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Eratosthenes' Parallel of Rhodes and the History of the System of *Climata*

Ptolemy was the first to use the so-called system of seven *climata* (*Almagest* 2.12 Heiberg I 172–187) which, due to his authority, was later to become one of the canonical elements of late antique, medieval European and Arabian geography. Κλίμα, taken as a technical geographical term, may be defined as the latitude which is expressed in terms of the length of the longest solstitial day (in equinoctial hours and fractions of an hour).[1] Κλίματα constituted a table of latitudes progressing by uniform steps of time (usually $^1/_2$ or $^1/_4$ of an hour) which was the main theoretical tool that ancient scientific geography possessed to construct the mathematical framework of the map. Ptolemy applied the term κλίμα only to the seven most important parallels: through Meroe (13 hours; 16° 27′), Syene (13 $^1/_2$ hours; 23° 51′), lower Egypt (14 hours; 30° 22′), Rhodes (14 $^1/_2$ hours; 36°), Hellespont (15 hours; 40° 56′), the middle of the Pontus (15 $^1/_2$ hours; 45° 1′), and the mouth of the Borysthenes (16 hours; 48° 32′).

E. Honigmann has suggested that Ptolemy's system of seven *climata* goes back ultimately to the geography of Eratosthenes. This hypothesis has found many supporters,[2] but at the same time it has met with vigorous opposition. The main argument in favour of Honigmann's hypothesis is the fact that Eratosthenes' geography exploited precisely the same set of latitudes[3] as that which constitutes Ptolemy's system of

[1] On the doctrine of κλίματα in ancient geography see E. Honigmann, Die sieben Klimata und die πόλεις ἐπίσημοι. Eine Untersuchung zur Geschichte der Geographie und Astrologie im Altertum und Mittelalter, Heidelberg 1929; O. Neugebauer, A History of Ancient Mathematical Astronomy, Berlin/Heidelberg/New York 1975, 43–45; 333–336; 725–733.

[2] Honigmann (n. 1) 13f.; 54; J. Fischer, Claudii Ptolemaei Geographiae Codex Urbinas Graecus 82. Tomus prodromus. Pars prior: Commentatio, Leiden/Leipzig 1932, 535; A. Diller, Geographical Latitudes in Eratosthenes, Hipparchus and Posidonius, Klio 27, 1934, 261–263; G. Aujac, Strabon et la science de son temps. Les sciences du mond, Paris 1966, 40–48; 168–170; O.A.W. Dilke, Greek and Roman Maps, Ithaca (NY) 1985, 178; Neugebauer (n. 1) 334 n. 8; 928; D. Marcotte, La climatologie d'Ératosthène à Poséidonios: genèse d'une science humaine, in: G. Argoud/J.-Y. Guillaumin (eds.), Sciences exactes et sciences appliquées à Alexandrie (III^e siècle av. J.-C.–I^{er} siècle ap. J.-C.), Actes du Colloque International (Saint-Étienne, 6–8 juin 1996), Saint Etienne 1998, 264; P. Kunitzsch, La table des climats dans le corpus des plus anciens textes latines sur l'astrolabe, in: L. Callebat/O. Desbordes (eds.), Science antique, science médiévale, Actes du Colloque International (Mont-Saint-Michel, 4–7 sept. 1998), Hildesheim/Zürich/New York 2000, 393.

[3] Strab. 1.4.2 C62–63 = Eratosth. F II C 2, 7; Strab. 2.5.42 C135 = F II C 5, 7; Strab. 2.5.35–42 C133–134 = F III A 17–22; Strab. 2.1.3 C68 = F III A 2; Cleomedes *Caelestia* 1.7.53, 108 Todd 35, 37 = F II B 34; Plin. nat. 2.183 = F II B 38; Strab. 2.1.19 C76 = F III A 9; cf. Strab. 2.2.2 C95; 2.5.7 C114; 2.5.24 C125–126; Plin. nat. 5.132 = F II B 28. All further references, unless specified, are to Strabo: Strabons *Geographika* mit Übers. und Kommentar hrsg. von Stefan Radt, I: Prolegomena. Buch I–IV. Text und Übersetzung, Göttingen 2002. In all translations of Strabo I follow D. R. Dicks and H. L. Jones (the Loeb

seven *climata*.[4] On the other hand, the main objection raised against the hypothesis rests on the fact that the term κλίμα is never applied to these latitudes in the preserved fragments of Eratosthenes (*apud* Strabo),[5] and neither of these latitudes is characterized by the length of the longest day. On this basis many scholars categorically reject that Eratosthenes could have been acquainted with the concept of κλίμα, and that his geography could have anything to do with the system of *climata*.[6]

