the Oceans by European seafarers. Mediterranean sailors only reluctantly made use of it. This unwillingness finds its explanation in the fact that these tools were considered of no real use within that rather small space. Therefore, for a long time modern scholarship deemed ancient sailors as unable to sail the blue sea and as limited to coasting. But ancient writers say exactly the opposite[2], and every source underlines that sailing the blue sea was common as early as the time of Homer (Arnaud 2005, 2011b, 2012). This clearly suggests that like in other cultural areas, the ancients had developed cognitive processes (Hutchins 1983, 1984, 1996a, 1996b) that allowed them to sail at open sea without the use of maps or compasses. Recent attempts to find out how they managed it (e.g. Medas 2004), exhibit the great difficulty to ex-

[2] Eratosthenes I.B8 Berger = Strabo *Geographica* 1.3.2,C.43 : εἰπών τε τοὺς ἀρχαιοτάτους πλεῖν καὶ κατὰ λῃστείαν ἢ ἐμπορίαν, μὴ πελαγίζειν δέ, ἀλλὰ παρὰ γῆν / "Having remarked that the Ancients, whether out on piratical excursions, or for the purposes of commerce, never ventured into the high seas, but crept along the coast". Coasting was considered an outdated practice in the 3^{rd} century BC.

plain it without referring to modern orthodromy. It is highly probable that the mariners' skills have their origin in a complex set of memories, places, conditions, and times (Arnaud 2005). This heritage of common sense geography was the background of Greek geography till Ptolemy.

From time to distance

In later Roman times, the man who has assembled a part of the corpus known today as "Geographi Graeci Minores", Marcianus of Heraclea, could write that two authors of *periploi* (or descriptions of measured segments of sea) distinguished themselves in using durations instead of distances: one he called Scylax of Caryanda. He is nowadays known as Ps.-Scylax. In its final form, this text is the result of the compilation of a certain number of sources the exact date of which is still under debate,[3] the compilation itself not being older than 297 BC (Counillon 2007).

The first Greek expression of distances was in time units, just as known from the Micronesian *etak* system (Thiering this volume; Gladwin 1970; Hutchins 1996a; Sarfert 191 1). When he wishes to express the distance between two points, Homer gives the sailing time one needed to cover the interval. This approach did not take into consideration the asymmetry of maritime distances. Any mariner knows that the distance and time from A to B and B to A are never equal, for they depend upon the conditions of wind and sea. The same day, when a ship sails from A to B following the wind, another ship, sailing from B to A struggles against the wind, tacks and therefore covers a distance up to three times longer (or more) than A–B, depending upon the ship's ability to sail against the wind. The following scheme shows the wearing technique (wearing is the normal tacking manoeuvre under square or lateen-rig).

[3] Mainly mid-4th century BC: Counillon 2004: 40–41; mainly or partly archaic: Peretti 1961; Peretti 1979, 1983 and 1988; González Ponce 1994, 1997 and 2001; Shipley 2011 and 2012.

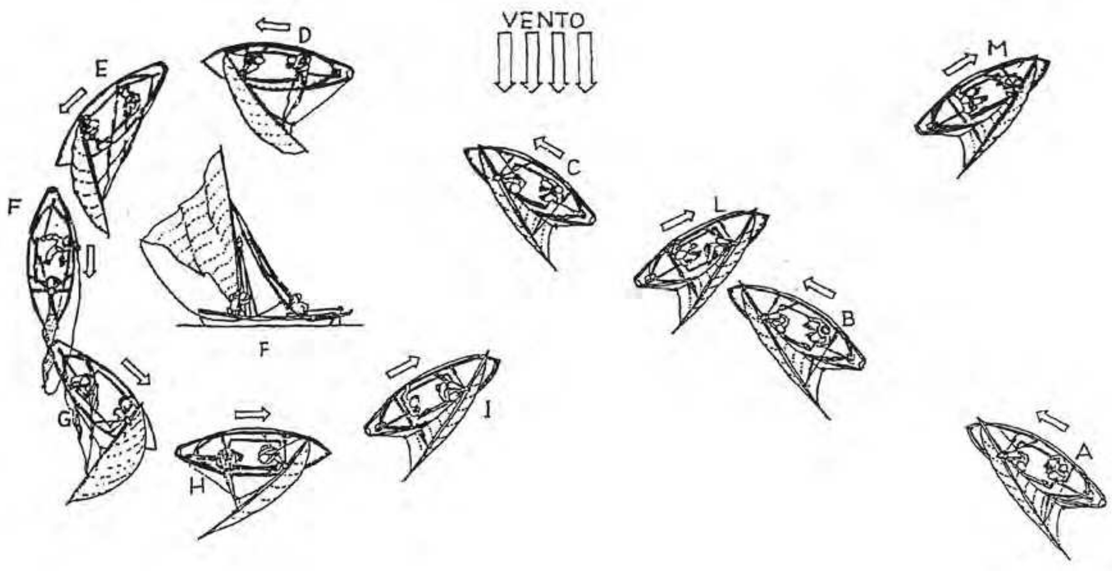

Figure 1: Wearing technique with a lateen rig (after Ricca Rosellini 1988)

The two charts below present an actual example from Micronesian cultures and their pilotage techniques. Arguably, such techniques have been used in ancient times as well.

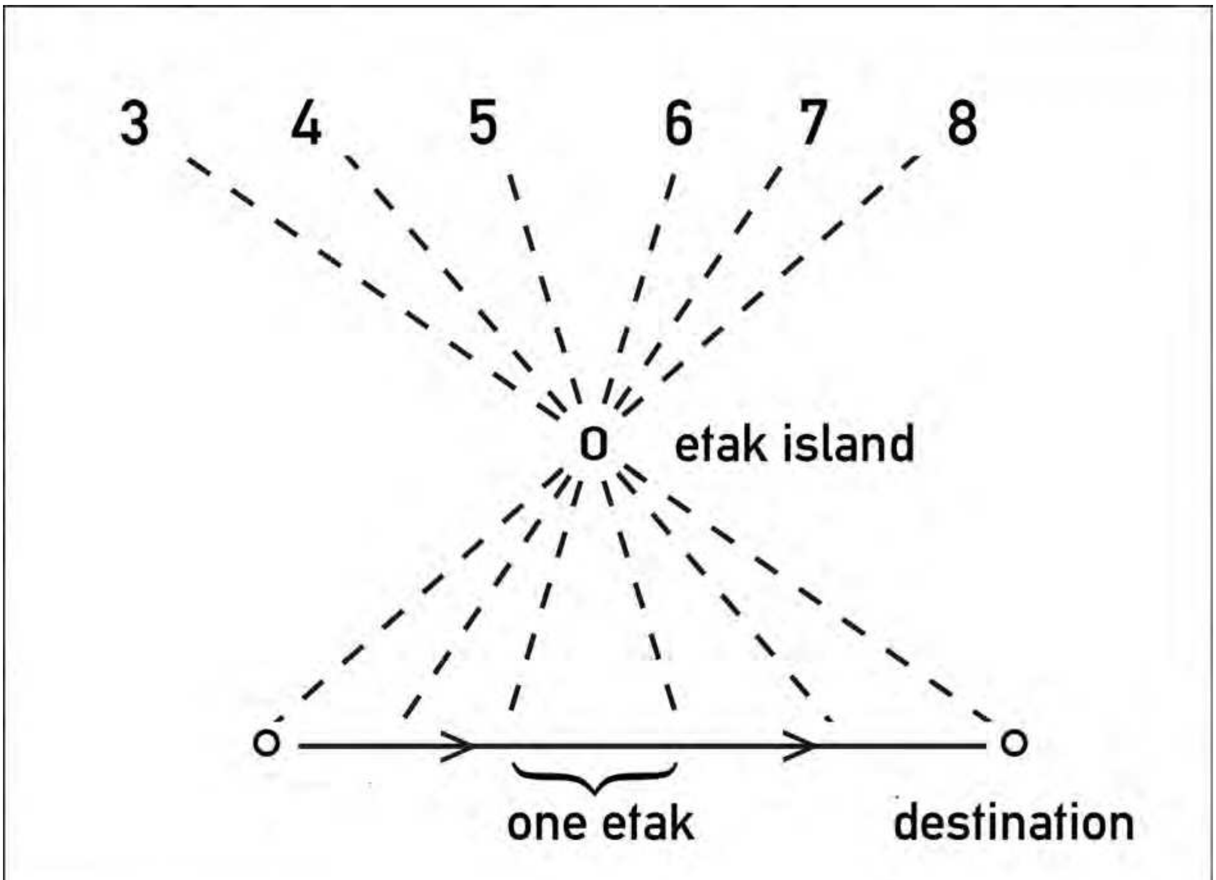

Figure 2

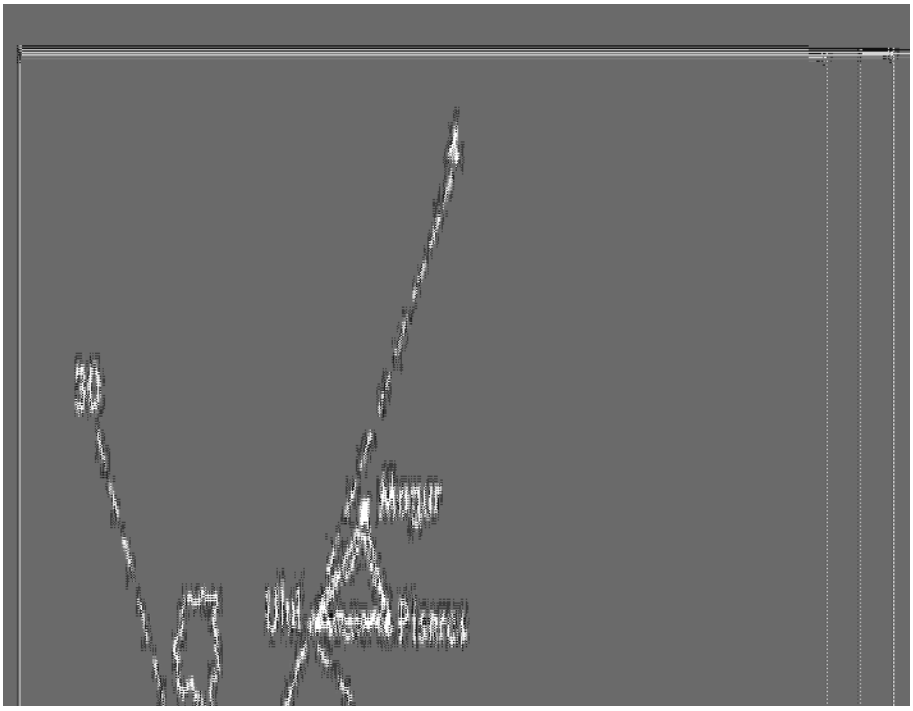

Figure 3

The expression of durations (*etak*) in order to compare distances presupposes, at least at a first step, the adoption of a common denominator and common norms between durations of the same nature. We find this in late 5th and early 4th century BC Attic writers, who use durations to express not only the length of long segments of shores but also of long segments of firm ground in the hinterland. On several occasions, Thucydides used sailing times to provide a notion of distance at sea.[4] In the first instance, he intended to make the reader understand the dimensions of the land of the Odrysii in Thrace. He then made the special conditions of the duration explicit:[5]

[4] Thuc. 6.1.2: Σικελίας γὰρ περίπλους μέν ἐστιν ὁλκάδι οὐ πολλῷ τινὶ ἔλασσον ἢ ὀκτὼ ἡμερῶν, καὶ τοσαύτη οὖσα ἐν εἰκοσισταδίῳ μάλιστα μέτρῳ τῆς θαλάσσης διείργεται τὸ μὴ ἤπειρος εἶναι. / “For the voyage round Sicily in a merchantman is not far short of eight days; and yet, large as the island is, there are only twenty stadia of sea to prevent its being mainland.” Cf. 7.50.2.