In this paper I wish to offer an additional argument in favour of Honigmann's hypothesis.[7] As I will show below, comparative examination of several passages in Strabo leads to the conclusion that all of them represent the views of Eratosthenes, and, what is the most important for our purpose, the statement in one of these passages that the parallel of Rhodes has the length of the longest daylight of 14 ½ hours came also from him. As another result, our analysis suggests that Eratosthenes' estimates of the latitudes of Gadeira, the Pillars of Heracles, and the Sicilian Strait were based on real astronomical observations.

The starting-point for our investigation is one passage of Strabo in which he gives a general outline of the shape of the *oikoumene* (2.5.14 C118):

Ἔστι δή τι χλαμυδοειδὲς σχῆμα τῆς γῆς τῆς οἰκουμένης, οὗ τὸ μὲν πλάτος ὑπογράφει τὸ μέγιστον ἡ διὰ τοῦ Νείλου γραμμὴ λαβοῦσα τὴν ἀρχὴν ἀπὸ τοῦ διὰ τῆς Κινναμωμοφόρου παραλλήλου καὶ τῆς τῶν Αἰγυπτίων, τῶν φυγάδων, νήσου μέχρι τοῦ διὰ τῆς Ἱέρνης παραλλήλου, τὸ δὲ μῆκος ἡ ταύτῃ πρὸς ὀρθὰς ἀπὸ τῆς ἑσπέρας διὰ Στηλῶν καὶ τοῦ Σικελικοῦ πορθμοῦ μέχρι τῆς Ῥοδίας καὶ τοῦ Ἰσσι-

The *oikoumene* resembles in shape a chlamys, its greatest breadth is marked by the line through the Nile, beginning from the parallel through the Cinnamon Country and the Island of the Egyptian exiles up to the parallel through Ierne, the [greatest] length [is marked by the line] perpendicular to that one, passing from the west through the Pillars and the Sicilian Strait up to the [Strait]

edition) with alterations. Eratosthenes' fragments are numbered according to H. Berger, Die geographischen Fragmente des Eratosthenes, Leipzig 1880; Hipp(archus)' fragments according to Berger and Dicks: H. Berger, Die geographischen Fragmente des Hipparch, Leipzig 1869; D. R. Dicks, The Geographical Fragments of Hipparchus, London 1960. On Eratosthenes' system of latitudes see Berger, Eratosthenes, 152f.; 188–198; idem, Geschichte der wissenschaftlichen Erdkunde der Griechen, 2. Auflage, Leipzig 1903, 421–426; 476–478.

[4] The only difference between them is that the parallel of the mid-Pontus is not attested in Eratosthenes' fragments, and the parallel for which the longest day is 14 hours is drawn through Alexandria, whereas Ptolemy places this city to the north of it.

[5] The term κλίμα occurs in two fragments of Eratosthenes, but both times in unreliable context. The first occurrence comes from a geographical poem of Ps.-Scymnus (112–114 Marcotte 108 = F 6 Berger), not the best authority on Eratosthenes' geography: Honigmann (n. 1) 10; D. R. Dicks, The *ΚΛΙΜΑΤΑ* in the Greek Geography, CQ 49, 1955, 254. The second time, the term κλίμα occurs within Strabo's quotation from Hipparchus (2.5.20 C77 = Eratosth. F II B 36 = Hipp. F II 4 Berger = F 17 Dicks; the text is given below in the paper), which cannot guarantee that it was in Eratosthenes' text too; see Dicks (n. 5) 252; idem (n. 3) 157–160.

[6] E. H. Bunbury, A History of Ancient Geography. Among the Greeks and Romans. From the Earliest Ages till the Fall of the Roman Empire II, New York ²1959 (reprint of 1883), 4 n. 2, 5–11; Berger, Eratosthenes (n. 3) 191f. n. 2; idem, Erdkunde (n. 3) 416f.; F. A. Thalamas, La géographie d'Ératosthène, Versailles 1921, 187–251; K. Reinhardt, s. v. Poseidonios (3), in: RE XXII.1, 1953, 678; Dicks (n. 5) 250–255; idem (n. 3) 156–160; idem, Eratosthenes, Dictionary of Scientific Biography IV, New York 1971, 389f.; cf. however, the refutation of this objection: Honigmann (n. 1) 21f.

[7] Some other arguments are set out in my recent paper D. A. Shcheglov, Ptolemy's System of Seven Climata and Eratosthenes' Geography, Geographia Antiqua 13, (in press).

κοῦ κόλπου, παρὰ τὸν Ταῦρον ἰοῦσα τὸν διεζωκότα τὴν Ἀσίαν καὶ καταστρέφοντα ἐπὶ τὴν ἑῴαν θάλατταν μεταξὺ Ἰνδῶν καὶ τῶν ὑπὲρ τῆς Βακτριανῆς Σκυθῶν. Δεῖ δὴ νοῆσαι παραλληλόγραμμόν τι, ἐν ᾧ τὸ χλαμυδοειδὲς σχῆμα ἐγγέγραπται οὕτως ὥστε τὸ μῆκος τῷ μήκει ὁμολογεῖν καὶ ἴσον εἶναι τὸ μέγιστον καὶ τὸ πλάτος τῷ πλάτει.

of Rhodus and the Gulf of Issus, along the Taurus, which traverses Asia and ends near the eastern sea between the Indians and the Scythians that are beyond Bactriana. One should imagine a parallelogram, in which this „chlamys-shaped" figure is inscribed so that the length [of the parallelogram] coincides with the length [of the figure], and their greatest dimensions are equal, and the same is true of the breadth.

This passage has a whole array of features which betray strong Eratosthenian influence. (1) First, it was in Eratosthenes' geography that the framework of the map was formed by two ‚coordinate axes' termed στοιχεῖα — i.e. the central parallel and meridian which intersected at Rhodes and were supposed to pass through the lines of the greatest latitudinal and longitudinal dimensions of the continent (see below). (2) The term χλαμυδοειδὲς as a definition of the shape of the *oikoumene*, is clearly of Eratosthenian origin too (2.5.6 C113 = F II B 27; cf. 2.5.9 C116, 2.5.18 C122).[8] (3) It was Eratosthenes who drew his chief parallel through the Sicilian Strait (F III A 2 = 2.1.1 C67), whereas Hipparchus (F V 9 Berger = F 50 Dicks = 2.5.39 C134), Posidonius (FGrH 87 F 62 = F 249 Edelstein-Kidd = F 41 Theiler),[9] Pliny (nat. 6.213; 215), and Ptolemy (Geogr. 3.4.1; 3 Müller 389; 394) placed the Sicilian Strait to the north of it.

(4) It was Eratosthenes who mentioned the „Scythians beyond Bactriana" (i.e. those who lived due east of it, in the same latitude with Bactra), which bordered India to the south, along the Taurus ridge (F III A 2 = 2.1.3 C68; 5 C69; 11 C71): „the traveller who directs his course from Amisus towards the equinoctial east [arrives] [. . .] afterwards at the road leading to Bactra and the Scythians beyond it, having the mountains always on the right" — ἐκ δὲ Ἀμισοῦ πρὸς τὴν ἰσημερινὴν ἀνατολὴν φερομένῳ [. . .] καὶ ἐφεξῆς ἡ ἐπὶ Βάκτρα καὶ τοὺς ἐπέκεινα Σκύθας ὁδὸς δεξιὰ ἔχοντι τὰ ὄρη. (5) Finally, it is also Eratosthenes who has established that the parallel that marks off the southern limit of the *oikoumene* (here — in the sense of the *continent*) passes through the Cinnamon Country and the Island of the Egyptian exiles (1.4.2 C63; 2.5.14 C119 = F II C 2, F III A 12).

Further, Strabo (2.5.14 C119) adduces two examples intended to prove that the outline of the *oikoumene* is really χλαμυδοειδὲς, to wit that it is continually tapering towards the west and the east from the central meridian. For this purpose, he refers to the reports of those travellers who sailed along the western and eastern parts of the continent in both directions, there and back (τοῦτο δὲ δῆλον ἐκ τῶν περιπλευσάντων τά τε ἑῷα μέρη καὶ τὰ δυσμικὰ ἑκατέρωθεν). As regards the eastern parts, he points out that, according to these reports, the Island of Taprobane must be situated in the same latitude with the

[8] K. Zimmermann, Libyen. Das Land südlich des Mittelmeers im Weltbild der Griechen (Vestigia 51), München 1999, 122. For comparison, Hipparchus defined the form of the *oikoumene* as „trapezoidal" (τραπεζοειδῆ; F IV 4 Berger), while Posidonius' described it as „sling-shaped" (σφενδονοειδῆ: FGrH 87 F 98a = F 200a Edelstein/Kidd = F 68a Theiler = Agathemerus Hypotyp. 1.1 Diller 60–61).