[5] 2.97.1–2: ἐγένετο δὲ ἡ ἀρχὴ ἡ Ὀδρυσῶν μέγεθος ἐπὶ μὲν θάλασσαν καθήκουσα ἀπὸ Ἀβδήρων πόλεως ἐς τὸν Εὔξεινον πόντον μέχρι Ἴστρου ποταμοῦ: αὕτη περίπλους ἐστὶν ἡ γῆ τὰ ξυντομώτατα, ἢν αἰεὶ κατὰ πρύμναν ἱστῆται τὸ πνεῦμα, νηὶ στρογγύλῃ τεσσάρων ἡμερῶν καὶ ἴσων νυκτῶν: ὁδῷ δὲ τὰ ξυντομώτατα ἐξ Ἀβδήρων ἐς Ἴστρον ἀνὴρ εὔζωνος ἑνδεκαταῖος τελεῖ. [2] τὰ μὲν πρὸς θάλασσαν τοσαύτη ἦν, ἐς ἤπειρον δὲ ἀπὸ Βυζαντίου ἐς Λαιαίους καὶ ἐπὶ τὸν Στρυμόνα (ταύτῃ γὰρ διὰ πλείστου ἀπὸ θαλάσσης ἄνω ἐγίγνετο) ἡμερῶν ἀνδρὶ εὐζώνῳ τριῶν καὶ δέκα ἀνύσαι.

> "The empire of the Odrysians extended along the seaboard from Abdera to the mouth of the Danube in the Euxine. The navigation of this coast by the shortest route takes a merchantman four days and four nights with a wind astern the whole way."

Thucydides gave not less than three indications here: the kind of route (straight), the kind of vessel (a 'merchantman', either called 'round vessel' or 'holkas' in 6.1.2) and the wind direction (from behind). Similarly, Marcianus of Heraclea, giving the conversion table between sailing times and distances, mentioned that this table was relating to a ship under sail following the wind.[6] Xenophon preferred another kind of vessel whose practice and sailing times were even more familiar to an Athenian reader: the trireme.[7]

Later in the same passage, Thucydides provided similar precisions about the conditions of duration of road travelling, when he gives the duration of the same segment by land:

> "... by land a man walking without equipment, travelling by the shortest road, can get from Abdera to the Danube in eleven days. [2] Such was the length of its coast line. Inland from Byzantium to the Laeaeans and the Strymon, the farthest limit of its extension into the interior, it is a journey of thirteen days for a man walking without equipment."

The commonsensical perception of space was – basically – time, at least for any spatial interval the dimension of which exceeded what would be expressed as actual measurements or as experienced knowledge of similar measured intervals. This implicit knowledge could be refined, whenever a comparison between countries and/or distances was necessary. The last periplus referring to durations instead of distances (González Ponce 2001) was that of Ps.-Scylax. It employed a sophisticated scale of times:

- nycthemerus
- "day"
- "long day"[8]
- half day
- *plous proaristidos* ("sailing with arrival before noon")
- one third of the half day

[6] Marcianus of Heraclea, *Epit. Per. Menipp.* 5 = *GGM* 1 p. 568: οὐριοδρομοῦσα ναῦς. See also Diodorus Siculus, 3.34.7, in a discussion about the breadth of the Earth: πολλοὶ τῶν πλοϊζομένων οὐριοδρομούσαις ναυσὶ φορτίσιν εἰς μὲν Ῥόδον δεκαταῖοι καταπεπλεύκασιν, ἐξ ἧς εἰς Ἀλεξάνδρειαν τεταρταῖοι καταντῶσιν, ἐκ δὲ ταύτης κατὰ τὸν Νεῖλον πλέοντες πολλοὶ δεκαταῖοι κατηντήκασιν εἰς Αἰθιοπίαν.

[7] *Anab.* 6.4.2: καὶ τριήρει μέν ἐστιν εἰς Ἡράκλειαν ἐκ Βυζαντίου κώπαις ἡμέρας μακρᾶς πλοῦς / "it is a long day's journey for a trireme to row from Byzantium to Heracleia".

[8] This value is also refered to by Herodotus (4.86, quoted below n. 10) and Xenophon (see previous note).This is probably a reference to the day at the summer solstice.

Nycthemerus and “day” are widely used, the other fractions being quite rare or exceptional. There is little doubt that the first two “units” derived from mariners. One must wonder whether higher levels of precision were ever elaborated by ancient mariners or geographers.

On several occasions,[9] I have tried to explain how almost all the distances collected and selected by ancient geographers actually originated within a corpus of durations, either converted into distances according to rather simple tables, or extrapolated after a combination of distances driven from durations (e.g. durations relating to the AB and AC intervals are known. These are converted into distances. Then, BC can be extrapolated after the formula AB-AC = BC). Strictly speaking, these durations consist of the core of the common sense geography of ancient mariners and formed their legacy. By the time of Herodotus,[10] who first tried to find a conversion table between times and distances expressed in stades, this unit was already used to estimate the extension of smaller spaces (mainly straits or little segments of shores). It seems that the stade[11] was employed when a man’s eye encompasses areas that it could also encompass on firm ground, and whose measurement was known before. In other words, it presupposes man’s implicit ability to estimate, by repetition, the visible length of a segment of landscape and suggests that a measure, derived from everyday experience, could be used to mentally structure and organise human environment. Such a structure is known as a cognitive map (Kuipers 1978, 1982; Tolman 1948). Its extension to non commensurable spaces (i.e. whose measure could not be estimated after the experienced knowledge of similar measured intervals) was the step beyond Herodotus intended to develop. It took more than one century, before the distances expressed in stades were applied to huge spaces at open sea. This eventually allowed to combine quantita-

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[9] Arnaud 1993; Arnaud 2005: 61–96; Arnaud 2011b.

[10] *Hist*. 4.86: μεμέτρηται δὲ ταῦτα ὧδε. νηῦς ἐπίπαν μάλιστα κῃ κατανύει ἐν μακρημερίῃ ὀργυιὰς ἑπτακισμυρίας, νυκτὸς δὲ ἑξακισμυρίας. [2] ἤδη ὦν ἐς μὲν Φᾶσιν ἀπὸ τοῦ στόματος (τοῦτο γὰρ ἐστὶ τοῦ Πόντου μακρότατον) ἡμερέων ἐννέα πλόος ἐστὶ καὶ νυκτῶν ὀκτώ: αὗται ἕνδεκα μυριάδες καὶ ἑκατὸν ὀργυιέων γίνονται, ἐκ δὲ τῶν ὀργυιέων τουτέων στάδιοι ἑκατὸν καὶ χίλιοι καὶ μύριοι εἰσί. [3] ἐς δὲ Θεμισκύρην τὴν ἐπὶ Θερμώδοντι ποταμῷ ἐκ τῆς Σινδικῆς (κατὰ τοῦτο γὰρ ἐστὶ τοῦ Πόντου εὐρύτατο) τριῶν τε ἡμερέων καὶ δύο νυκτῶν πλόος: αὗται δὲ τρεῖς μυριάδες καὶ τριήκοντα ὀργυιέων γίνονται, στάδιοι δὲ τριηκόσιοι καὶ τρισχίλιοι. [4] ὁ μέν νυν Πόντος οὗτος καὶ Βόσπορός τε καὶ Ἑλλήσποντος οὕτω τέ μοι μεμετρέαται καὶ κατὰ τὰ εἰρημένα πεφύκασι, παρέχεται δὲ καὶ λίμνην ὁ Πόντος οὗτος ἐκδιδοῦσαν ἐς αὐτὸν οὐ πολλῷ τεῳ ἐλάσσω ἑωυτοῦ, ἣ Μαιῆτίς τε καλέεται καὶ μήτηρ τοῦ Πόντου. / “These measurements have been made in this way: a ship will generally accomplish seventy thousand orguiae in a long day’s voyage, and sixty thousand by night. [2] This being granted, seeing that from the Pontus’ mouth to the Phasis (which is the greatest length of the sea) it is a voyage of nine days and eight nights, the length of it will be one million one hundred and ten thousand orguiai, which make eleven thousand stades. [3] From the Sindic region to Themiscura on the Thermodon river (the greatest width of the Pontus) it is a voyage of three days and two nights; that is, of three hundred and thirty thousand orguiai, or three thousand three hundred stades. [4] Thus have I measured the Pontus and the Bosporus and Hellespont, and they are as I have said. Furthermore, a lake is seen issuing into the Pontus and not much smaller than the sea itself; it is called the Maeetian lake, and the mother of the Pontus.” See also Geus (in this volume).

[11] The stade’s variable length (150 to 210 m plus minus) is never precised by ancient writers, cf. Arnaud 1993.

tive data – gathered from land and from sea expressed in a single unit – and to build up the first 'geometry' of the known world, associating figures and measures of the Earth in an Euclidian-based geometrical approach of the whole world.

The first known example, developed on the basis of the corpus of maritime distances, is that of Dicaearchus, who calculated the length of the known world between Issus and Gades and paved the way for generations of later geographers. It actually took almost two centuries for the distances to supplant the durations. At some time during the 3rd century BC, they had replaced durations in any preserved Greek text. A new perception of the world was born. Although it still relied on the common sense geography of mariners, it was now a geographer's geography. Nevertheless, the latter was strongly influenced by many aspects of the common sense geography of mariners.

Finding the Orientation

Not only had ancient mariners left a legacy in form of a corpus of durations, they apparently had also provided a large set of *oriented* durations and subsequent distances. This data was large and trustful enough to make Timosthenes,[12] an admiral of Ptolemy II, deem it possible to draw a world-map by means of a combination of distances and orientations, exactly in the same way the authors of later medieval nautical charts used to draw a new figure of the sea.

The methods and tools available to reach that goal were rare.

Looking at the stars

The earliest mention of ancient orientation is linked with astronomical navigation by night (see the chart below used in Micronesian cultures).

[12] Wagner 1888; Wachschmuth 1904; Gisinger 1937; Meyer 1998; Dunsch 2012; Prontera 2013.