[9] For the interpretation of this passage see D. A. Shcheglov, Hipparchus' Table of Climata and Ptolemy's Geography, OTerr (in press).

Cinnamon Country (i.e. the southernmost extremity of the continent), which is also confirmed by the similarity of their climatic conditions:

Τῆς τε γὰρ Ἰνδικῆς νοτιωτέραν πολὺ τὴν Ταπροβάνην καλουμένην νῆσον ἀποφαίνουσιν, οἰκουμένην ἔτι καὶ ἀνταίρουσαν τῇ τῶν Αἰγυπτίων νήσῳ καὶ τῇ τὸ κιννάμωμον φερούσῃ γῇ (τὴν γὰρ κρᾶσιν τῶν ἀέρων παραπλησίαν εἶναι) [...]

They argue that the so-called Island of Taprobane [lies] far to the south of India, being still inhabited and rising opposite to the Island of the Egyptians and the Cinnamon-producing Country, (for the mixture of the airs is similar [in the both regions]).

What is important about this passage is that we know that it was Eratosthenes who placed Taprobane on the parallel of the Cinnamon Country (F II C2 = 1.4.2 C62–63; cf. F III B 12 = 15.1.14 C690). It was also he who used the comparison of climatic conditions as a main tool to prove that two distant localities lie in the same latitude, at least in two cases:[10] (1) arguing that Bactra and Colchis lie in the same latitude with Amis (F III A 11 = 2.1.11 C71); and (2) arguing that southern India is in the same latitude with Meroe (F III A 2 = 2.1.20 C77).[11] For similar reasons, H. Berger has included the present passage of Strabo about Taprobana among the fragments of Eratosthenes (F III A 12).[12]

Just after the explanation of why Taprobane should be located at the latitude of the Land of Cinnamon, Strabo makes a similar statement about the western parts of the continent, in which he points out that that the same method was used to determine which places lie on the same parallel with Rhodes (2.5.14 C119):

ὁμοίως δὲ καὶ περὶ τῆς ἔξω Στηλῶν λέγεται· [...] τὸ τῶν Ἰβήρων ἀκρωτήριον ὃ καλοῦσιν Ἱερόν, κεῖται δὲ κατὰ τὴν γραμμήν πως τὴν διὰ Γαδείρων τε καὶ Στηλῶν καὶ τοῦ Σικελικοῦ πορθμοῦ καὶ τῆς Ῥοδίας. συμφωνεῖν γὰρ καὶ τὰ ὡροσκοπεῖα καὶ τοὺς ἀνέμους φασὶ τοὺς ἑκατέρωσε φοροὺς καὶ τὰ μήκη τῶν μεγίστων ἡμερῶν τε καὶ νυκτῶν· ἔστι γὰρ τετταρεσκαίδεκα ὡρῶν ἰσημερινῶν [καὶ ἡμίσους].

Similarly they say about the places beyond the Pillars; [...] the so-called Sacred Promontory of the Iberia lies nearly on the line through Gadeira, the Pillars of Hercules, the Sicilian Strait and the Strait of Rhodes. For [in all these localities] the shadows of the sundials, the winds [blowing] in both directions, and the lengths of the longest days and nights are in agreement with one another; for [the length of the longest day] amounts to fourteen [and a half] equinoctial hours.

Many facts about this passage point to Eratosthenes. The passage is a direct continuation of the general geographical sketch which, as we have shown, is based on the views of

[10] On this Eratosthenes' method see Berger, Eratosthenes (n. 3) 181; 183f.; 191; idem, Erdkunde (n. 3) 467–469; K. Abel, s. v. Zone, in: RE Suppl. XIV, 1974, 1049; 1059f.

[11] K. Mannert, Einleitung in die Geographie der Alten und Darstellung ihrer vorzüglichen Systeme, Leipzig 1829, 92; J. O. Thomson, History of Ancient Geography, Cambridge 1948, 134; 166. That Eratosthenes did not use astronomical observations to determine the latitude of southern India is clearly evidenced by Hipparchus' critical remark: τὸ δ' ἐν τῇ Ἰνδικῇ κλίμα μηδένα ἱστορεῖν, μηδ' αὐτὸν Ἐρατοσθένη – „Nobody gives any account of the *clima* in India, not even Eratosthenes himself" (F IX 4 Berger = F 17 Dicks = 2.1.20 C77). This fact was also noted by Berger, Eratosthenes (n. 3) 180f.

[12] Berger, Erdkunde (n. 3) 190f.

Eratosthenes.[13] The fact that this passage is coupled with the remark about the latitude of Taprobane, which undoubtedly comes from Eratosthenes, should be especially emphasized. Two elements within this passage reflect Eratosthenian ideas too: (1) the Sicilian Strait is placed at the latitude of Rhodes, (2) the reports about the directions of the winds are used as one of the main criteria for assigning distant localities to the same latitude, the same method was used by Eratosthenes to show that Bactra and Colchis lie at the latitude of Amisus (F III A 11 = 2.1.11 C71): καὶ τοῖς ἀνέμοις ἐλέγχεται καὶ ὥραις[14] καὶ καρποῖς καὶ ταῖς ἀνατολαῖς αὐταῖς – „is proved by the winds, the seasons, the crops, and the sun-risings."

These circumstances render it highly probable that the two statements in the passage under discussion – that the latitudes of Gadeira, the Pillars of Heracles, and the Sicilian Strait were determined from real observations, and that the length of the longest daylight in all these places is 14 $^1/_2$ hours – must also have been derived from Eratosthenes.

Confirmation of this assumption can, I believe, be found in a fragment of Hipparchus, in which he criticizes the way Eratosthenes has drawn his main parallel (F II 2 Berger = F 14 Dicks). In this fragment Hipparchus emphasizes that every estimate of latitude ought to be based on astronomical observations and accurate measurements, and criticizes Eratosthenes' reasonings, which do not satisfy this demand. Strabo, on his own part, is trying to defend Eratosthenes by searching for weak points in Hipparchus' arguments (2.1.11 C71):

πολλαχοῦ γὰρ ἡ ἐνάργεια καὶ τὸ ἐκ πάντων συμφωνούμενον ὀργάνου πιστότερόν ἐστιν, ἐπεὶ καὶ αὐτὸς ὁ Ἵππαρχος τὴν ἀπὸ Στηλῶν μέχρι τῆς. Κιλικίας. γραμμήν, ὅτι ἐστὶν ἐπ' εὐθείας καὶ ὅτι ἐπὶ ἰσημερινὴν ἀνατολήν, οὐ πᾶσαν ὀργανικῶς καὶ γεωμετρικῶς ἔλαβεν, ἀλλ' ὅλην τὴν ἀπὸ Στηλῶν μέχρι Πορθμοῦ τοῖς πλέουσιν ἐπίστευσεν. ὥστ' οὐδ' ἐκεῖνο εὖ λέγει τὸ ἐπειδὴ οὐκ ἔχομεν λέγειν οὔθ' ἡμέρας μεγίστης πρὸς τὴν βραχυτάτην λόγον οὔτε γνώμονος πρὸς σκιὰν ἐπὶ τῇ παρωρείᾳ τῇ ἀπὸ Κιλικίας μέχρι Ἰνδῶν, οὐδ' εἰ ἐπὶ παραλλήλου γραμμῆς ἐστιν ἡ λόξωσις ἔχομεν εἰπεῖν, ἀλλ' ἐᾶν ἀδιόρθωτον, λοξήν φυλάξαντες, ὡς οἱ ἀρχαῖοι πίνακες παρέχουσι.

For frequently the clearness, and general agreement, are more trustworthy than [the measurements] taken by means of instruments; after all, Hipparchus himself took the line from the Pillars to Cilicia to be a straight one and [running] due east, not wholly on the basis of instruments and geometrical calculations, but he rested on the reports of sailors in respect of the whole section from the Pillars to the Strait. So Hipparchus is not right when he says: „Since we have no knowledge either of the ratio of the longest day to the shortest or of the gnomon to its shadow along the mountain-sides from Cilicia to India, nor can we say whether the mountain range slants along the parallel, we should leave it uncorrected, as the old maps show."