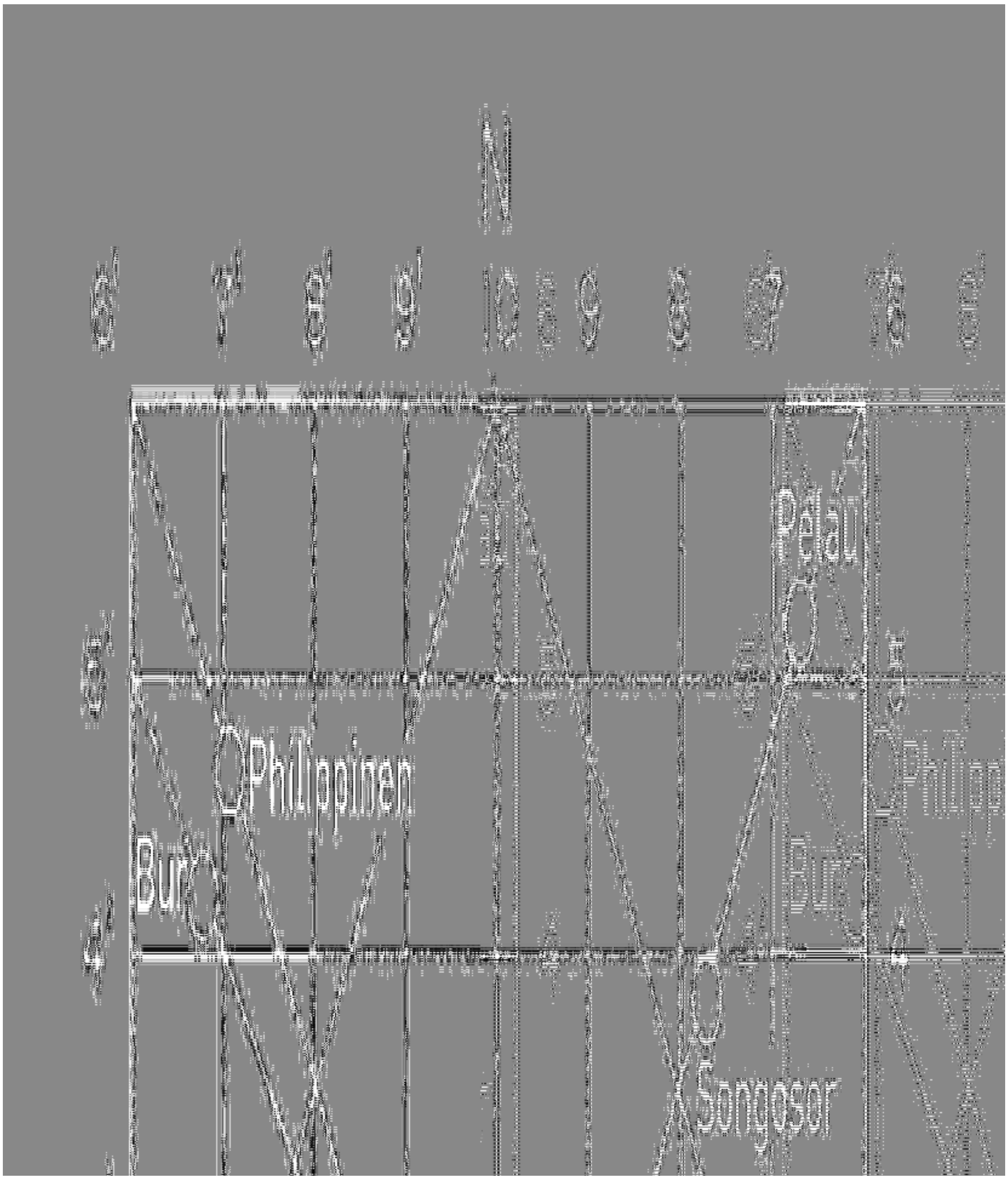

Figure 4

This chart from Micronesian cultures is a cognitive map of the various orientational cues arguably also applied in ancient techniques. According to Homer, Calypso herself shows Odysseus not only how to build a sail-only 'merchantman' able to sail night and day with reduced crew (in that case, Odysseus alone), but also to find the right direction to the destination by night.[13] The text mentions four constellations, three of which

[13] *Od*. 5.270–277: αὐτὰρ ὁ πηδαλίῳ ἰθύνετο τεχνηέντως / ἥμενος, οὐδέ οἱ ὕπνος ἐπὶ βλεφάροισιν ἔπιπτεν / Πληιάδας 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. / "and he sat and guided his raft skilfully with the steering-oar, nor did sleep fall upon his eyelids, as he watched the Pleiads, and late-setting Bootes, and the Bear, which men also call the Wain, which ever circles where it is and watches Orion, and 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."

were especially important for seasonal sailing.[14] Solely, the Bear was of real significance for navigation, and Calypso warned Ulysses to keep it on the left, therefore to sail eastward. The visible movement of the sky (in reality, the effect of Earth's rotation) makes all constellations (the starry sky of antiquity) rotate anticlockwise around the North Pole. Due to the precession of equinox, modern Polaris (α *Ursae Minoris*) was significantly further away from the pole than it is now. Around 500 BC, β *Ursae Minoris* was the closest star to the North Pole. Like the whole constellation it turned around the pole, whose position was marked only approximately. At any latitude within the Mediterranean, it stayed always above the horizon and thus remained visible for any time of the year and day. The further a constellation lies away from the pole, the longer is the circumference of its apparent movement, and the longer is the time it stays below the horizon.

The fact that the indiscernable North Pole provided the only useful astronomical means of orientation is underlined by a well-known passage in Lucanus' *Pharsalia*[15], where Pompey asks the steer man's about the secret of the relationship between stars and sailing routes. The latter answers that constellations cannot be used directly to find the direction to a destination. In fact, such a use would be dangerous:

> *"Not by the constellations moving ever*
> *Across the heavens do we guide our barks;*
> *For that were perilous; but by that star*
> *Which never sinks nor dips below the wave,*
> *Girt by the glittering groups men call the Bears.*
> *When stands the Lesser Bear clear before the mast,*
> *Then to the Bosporus look we, and the main*
> *Which carves the coast of Scythia."*

[14] On astronomical navigation see Medas 2004.

[15] Lucan., *Phars*. 8.165–190: *Saepe labor moestus curarum odiumque future / Proiecit fessos incerti pectoris aestus, / 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 vagary / Stella, timens Borean: illa quoque perge sinistra, / Trans Pharon, in medio tanget ratis aequore Syrtes. / Sed quo vela dari, quo nunc pede carbasa tendi / Nostra iubes? Dubio contra cui pectore Magnus, / Hoc solum toto, respondit, in aequore serva, / Ut sit ab Emathiis semper tua longius oris / Puppis, et Hes-periam pelago coeloque relinquas: / Cetera da ventis*.

Only the Pole Star and its relation to parts of the boat provided the direction. Several similar indications are to be found in the *Stadiasmus Maris Magni*.[16]

For that reason, with the *exception* of the Bears, star constellations in general were of little use for sailing, unless not only an instrument like the astrolabe, but also a mathematical perception and application of geography were involved in sailing.

At a different level of knowledge and skill, the sky could also provide approximate information about the latitude. The latitude determines the part of the sky which is visible from a certain vantage point.[17] The appearance or disappearance of some constellations or stars (e.g. Canopus) could characterise a latitude. So did the elevation of the pole or constellations. Lucanus mentions these two clues of latitude in the text quoted above. The astrolabe later became the basic device for calculations of that kind. As we have already noticed, its use presupposes a stereometric approach to the Earth an ancient mariner usually did not have. Simpler tools, like the Arabic *kamal* (Medas 2004: 176–179), a rectangular wooden card, may have had the same function. But even a rough approximation allowed ancient mariners to follow a latitude approximately. In the passage of Lucanus quoted above, the same pilot refers to the visibility of Canopus and to the elevation of Bootes as indications of latitude.

Looking at the sun

The sun can provide only a very rough estimation, except at midday, when even a crude sundial indicates true South. Ashore, at a fix point, on this basis, one is able to establish any desired destination with more than acceptable precision (see Thiering this volume on the various orientation cues in pilotage). On a movable as a boat, things are quite different: sunrises and sunsets do vary every day, forming a maximum angle of ca 24° south or north with the equator at the solstices, and no angle at the equinox. This makes the use of any solar compass, the existence of which has been hypothesised by some scholars (see Medas 2004), very doubtful. For using it at sunset and sunrise one needs to know the exact angle of sunset and sunrise with the equator for any given day. It can hardly be employed between sunrise and noon, or noon and sunset

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[16] E.g. 186: Ἡ δὲ Ἀφροδισιὰς κεῖται ἔγγιστα τῆς Κύπρου πρὸς τὴν Αὐλιῶνα ἀκτὴν *κατὰ πρύμναν ἔχοντι τὰ μέρη τῆς ἄρκτου* στάδιοι φʹ. / "Aphrodisias lies very close to Cyprus; by the rugged banks of Aulion, *keeping the parts of the Bear astern*, 500 stades."

[17] For the 'horizon of the place', according to ancient terminology, horizon is a circle drawn on the celestial globe. Its position varies with the place of observation and is determined by the disk whose axis would be the line drawn from the place to the centre of the Earth. The tangent parallel on the celestial globe determines in turn the polar circles for the horizon of the place. If the place is the pole the horizon is the equator. If the place is situated on the equator, the polar circle is reduced to a point: the pole. For the horizon of Rhodes (36° N according to the ancients), the polar circles were at 54°.

unless there was a tool to calculate time on board. So far, there is no evidence to support the claim that ancient ships had such devices.

Wind

Wind has been mentioned in connection with orientation quite early and often in ancient sources (see Ilyushechkina/Görz/Thiering in this volume). Several passages of the *Stadiasmus Maris Magni*, all relying upon the same source, probably dating to mid-2nd century BC,[18] associate the wind name, a reference to a supposed course under that wind and an astronomical orientation, or just mention a relationship of the ship to a wind (generally following it) to express the orientation of her course, when others, relying upon other sources, refer to winds just as orientations in a windrose (see Thiering on frames of reference and Ilyushechkina/Görz/Thiering this volume).

Winds have probably been the first tool to define and fix routes at blue sea. Greeks and Romans knew that during the months of July and August stable conditions