[13] In S. Radt's edition of Strabo, the present passage and the quotation from Posidonius that follows immediately after it (FGrH 87 F 99 = F 204 Edelstein/Kidd = F 14 Theiler) are included within the brackets of the same parenthesis. Nevertheless, Posidonius' fragment appears to be an addition to the preceding account, rather than a continuation of it. I. G. Kidd has correctly pointed out that Posidonius' logic in this fragment is the reverse of the logic of the preceding passage: I. G. Kidd, Posidonius II: The Commentary, Part 2: Testimonia and fragments 150–293, Cambridge/New York/Melbourne 1988, 734f. Posidonius argues that the star he has observed in Gadeira was Canopus, for (1) Canopus is similarly observable at Cnidus, and (2) Cnidus and Gadeira lie in the same latitude. Strabo's logic would suggest the reverse: astronomical observations should be used as a proof that Cnidus and Gadeira lie in the same latitude.

[14] On this expression see Berger, Erdkunde (n. 3) 183f.

So, Hipparchus is said by Strabo to have adopted the western half of the ‚basic' parallel, crossing the Mediterranean Sea, as it was established by Eratosthenes, but rejected the eastern one, traversing the whole length of Asia, because it did not rest on measurements of latitude. Strabo's statement that Hipparchus has adopted the western half οὐ πᾶσαν ὀργανικῶς καὶ γεωμετρικῶς implies that this part of the Eratosthenian parallel was based on some measurements of latitude. The difficulty arises from Strabo's remark as to in what part the position this parallel adopted by Hipparchus was not based on the measurements — ὅλην τὴν ἀπὸ Στηλῶν μέχρι Πορθμοῦ τοῖς πλέουσιν ἐπίστευσεν — for this segment of the parallel is actually an abstract line drawn through the open sea and not associated with any places which would require measurements or calculations of their latitude. It seems reasonable that, if Strabo had at his disposal any more strong argument to accuse Hipparchus, such as, for example, his fail to use measurements or calculations in determining the latitudes of the Pillars of Hercules or Sicily, he would not have missed the opportunity to employ it. Accordingly, the fact that, instead of doing anything of the sort, Strabo puts forward such an odd argument, may be regarded rather as an indication that the latitudes of the Pillars and Sicily were really determined by Eratosthenes from some astronomical observation, and this is why they have escaped Hipparchus' criticism.

Finally, Hipparchus' remark that for the eastern half of the parallel οὐκ ἔχομεν λέγειν οὔθ' ἡμέρας μεγίστης πρὸς τὴν βραχυτάτην λόγον οὔτε γνώμονος πρὸς σκιὰν („we have no knowledge either of the ratio of the longest day to the shortest, or of the gnomon to the shadow") implies that it was just the same type of data that had been used by Eratosthenes to determine the latitudes of the localities connected with the western half.

Two striking coincidences are observed between Strabo's passage about the parallel of Rhodes quoted above (2.5.14 C119) and Hipparchus' critical remarks against the way Eratosthenes has established the eastern half of this parallel (Hipp. 2.1.11 C71 = F II 2 Berger = F 14 Dicks). (1) Both texts intimate that the latitudes of the places through which the western half of the main Eratosthenian parallel passes were determined on the basis of real observations. (2) In both cases, as an explanation of what kind of observation is implied, the same two parameters are mentioned: the proportion of the gnomon of the sundial to its shadow, and the length of the longest day.

Such mutual agreement between the two passages lends more credence to the assumption that they both represent Eratosthenes' views, and particularly that it was also he who assigned the length of the longest day of 14 ½ hours to the parallel of Rhodes.

Importantly, the two mentioned parameters — the shadow-to-gnomon ratio and the length of the longest day — were defined by Hipparchus as two chief constituents of the concept of κλίμα in the sole fragment in which he demonstrates the meaning of this term with a concrete example (F II 4 Berger = F 17 Dicks = 2.1.20 C77):

τὸ μὲν οὖν κατὰ Μερόην κλίμα Φίλωνά τε τὸν συγγράψαντα τὸν εἰς Αἰθιοπίαν πλοῦν ἱστορεῖν, ὅτι πρὸ πέντε καὶ τεσσαράκοντα ἡμερῶν τῆς θερινῆς τροπῆς κατὰ κορυφὴν γίνεται ὁ ἥλιος, λέγειν δὲ καὶ τοὺς λόγους τοῦ γνώμονος πρός τε τὰς τροπικὰς σκιὰς καὶ τὰς ἰσημερινάς, αὐτόν τε Ἐρατοσθένη συμφωνεῖν ἔγγιστα τῷ Φίλωνι.