[18] Arnaud 2010. The words εὐθυδρομοῦντι, ἐπ’ εὐθείας πλέοντι, τὸν ἐπίτομον οὐριώτατα, οὐριοδρομοῦντος are apparently used as synonyms to express a straight course. The last two seem to add to that meaning the idea that they are following the wind (cf. Diod. Sic. 3.34.7 and Marcianus of Heraclea, *Epit. Per. Menipp.* 5 = *GGM* 1 p. 568 for the same double meaning). *Stad. Mar. Magn*. 137: ἀπὸ Βαλανεῶν εἰς Λαοδίκειαν εὐθυδρομοῦντι λευκονότῳ ἐπὶ τὰ πρὸς ἠῶ τῆς ἄρκτου στάδιοι σʹ. / “From Balanea to Laodicea, by running a straight course with the leuconotus wind towards places east of the Bear, 200 stades”; Id. 148: ἀπὸ δὲ τοῦ Ποσειδίου τὸν ἐπίτομον εἰς Σελεύκειαν πλεόντι ζεφύρῳ στάδιοι ριʹ. / “From the temple of Poseidon the short way to Seleuceia, by sailing the west wind, 110 stades”; Id. 150: Ἀπὸ τῶν Γεωργίων ἐπὶ τὸν Ῥωσσαίων κόλπον στάδιοι τʹ· ἀπὸ δὲ τοῦ Ποσειδίου ἀκρωτηρίου ἐπὶ τὸν κόλπον **οὐριώτατα** στάδιοι σʹ. / “From Georgia to the gulf of Rhossaeoi, 300 stades. From the peninsula of Poseidios to the gulf of Rossaeoi, *with the fairest wind*, 200 stades”; Id. 157: Ἀπὸ τῶν Πυλῶν εἰς κώμην Ἀλὰς στάδιοι νʹ· ἀπὸ τοῦ Μυριάνδρου **οὐριοδρομοῦντος** στάδιοι ρʹ. / “From the Gates to the town of Alas, 50 stades. From Myriandros, *with a fair wind*, 100 stades”; Id. 158: Ἀπὸ τῶν Ἀλῶν εἰς πόλιν Αἰγαίας στάδιοι ρʹ· ἀπὸ δὲ τοῦ Μυριάνδρου **εὐθυδρομοῦντι ἐπὶ τὸν πόλον νότῳ** στάδιοι ρʹ. / “From Alas to the city of Aigaiai, 100 stades. From Myriandros *by running a straight course towards the pole by the south wind*, 100 stades”; Id. 159: Ἀπὸ Αἰγαίων ὁ παράπλους κρημνώδης ἐπὶ κώμην Σερετίλην σταδίων ρνʹ. ἀπὸ δὲ Ῥωσοῦ **εὐθυδρομοῦντι** ἐπὶ τὴν Σερετίλην ἐπὶ τὸν πόλον νότῳ στάδιοι σνʹ. / “From Aigaiai it is a precipitous coasting voyage, to the town of Seretila, 150 stades. From Rhosos *by running a straight course* to Seretila towards the pole by the south wind, 250 stades”; Id. 164: (…) ἀπὸ τοῦ σκοπέλου δὲ μὴ κατακολπίζοντι, ἀλλ’ ἐπ’ εὐθείας πλέοντι εἰς Ἀντιόχειαν ἔπειτα **πρὸς ἀνατολὴν τῆς ἠπείρου νότῳ τὰ εὐώνυμα μακρὸν διαραμένῳ** στάδιοι τνʹ. / “From the reef by not following the curves of the gulfs, but by sailing straight to Antiocheia, then *to the east of the mainland crossing by the south wind far to the left*, 350 stades”; Id. 165: Ἀπὸ τοῦ Πυράμου ποταμοῦ εὐθυδρομοῦντι εἰς Σώλους **ἐπὶ τὰ πρὸς ἑσπέραν μέρη τῆς ἄρκτου νότῳ μικρῷ** παρέλκας στάδιοι φʹ. “From the river of Pyramos, by sailing straight to Soli, *on the westward parts of the Bear, drawing on a little by the south wind*, 500 stades”; Id. 178: Ἀπὸ τῆς ἄκρας ἔγγιστα πρὸς τὴν Κύπρον εἰς πόλιν Καρπασίαν οὐριώτατα στάδιοι υʹ. / “From the nearest cape to Cyprus to the city of Carpasia, with the fairest wind, 400 stades”; Id. 185: Ἀπὸ δὲ τῆς Σαρπηδονίας ἄκρας εἰς Ἀφροδισιάδα ὁ πλοῦς ἐπὶ τὴν καρκίνου δύσιν σταδίων ρκʹ. / “From the cape of Sarpedonia to Aphrodisias, a voyage sailing towards the setting of Cancer, 120 stades”; Id. 233: Ἔστι δὲ ἀπὸ τῶν Χελιδονίων ἐπὶ Μάριον καὶ τὸ τῆς Κύπρου ἀκρωτήριον τὸν Ἀκάμαντα **ἐπ’ ἀνατολὰς τοῦ κριοῦ οὐριώτατα ζεφύρῳ** στάδιοι ͵αωʹ / “From Chelidonia to Marios and Acamas the peninsula of Cyprus, *to the east of the Ram by the fairest west wind*, 1800 stades”; Id. 272: ἐκ Ῥόδου δὲ ἐπὶ τὴν Κύπρον ἐπὶ τὴν ἑσπερίαν **τὴν ἐπ’ ἀνατολὰς τοῦ κριοῦ οὐριώτατα ζεφύρῳ** στάδιοι ͵βωʹ·/ “From Rhodes to Cyprus *to the west, which is to the east of the Ram, with the fairest West wind*, 2,800 stades”; Id. 280: Ἔστι δὲ ἀπὸ Κῶ εἰς τὴν Δῆλον διὰ πόρου πλέειν **ἐπὶ τὴν δύσιν τοῦ κριοῦ οὐριώτατα ἀπηλιώτῃ** σταδίοις ͵ατʹ·/ “To sail from Cos to Delos {*through the strait*} {*on the setting*} *of the Ram, with the fairest East wind*, is 1,300 stades”.

of wind, in terms of orientation as well as of strength, existed in most (if not all) areas of the Mediterranean. Etesian winds were celebrated by ancient writers[19]. They allowed, by experience, to wait for a certain wind and sail from A to B by just maintaining a certain relationship between this wind and the ship.[20] After a certain lap of time, one would arrive in sight of a known shore and landmarks, and rectify direction, if necessary.[21]

We do not know exactly when winds became the fundament of this system of orientations.[22] The first known complex windrose is Aristotle's twelve-rhumb rose (*meteor*. 363a21–b26). Eight of its twelve winds coincide with astronomical points – the poles, winter, equinoctial and summer sunsets and sunrises –, thus introducing approximations: the tropics, determined by solstitial sunsets and sunrises, form an angle of 24.6° instead of 30° (360° : 12 = 30°) with the equator. Some assume that this windrose was but a more complex and erudite version of the earlier eight-rhumb windroses, made for purely geographical purposes (Aujac 1987: 147). The later 12-rhumb rose of Timosthenes was very similar to Aristotle's in its conception, with the main difference that winds were distributed every 30°. Both windroses were in fact very artificial. Aristotle was unable to give a wind's name to two directions. These were denominated by Timosthenes after a hybridation of other winds names: he invented the Libonotus between Lips and Notus, and Euronotus between Eurus and Notus. As the even more complex 18-rhumb rose described by Vitruvius, these seem to have been a very theoretical sophistication with respect to the more popular 8-rhumb rose which formed the basis for the Tower of Winds.

[19] Etesian are not only the strong, ill-famed, winds that blow over the Egean, but any single wind blowing continuously in July and August. Among these are the East winds that blow on Southern Spain, cf. Strab. *geogr*. 3.2.5, C 143–144 or the Northwestern winds that lead to Egypt, cf. Philo, *In Flacc*. 26. The 19th century Sailing Directions used to compare the latter with the Trade winds. And such they used to be. As a consequence, these were an obstacle to sailing in the opposite direction.

[20] Arnaud 2005.

[21] Cf. Heliod., *Theag*. 5.17: the pilot recognizes the heights (rather than the capes) of Zakynthos' when the passengers on board are just seeing a cloud. He then decides to reduce sail despite a favourable wind. Asked why he was doing so by the passengers, the pilot answers that if the ship continued at the same speed it would be at destination at night, roughly during the first watch, and that this would be too dangerous. It was therefore ne-cessary to slow down the ship in order to arrive at sunrise (Ὑπερβαλόντες δὴ, λέγων, τὸν πορθμὸν καὶ νήσους Ὀξείας ἀποκρύψαντες τὴν Ζακυνθίων ἄκραν προσκοπεῖν ἀμφεβάλλομεν 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 τὰ πολλὰ καὶ κρημνώδεσι· καλὸν οὖν ἐννυκτερεῦσαι τῷ πελάγει καὶ τὸ πνεῦμα ὑφειμένως δέχεσθαι, συμμετρουμένους ὅσον ἂν γένοιτο αὔταρκες ἑῴους ἡμᾶς τῇ γῇ προσπελάσαι). The appreciation of speed and time to destination seem to have been very familiar to pilots and was just amazing for most passengers.

[22] For windroses, see Kaibel 1888; Böker 1958; for their relationship to navigation, Taub 2011.

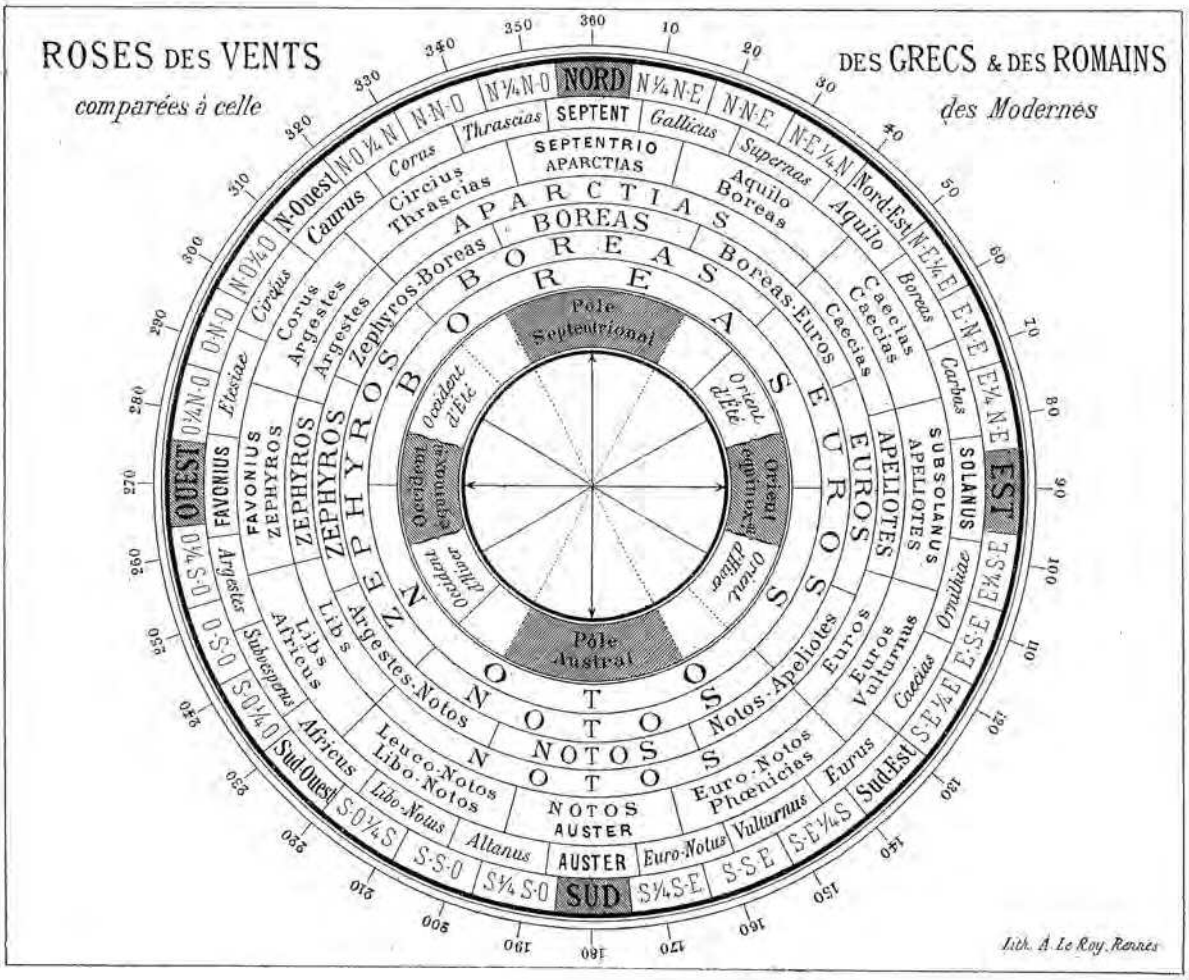


Figure 5: the ancient windroses of the Greeks and the Romans (after Vars)

The relation between real winds and theoretical directions is well-attested by anemoscopes, but they all prefer considering winds as quite large sectors, rather than lines. The well-known Tower of Winds at Athens, the date of which is still under discussion, is one of these. It combines sundials with a wind indicator. Each of the eight faces bears the name and allegory of a wind. The so-called Boscovitch (or Pesaro) anemoscope associated the image of the main circles of the celestial globe (meridian, tropics, arctic circles, equator) with a 12-rhumb indicator. It can be oriented at midday, sunrise and sunset through a central gnomon and the meridian-line. Naturally, it was of little use on a ship as a sun-compass (being the ship a mobile).[23]

[23] See Medas 2004: 171–173 & fig. 72, Arnaud 1993: 228, and our discussion above.

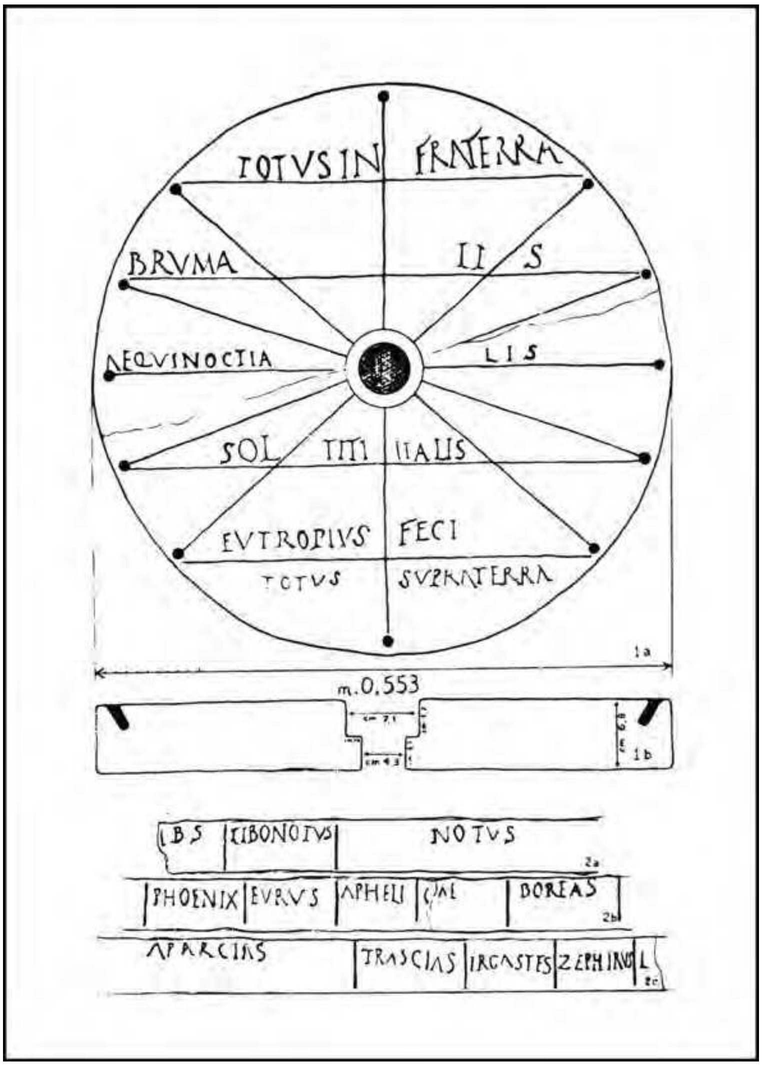


Figure 6: The Boscovitch anemoscope (ca. 200 AD)

To summarize: there is a stark contrast between the confidence the ancients had in orientation, derived from mariners' experience, and the rare and poor instruments they actually employed. But were the Greeks and Romans actually so confident in these data?

Subjective (mis-)orientation and perception of shores

Ptolemy[24] considered that no orientation between two points can be established without skilful and accurate astronomical observation: only the combination of known dis-

[24] *Geogr*. 1.2.2–3: "For in the first place, in either procedure one has to assume as known the absolute direction of the interval between the two localities in question, since it is necessary to know not merely how far this place is from that, but also in which direction, that is, to the north, say, or to the east, or more refined directions than these. But one cannot find this out accurately without observation by line [with respect to one's horizon], and thereby [the absolute directions] of the transverse intervals, are easily demonstrated at any place and time." (transl. Berggren/Jones).

tances between two places and their latitudes could allow, by extrapolation and calculation, to estimate the orientation of the route between those places. In the following passage (*geogr*. 1.4), he adds that, in regard to the information gathered from the mariners' experience, only

> "… a few of those who came after (Hipparchus) [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 winds). Most intervals, however, and specially those to the east or west, have been reported in a cruder manner, both because it was not yet understood how useful the more mathematical mode of investigation is, and because no one bothered to record more lunar eclipses that were observed simultaneously at different localities." (Transl. Berggren/Jones)

It is interesting that in this passage he refers only to cardinal points when he speaks of orientations obtained without astronomical observation. These are generally the ones used by ancient geographers, as if the more complex wind-roses we have mentioned above were but an artificial, useless production. There are good reasons to doubt whether the mariners had such a precise notion of the winds directions. It is worth mentioning that when it refers to actual winds in sailing contexts, the *Stadiasmus Maris Magni* uses only the four cardinal winds and employs periphrastic expression to indicate intermediate directions.[25]

Basically, the world maps of ancient geographers consisted of sites lying 'opposite to each other' and 'on the same parallel'. Even these were very rough approximations. Let us recall that Alexandria, Rhodes, Byzantium and the mouths of Borysthenes/Dniepr (Eratosthenes) or Tanais/Don (Strabo) were supposed to lie on the same meridian[26]. In reality, they are very far removed from this imagined line. The same can be said of the supposed 'equator' of the Eratosthenian world-map, the former 'diaphragm' of Dicaearchus, or the supposed parallel of Rhodes. According to the ancients, this ran from Issus to Rhodes, thence to Cape Matapan, the straits of Messina, cape Caralis (Cagliari), the columns of Hercules and Gades (Cádiz). The condition for such an organization was the completely wrong mis-orientation of the sides of Sicily, common to any ancient geographer, but absent from medieval nautical charts.

[25] *Stad. Mar. Magn.* 164: (…) ἀπὸ τοῦ σκοπέλου δὲ μὴ κατακολπίζοντι, ἀλλ' ἐπ' εὐθείας πλέοντι εἰς Ἀντιόχειαν ἔπειτα **πρὸς ἀνατολὴν τῆς ἠπείρου νότῳ τὰ εὐώνυμα μακρὸν διαραμένῳ** στάδιοι τν′ / "From the reef by not following the curves of the gulfs, but by sailing straight to Antiocheia then *to the east of the mainland crossing by the south wind far to the left*, 350 stades"; Id. 165: Ἀπὸ τοῦ Πυράμου ποταμοῦ εὐθυδρομοῦντι εἰς Σώλους **ἐπὶ τὰ πρὸς ἑσπέραν μέρη τῆς ἄρκτου νότῳ μικρῷ** παρέλκας στάδιοι φ′. / "From the river of Pyramos, by sailing straight to Soli, *on the westward parts of the Bear, by the South wind* drawing a little aside, 500 stades."
[26] Berger 1903^2: 412–417 (Eratosthenes), 540–542 (Strabo).

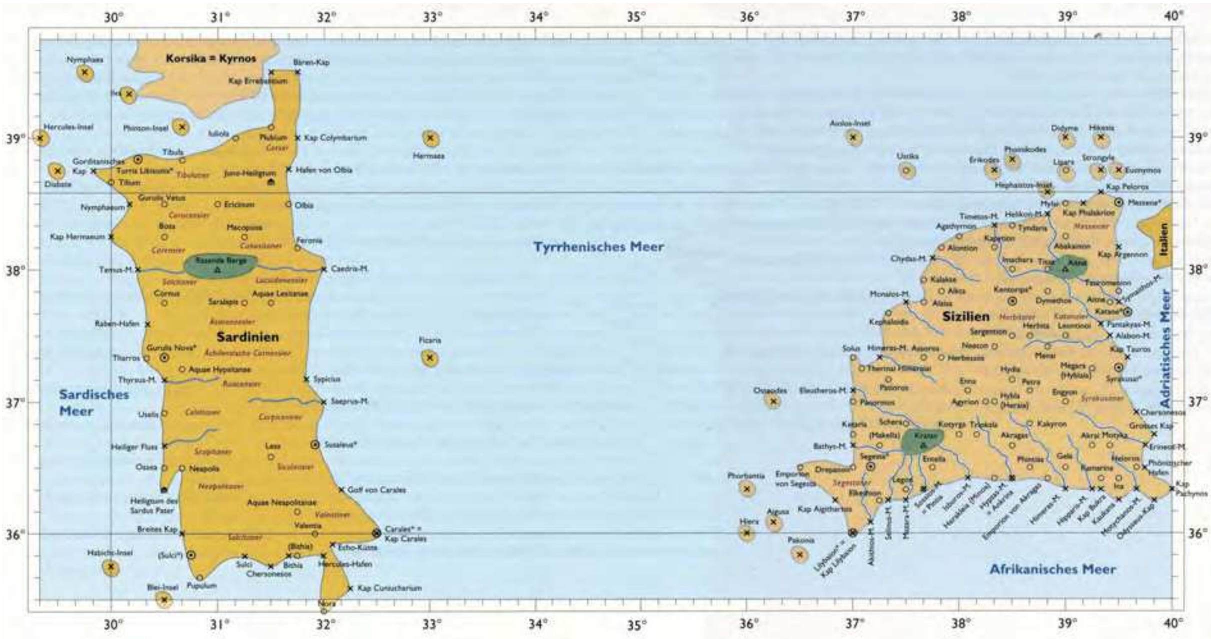


Figure 7: Ptolemy's Sardinia and Sicily (after Stückelberger/Graßhoff 2006)

All these features disappeared from medieval nautical charts drawn after directions given by the compass.

Other information about directions found in the *Stadiasmus Maris Magni* hardly match reality. We may suspect that some of the directions and winds mentioned in the text have been invented in order to construct a map, and are mere extrapolations, for the winds referred to are normally absent in the respective areas. Prudence demanded by such a situation incites not to pay too much attention to these when they form a coherent group. In at least one isolated passage, the information given by the *Stadiasmus* fits with real winds[27], when it describes the passage from Balaneas (Banyas) to Laodikeia (al-Lādhiqīyah) in Syria:

> *Stad. Mar. Magn.* 137: ἀπὸ Βαλανεῶν εἰς Λαοδίκειαν **εὐθυδρομοῦντι λευκονότῳ ἐπὶ τὰ πρὸς ἠῶ τῆς ἄρκτου** στάδιοι σʹ.
> "From Balanea to Laodicea, *by running a straight course with the Leuconotus wind towards places east of the Bear*, 200 stades."

[27] http://www.windfinder.com/windstats/windstatistic_lattakia.htm (30-09-2013).