Philo, who wrote an account of his voyage to Ethiopia [FGrH 670 F 2], reports about the clima of Meroe that the sun is in zenith 45 days before the summer solstice,[15] and he also gives the ratio of the gnomon to both the solstitial and equinoctial shadows; and Eratosthenes himself agrees very closely with Philo.

[15] It corresponds to the latitude where the longest day is 13 hours.

My contention is that we can legitimately conclude from this passage,[16] as well as from the two others discussed above, that Eratosthenes knew the concept of „clima" and used it in his geography, albeit he might have not employed the term κλίμα.

We have to stress that such manner – to use the concept that lies behind the label of κλίμα without mentioning the very term – is typical for ancient authors. Most of those authors who speak of the latitudes based on the concept of *climata* prefer to use the terms παράλληλος[17] or οἴκησις[18] instead. For example, Cleomedes, when describing a system of *climata*, uses no special term at all to refer to its latitudes (2.1.438–444 Todd 59). The absence of the term κλίμα in Eratosthenes' fragments, therefore, can in no way be taken as evidence that he did not use the concept of *clima* in his geography.[19]

The other conclusion we reach then is that, when Eratosthenes placed Gadeira, the Pillars of Heracles, and the Sicilian Strait on the parallel of Rhodes, he relied on real measurements of the latitude in these localities. This conclusion gains further confirmation from the fact that it is in perfect accord with the role that the parallel of Rhodes plays in the method of mapping, described by Strabo (2.5.16 C120), which, no doubt, goes back to Eratosthenes (F III A 24).[20] This method presupposes that, in order to compose a map of the world, in the first place, one should fix the position of the central parallel and meridian which pass through the lines of the greatest latitudinal and longitudinal dimensions of the *oikoumene*, and only after that should construct a set of auxiliary parallels and meridians, which make it possible to determine the positions of all other localities with respect to these two axes. Strabo explains the special importance of the two axes as follows:

[16] As was recognized by Berger, Eratosthenes (n. 3) 128; F. Gisinger, Rez. zu Honigmann (n. 1), Gnomon 1933, 96; W. Theiler, Poseidonios. Die Fragmente II: Erläuterungen, Berlin/New York 1982, 30.

[17] It has often been observed that the sources do not make clear distinction between the terms κλίμα and παράλληλος, but use them synonymously, depending on the context: K. Müllenhoff, Deutsche Altertumskunde I, Berlin 1870, 328–349; W. Kubitschek, s. v. Klima (2), in: RE XI.1, 1921, 842; Dicks (n. 5) 250f.; idem (n. 3) 155; Neugebauer (n. 1) 334; J. Engels, Die strabonische Kulturgeographie in der Tradition der antiken geographischen Schriften und ihre Bedeutung für die antike Kartographie, Orbis Terrarum 4, 1998, 83.

[18] The latitudes that were considered in Hipparchus' work are called by Strabo sometimes *climata*, sometimes *parallels*, sometimes *oikeseis*; cf. especially: 1.1.20 C12: τὰ περὶ τῶν κλιμάτων δὲ ἐν τοῖς περὶ τῶν οἰκήσεων δείκνυται; 1.4.1, 5, 7, 34–36 C62, 113, 131–133. Ptolemy makes no distinction at all between the terms κλίμα and οἴκησις: Alm. 8.6 Heiberg II 528: τὸ ὑποκέμενον κλίμα τῆς ἐπιζητουμένης οἰκήσεως; he applies the term οἴκησις to the parallels of the Shadow Table: 2.6.1 Heiberg I 104 cf. 3.1 Heiberg I 191. On the term οἴκησις see H. von Mžik, Des Klaudios Ptolemaios Einführung in die darstellende Erdkunde I: Theorie und Grundlagen der darstellenden Erdkunde (Klotho 5), Wien 1938, 16 n. 1; G. Aujac, Lexique grec des terms techniques, in: eadem (éd.), Strabon. Géographie I.2., Paris 1969, 188f. The latitudes which all other sources call *climata* (Vettius Valens, *Anthologia* 1.7 Kroll 24, 157; Firm. *Matheseos libri* 2.11 Kroll/Skutsch I 53–55; Michig. pap. 149, XI 38–47; Mart. Cap. 8.876f. Dick 462) are referred to as *parallels* by Pliny (nat. 6.211–219).

[19] As argued by Dicks (n. 5) 250–255; idem (n. 3) 156–160; idem (n. 6) 389f.

[20] On Eratosthenes as the source of this description see Berger, Eratosthenes (n. 3) 198–200; idem, Erdkunde (n. 3) 400; 403–406; 428; 476–478. For a good discussion of this method see C. van Paassen, The Classical Tradition of Geography, Groningen 1957, 39–42; G. Aujac, La Géographie dans le monde antique, Paris 1975, 71–76; C. Jacob, Cartographie et rectification, in: G. Maddoli (ed.), Strabone. Contributi allo studio della personalità e dell'opera II, Perugia 1986, 52f.; F. Prontera, Sulle basi empiriche della cartografia greca, Sileno 23, 1997, 50–54.

ἐπεὶ δὲ διὰ γνωρίμων τόπων λαμβάνεσθαι δεῖ τὰς εὐθείας ταύτας, αἱ μὲν ἐλήφθησαν ἤδη – λέγω δὲ τὰς μέσας δύο, – τήν τε τοῦ μήκους καὶ τοῦ πλάτους, τὰς λεχθείσας πρότερον –, αἱ δ' ἄλλαι ῥᾳδίως γνωρίζοιντ' ἂν διὰ τούτων τρόπον γάρ τινα στοιχείοις χρώμενοι τούτοις τὰ παράλληλα μέρη †συνεχόμεθα† καὶ τὰς ἄλλας σχέσεις τῶν οἰκήσεων τάς τ' ἐπὶ γῆς καὶ πρὸς τὰ οὐράνια.

For these straight lines should be taken through well-known places; and some of them have already been taken – I mean the two aforesaid middle [lines] – one of the length and the other of the breadth – and the others will be easily determined by means of these two. For, by using these [lines] as a sort of basic elements, we shall determine the parallel parts [of the world] and other positions of the *oikeseis*, both on the earth and with respect to the celestial phenomena.

The opposition γνωρίμων – γνωρίζοιντ' ἂν used in this passage indicates that a distinctive feature which singles out the two στοιχεῖα from all other parallels and meridians is that the localities, through which they passed, were supposed to be firmly established beforehand, whereas all other places were not, so that their position could only be determined with respect of these localities. The internal logic of this two-step method of mapping presupposes that the positions of the localities connected with the στοιχεῖα were to be determined from such kind of data which were lacking for all other places, and such data most probably must have been furnished by accurate observations of latitude.[21] To put it another way, the very method of Eratosthenes required that the latitudes of such places as Gadeira, the Pillars of Heracles, the Sicilian Strait, and Rhodes, o u g h t to be based on real observations and measurements.

Now we are in a position to sum up the main conclusions of our inquiry: (1) The latitudes of Gadeira, the Pillars of Heracles, and the Sicilian Strait were determined by Eratosthenes (*inter alia*) from some real measurements of the gnomon shadow and the length of the longest day, as was dictated by his method of mapping; (2) it was already Eratosthenes who characterized the parallel of Rhodes by the length of the longest day of 14 $^1/_2$ hours; (3) Eratosthenes therefore knew and used the concept of *clima*, albeit he probably did not mention the very term κλίμα.

Summary

There is a long and continuing controversy as to whether Eratosthenes used a system of κλίματα in his geography, or he did not know about this concept at all. One of the arguments of those who deny that he knew this concept rests on the fact that the latitudes mentioned in the fragments of Eratosthenes are never characterized by the length of the longest daylight, which is the main feature of the concept of κλίμα. The present article attempts to refute this argument by showing that Eratosthenes did refer to the length of the longest day to characterize at least one parallel, that of Rhodes, albeit he probably did not mention the term κλίμα.

[21] The same is suggested by the reference to τὰ οὐράνια, with respect to which the positions of *oikeseis* were to be determined in the passage at issue.

Zusammenfassung

Es gibt eine schon länger anhaltende Diskussion darüber, ob Eratosthenes ein System der κλίματα in seinem geographischen Werk benutzte, oder ob er diesen Begriff überhaupt nicht kannte. Eines der Argumente dafür, daß er diesen Begriff nicht kannte, stützt sich auf die Tatsache, daß die in den Fragmenten des Eratosthenes erwähnten Breiten niemals durch die Dauer des längsten Tages charakterisiert wurden, was eine Besonderheit des Begriffes κλίμα ist. Der vorliegende Artikel versucht dieses Argument zu widerlegen und zu beweisen, daß Eratosthenes die Dauer des längsten Tages benutzte, um wenigstens einen Breitengrad, den von Rhodos, zu charakterisieren, doch wahrscheinlich erwähnte er den Terminus κλίμα nicht.