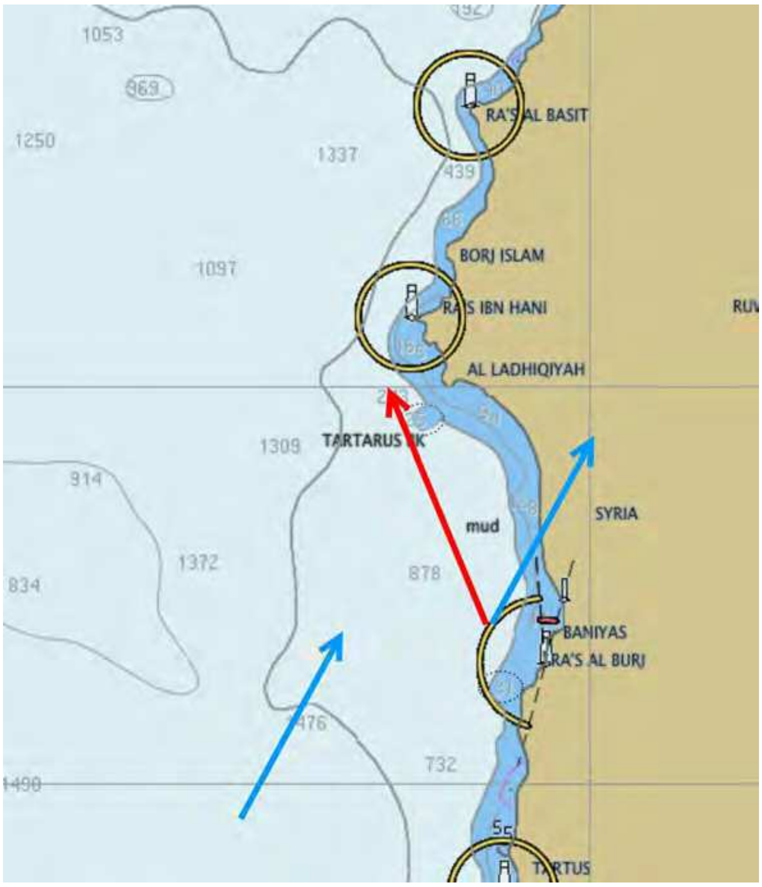
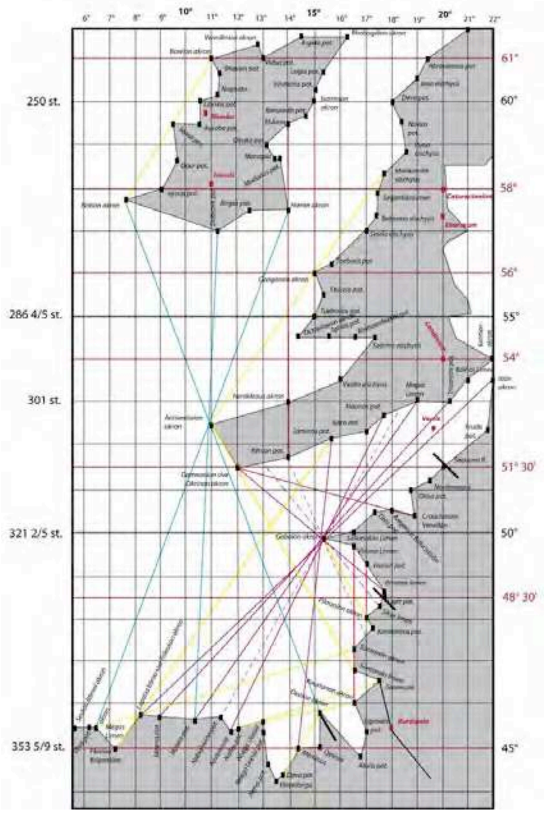


Figure 8: The route from Banyas, real (red) and supposed (blue)

Wind orientation (Leuconotus) and the supposed astronomic direction are drawn in blue colour on the nautical chart above, while the actual route is marked by the red dart. The error, more than 50°, is significant. Its explanation is, with all probability, to be found in the first miles of the route from Laodikeia (al-Lādhiqīyah) to Banyas, along Ras Ziaret, whose orientation is exactly opposite to the Leuconotus. Extending an orientation from its very beginning over the whole route was a very common practice, as we will see. Referring to the opposite route the source of the *Stadiasmus* has just renamed the wind according to the opposite direction.

It is a well-established fact that ancient *periploi* shared the common trend to distribute places mentioned in the same itinerary on a straight line and in the same direction and therefore to underestimate changes of orientation (Janni 1984: 36–7; 120; González Ponce 1995: 54–55). As already noticed by P. Janni, the orientation assigned to the whole segment generally tended to be the orientation of the route at its very starting point.

I have already commented on Ptolemy's mapping of the Ocean (Arnaud 2011a). It relies mainly on the principle of absolute symmetry of opposite coasts with respect to two capes used as symmetrical centres: Cape Antiouestiaïon (Land's End, Cornwall) and cape Gabaïon (cape Finistère, Brittany). Drawn on a modern map, this makes no sense, unless we admit that these capes were situated on several routes and have thus been considered as the point of intersection of full linear routes. Ptolemy's maps have emphasized the general trend of ancient mariners to distribute in a straight line places situated along a single route.



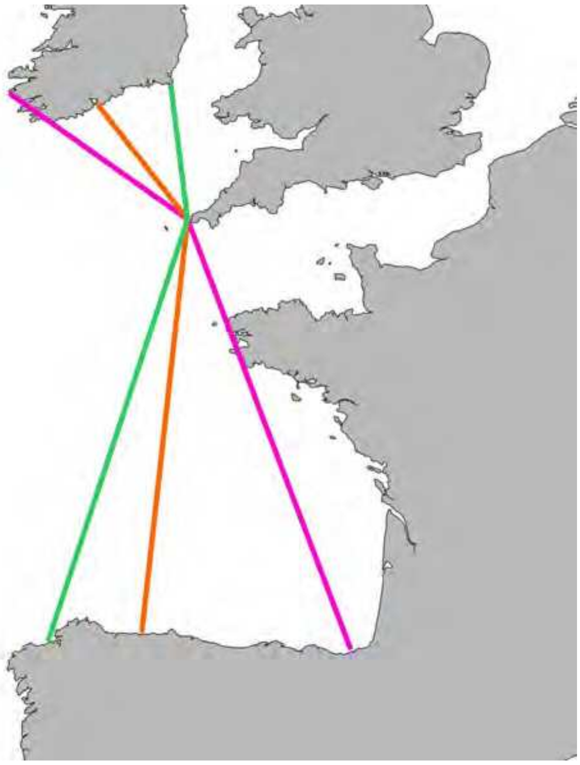
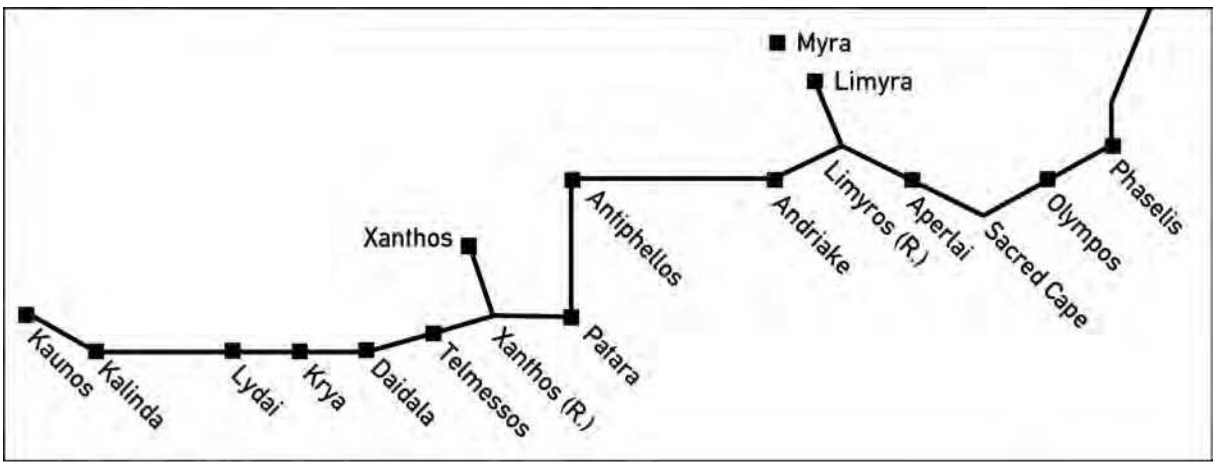


Figure 9: Ptolemy's symmetries and their actual figure on a modern map

Modern mariners as well as ancient ones are conscious that the perception of shores, seen from the sea, is bi-dimensional. Only elevations and colours can be distinguished, but morphological figures, mainly gulfs and capes, cannot be identified from the sea at a certain distance. It is necessary to rely on known natural or artificial landmarks (towers, temples, often present on capes, monumental tombs etc.) to identify the location of a cape, gulf, or mooring. Their very nature is perceptible only at close range from the coast, and following any sinuosity. For that reason, the Greeks established a distinction between *katakolpizein*, meaning "to sail following the curves of the gulfs", and *euthyploia* (and similar terms), meaning "sailing by following a straight line". In theory, this points to two kinds of sailing, but this is theory only, since *katakolpizein* is not only absurd as a way of sailing, but also dangerous: most dangers linger close to the shore. Furthermore, strictly speaking, this would not be 'coasting' (*paraplous*), but following the minutiae of the shore even when it is neither useful nor necessary. It may happen at a certain moment during the voyage – generally at the beginning or at the end – but this is not a realistic way of sailing.

No sailor has ever experienced all the details of a single shore, even within the limits of a small area. I once (Arnaud 2009) tried to show that the harbours and ports listed by the *Stadiasmus Maris Magni* in Lycia were all real, even the less illustrious ones, and the worse ones in terms of sailing, but that the route made up by the addition of the linear intervals between them was only virtual. The perception of gulfs and capes as geographical features could be Strabo's theoretical view[28] as a map-maker. It was not, by nature, the kind of perception and representation a mariner would have. As a result, on the ground of periploi written by the mariners, the same Strabo apparently imagined the whole coast between Kaunus and the Sacred Cape (cape Ghelidonia) as a roughly horizontal line. Ptolemy's map does not provide a much different view. All the places between Kaunos and Xanthos are distributed on the same parallel, cancelling the whole gulf of Telmessos. Instead, Antiphellos (Kaş) appears as the bottom of a huge gulf between Patara and the Andriakè, erroneously located before Aperlae. This probably echoes the smaller, but remarkable gulf Antiphellos lied in (the so-called "Kastellorizou kolpos"). This is clearly an overemphasized detail.



(according to Ptol. geogr. 5, 3, 2-3)

[28] Strab. 14.3.1.

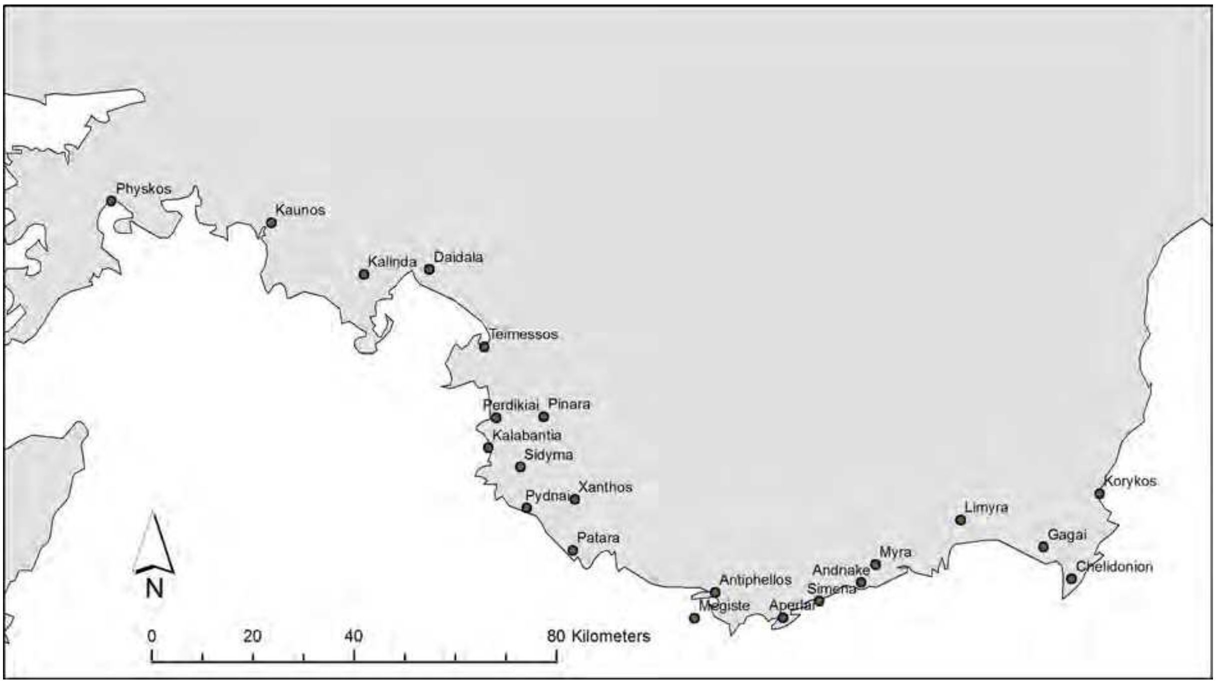


Figure 10: Lycia according to Ptolemy (above) and on a modern map

The treatment of capes by Ptolemy shows that their importance is congruent less to the geographical features (i.e. their size) than to the sailing experience: the higher a cape's importance, either as a landmark, a meteorological boundary or an obstacle in sailing, the bigger it is in Ptolemy's map. The treatment of Crete provides a very clear example of this subjective perception and reconstruction of space (Arnaud 2005): there is no correlation between the importance ascribed to capes and gulfs by Ptolemy and their actual size. These are all capes mentioned by geographers as starting points of measured routes (the information gathered from mariners). Their size is but a consequence of the subjective importance they had to mariners.

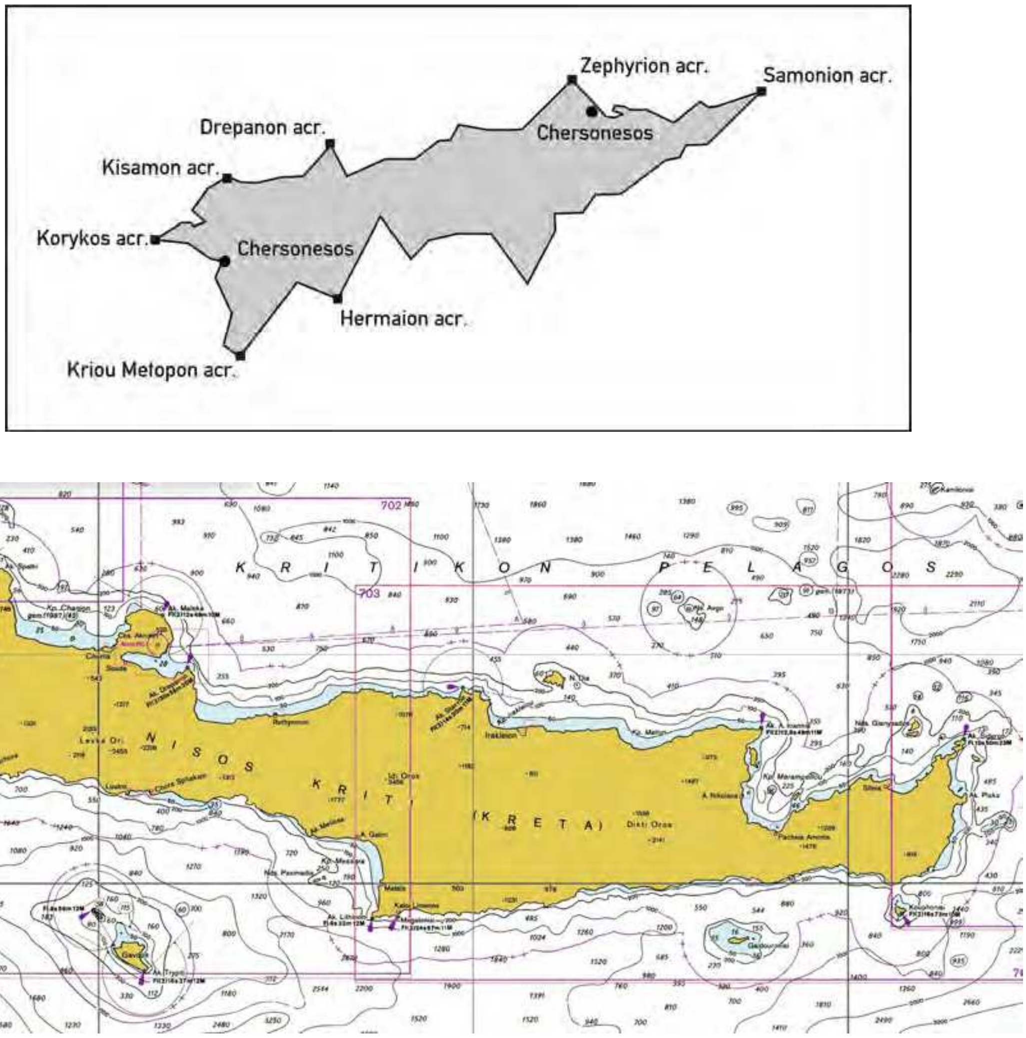


Figure 11: Crete after Ptolemy (above) and modern nautical charts (below)

The cartographic shape of southern Sardinia illustrates quite clearly how the peculiar mariners' perception of space has impacted the image of the world produced by armchair geographers (as well as by the few travelling ones, as Artemidorus). On the western coast, the sequence of place names[29] between Tharros and Neapolis seems correct, at least as far as we know, given that the whole shoreline in this area has been subject to major morphological changes through time (even during antiquity, cf. Spanu/Zucca 2013). All belonged to the wide gulf known as the gulf of Oristano, which includes a complex network of moving rivers and lagunas, and the list of place-names given by Ptolemy may have included places that were not situated along the gulf's shore *stricto sensu*, but also places situated on rivers or lagunas that had their mouth on the gulf's shores. It is worth mentioning that not only the existence of the gulf has been cancelled by Ptolemy (or by his sources), but the inner cape before Neapolis has been emphasi-

[29] Τάρραι πόλις (Tharros / Torre S. Giovanni), Θύρσου ποτ. ἐκβ. (Foce del Tirso), Οὔσελλις πόλις κολωνία (Oristano?), Ἱεροῦ ποτ. ἐκβ., Ὀσαῖα / Ὀθαῖα (Othoca / Sa. Giusta), Σαρδοπάτορος ἱερόν, Νεάπολις (Sa maria di Neapoli).

zed. A landmark (the sanctuary of Sardus Pater) probably signalled this flat cape. The distances between these points have been overestimated, maybe because they included the perimeter of lakes (by land?), or because they did not refer to any actual sailing along the gulf's shores (highly improbable if reported to a real navigation given the sinuosities of the gulf).

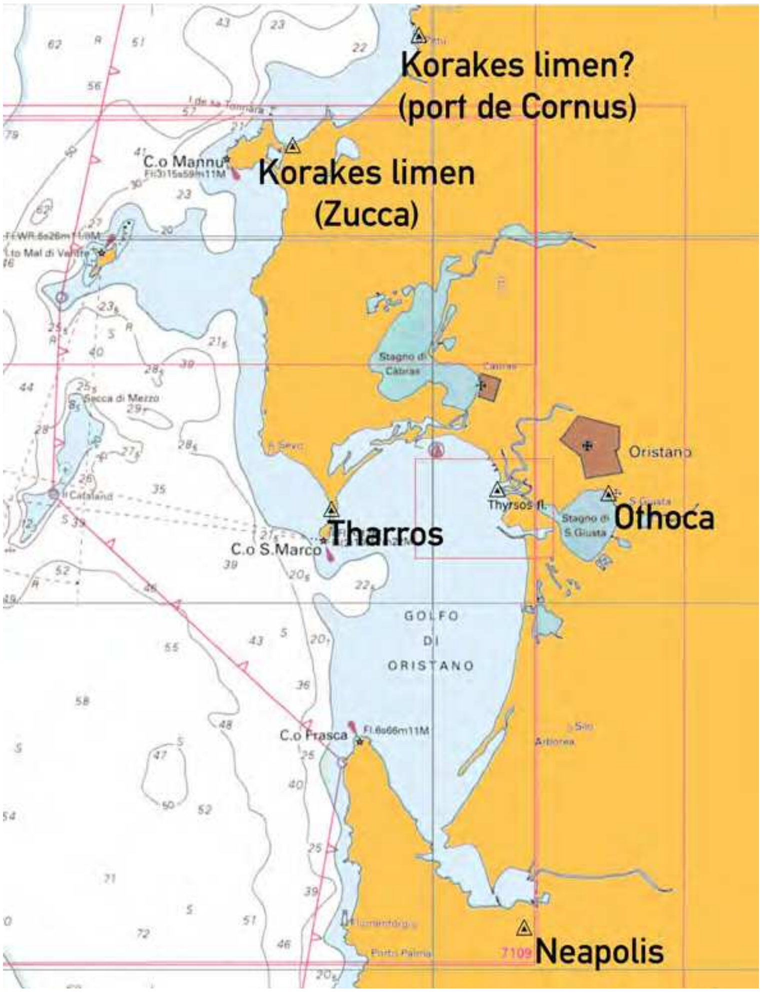


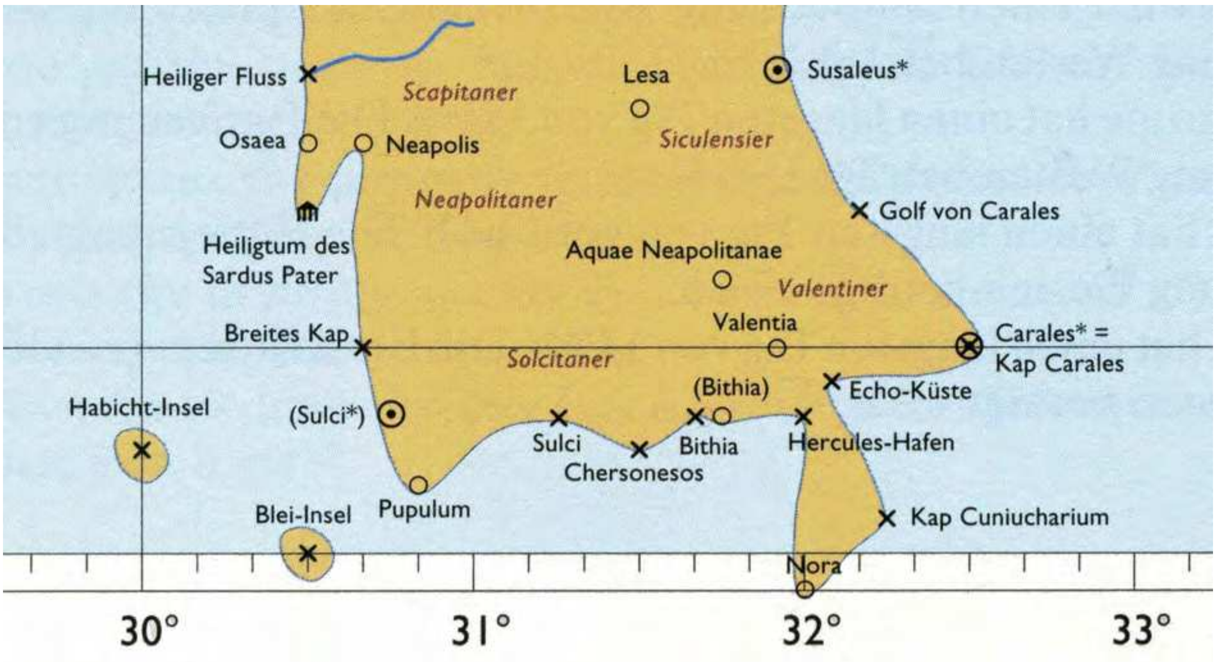
Figure 12: Ptolemy's place-names around the gulf of Oristano

On the other hand, distances to Sulci, another well-known place in Sardinia, have been reduced. Sulci was situated on the island of S. Antioco at the base of the large flush and sub-flush isthmus which prevented any sailing there and forced to turn around the island. As a result, neither the nature of the island nor that of the isthmus have been correctly perceived, and Sulci and its harbour have been separated by a huge distance in the mind of ancient geographers.

Between Chersonesos (Cape Teulada)[30] and the port of Hercules, where the city of Bithia (Chiaia) was situated, the gulf of Teulada has entirely disappeared from topo-

[30] For the identifications, see Mastino/Spanu/Zucca 2005: 165–174.

graphy as well as cape Spartivento, since the change of direction of the coast, then running north-east, has been entirely misunderstood. The "port of Hercules" was probably somewhere behind the current shoreline of Porto d'Agumu rather than at cala d'Ostia, too unsheltered and small to be worth the word *limen*. It became the bottom of a deep gulf, the southernmost point of which is Nora, with the coast running due south between the two points, while it is actually north-east. Hence, Nora became the southernmost part of Sardinia. Whoever sails along these coasts knows that cape Spartivento (actually a succession of smaller capes) is not a very remarkable point, neither in terms of weather conditions, nor in terms of noticeable change of coastal orientations. The most likely explanation for the supposed orientation of the coast between port of Hercules and Nora is that this orientation was that of capo di Pula itself between cala di Nora and the edge of the cape, although the route between the two points does not exceed 0.33 nm now – maybe slightly more in antiquity due to the silting of the bay. If so, Nora's peninsula (capo di Pula) would have been once more overemphasized. What follows, shows that the orientation up to cape Counioucharion (Κουνιουχάριον ἄκρον, Punta Zavorra?) as well as thence to the "Echo Beach" (Αἰγιαλὸς προσηχής, probably the sand beach and limit of the lake of Cagliari between Sarroch and Cagliari) is the actual orientation of the coast just after Punta Zavorra, but not further than a short distance from that point. It is striking that Cape Caralis (*promuntorium Caralitanum*) has turned to be the easternmost point of Sardinia.



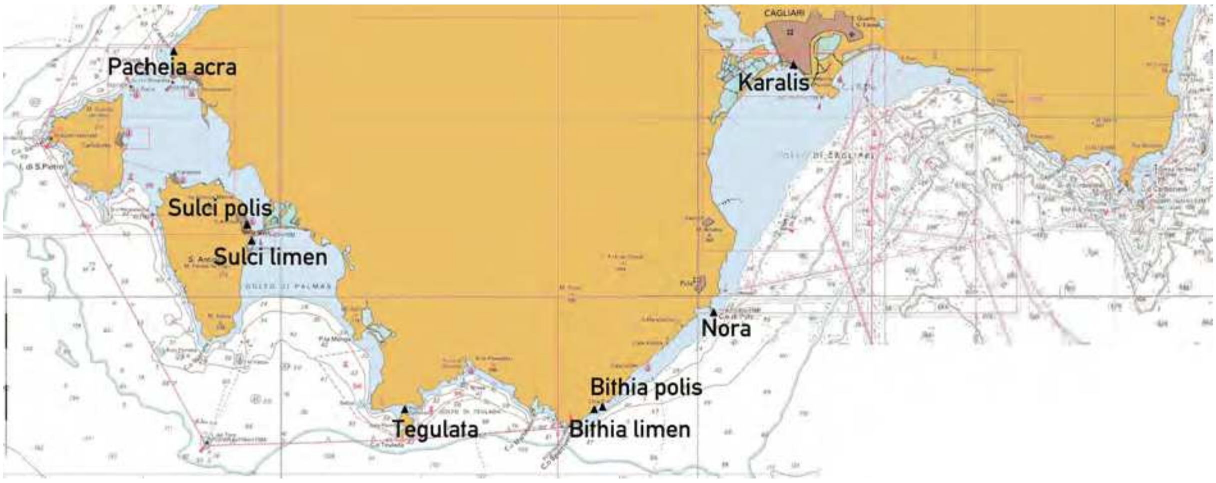


Figure 13: Southern Sardinia after Ptolemy (above left) and current chart

This figure echoes the rest of the tradition, but differs in the point that the latter also considered this cape as the southernmost point of Sardinia. The main reason can be attributed to the fact that it was the departure point to Galita, Tabarca and Africa as well as to Rome, as recorded by the *Antonine Itinerary*.[31]

By the time of Dicaearchus, it became a reference point on the diaphragm, whence the distances to Cádiz (200 Roman miles, equal to 1.600 stadia) and to Africa (1.400 Roman miles, equal to 11.200 stadia) were measured. Pliny, citing Artemidorus, transmitted the distances to Gades, Lilybaeum and Africa, giving the following figures:

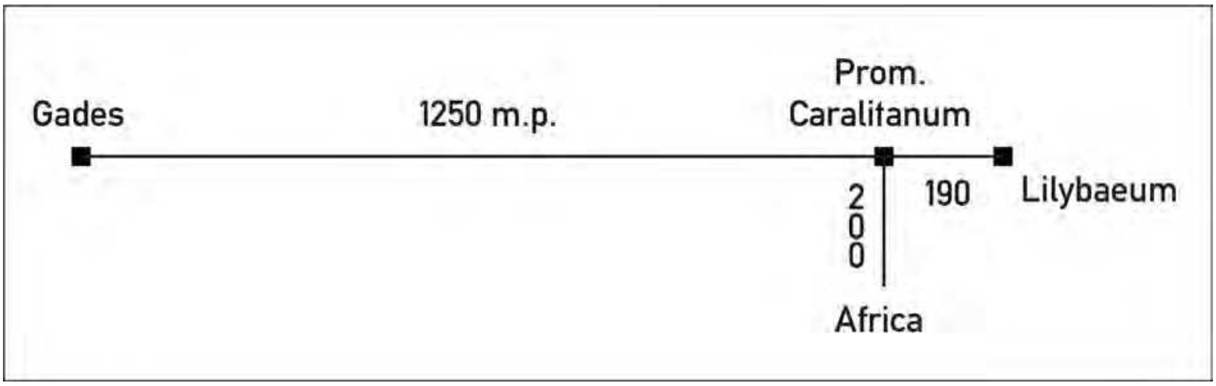


Figure 14: Caralis in Pliny's schema of distances and orientations

[31] *Itin. Ant.* 494.3–4: *a Caralis de Sardinia traiectus in portum Augusti stadia III*; 494.5: a *Caralis traiectus in Africam Carthaginem stadia MD:* from Caralis (Cagliari) in Sardinia, the crossing to the port of Augustus (Ostia): 3,000 stades; 494.6–7: *a Caralis Galatam usque insulam stadia DCCCCXXV*: From Caralis (Cagliari) to the island Galata (La Galite): 925 stades; 514.4: *Insula Galata: a Caralis de Sardinia stadia DCCXXX*: Island Galata (la Galite): from Caralis (Cagliari) in Sardinia, 730.

Because Ptolemy makes this cape the limit of the southern and eastern shores of the island, the *promuntorium Caralitanum* has been identified with capo Carbonara.[32] This is unlikely. First, cape Carbonara lies at a distance of 20 nm, equal to nearly 40 km, from Caralis, and Ptolemy considered the cape and the city as a single place. Second, Caralis is located at the base of a long, notable cape (capo S. Elia), which allows to identify the site. Last, this white cape is the most remarkable landmark of the area, which is not the case with cape Carbonara. Not only is it nearly invisible until the very last moment of the voyage, but the cape is also bordered by islets and isola dei Cavoli, making it more suitable to turn round the island rather than to sail through the narrow passage between the island and the cape in a very windy sector.

It actually seems that the whole area between Caralis (both cape and city) and cape Carbonara, called "Gulf of Caralis"[33], has been shifted northwestwards, following the orientation of the coast immediately after capo S. Elia (fig. 12). Everything looks like as if areas of interest had been overemphasized, almost drawn at a different, higher scale, and as if orientation was mainly inspired by that of the first leg of the route. Ptolemy's mapping seems to echo the mental maps/frames of the mariner's common sense geography: a synthesis of independent particular views inserted into a combination of erroneous orientations.

Conclusion: Ancient mariners between the hodological perception of space and 'common sense geography'

In his heroic reconstruction of the discovery of the direct monsoon route from East Africa to India, the author of the *Periplus Maris Magni* imagined that a certain Hippalus, commander or pilot (the Greek word *kybernetes* may have both meanings by the time this work was written) has conceived the cartographic shape of the Indian sea by combining the directions and distances he had acquired during his enterprise, and imagined the virtual track he had to follow.[34] Nice story, but pure fiction. Hippalus was probably the name of the monsoon, and the author was reasoning like a geographer. Thus thinks Lucanus when he makes the pilot speak. It is nevertheless worth wondering whether ancient mariners may have achieved more than a mere addition of linear information, opening the way to a pre-geographic hodological space. The expression 'deuteros

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[32] Hülsen 1899: 1568.

[33] Ptol. *geogr*. 3.3.4; Claud., *B. Gild*. 520sq.

[34] *Peripl mar. Erythr.* 57: πρῶτος δὲ Ἵππαλος κυβερνήτης, κατανοήσας τὴν θέσιν τῶν ἐμπορίων καὶ τὸ σχῆμα τῆς θαλάσσης τὸν διὰ πελάγους ἐξεῦρε πλοῦν. / "The captain Hippalus, for the first, having conceived the location of trade-harbours and the design of sea found the route through the blue sea …"

plous' had become proverbial by the times of Plato to express a 'plan B'. This nautical metaphor shows that in case a mariner could not find the expected wind at a certain place, he could follow another route to his destination. This can be described as the first step to the assumed experience of Hippalus.

We simply do not know to what extent this first step may have actually been organized in the form of a coherent mental image or cognitive map – this would be, strictly speaking, a 'geography'. There are many reasons to doubt whether ever ancient mariners had a coherent vision of the Mediterranean. The main one is that that the mariners' experience consisted mainly in the life-long repetition of a limited number of routes to an even more restricted number of destinations. The common sense geography of mariners we have sought was probably a sum (rather than an amalgam) of common sense perceptions of limited areas, the addition of which has created a virtual, non-codified, unexplained, intuitive, non-reasoned legacy, and the ground for a common sense geography, which was that of a whole people. At a certain point, the maritime culture was so deeply rooted in the life of most Greeks that one wonders who was not a mariner in 4th century BC Athens. There is no denying the fact that the mariners' experience has been the origin of a common sense geography, which, in turn, has been the origin of the classical tradition of geography.

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