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Ptolemy's Latitude of Thule and the Map Projection in the pre-Ptolemaic Geography[1]

The modern histories of geography and cartography have the development of map projections begin, as a rule, with the *Geography* of Claudius Ptolemy, the first extant work in which due attention is paid to this subject, and detailed instructions are given for constructing two types of map projection. It is almost generally agreed that ancient cartographers before Ptolemy, with few exceptions, never used map projections in practice.[2]

This paper argues that Ptolemy's reports taken together with the evidence of other sources (Strabo on the methods of drawing plane maps, Agathemerus on the shape of the oikoumene according to Hipparchus, Pomponius Mela on the shape of the continent) allow us to conclude that long before Ptolemy ancient geographers employed a map projection, similar to the one which in modern terms is called trapezoidal. This hypothesis, in its turn, makes it possible to answer the following questions: 1) why Ptolemy places the island of Thule at the latitude of 63º, rather than 66º, as was generally assumed before him, 2) what could have been implied by the term τραπεζοειδής as referring to the shape of the oikoumene in Hipparchus' geographical system, 3) why, according to Pomponius Mela, the continent was quadrilateral in shape.

1 This paper was prepared as a part of the research project supported by the Gerda Henkel Stiftung (AZ 25/SR/05: The "Roman Chorography" between Hellenistic Scientific Geography and Popular Paradoxography). I wish to thank Prof. K. Brodersen for helpful suggestions with regard to this paper.

2 Cf. O. Neugebauer, A History of Ancient Mathematical Astronomy, Parts 1–3, Berlin, Heidelberg, New York 1975, 879ff.; J.P. Snyder, Flattening the Earth. Two Thousand Years of Map Projections, Chicago, London 1997. The exceptions are Eratosthenes, Hipparchus, and Marinus of Tyre. Marinus is known to have used the most primitive equirectangular cylindrical projection, which is sometimes ascribed to Eratosthenes. Hipparchus is credited by some scholars with a sort of trapezoidal projection. I shall consider these cases in what follows.

1. The latitude of Thule and the "turning" of Scotland in Ptolemy's *Geography*

The starting point of our investigation is the ratio of 115/93/52 which Ptolemy takes as a basis for constructing his first projection (*Geography* 1,20,8 Nobbe 42).[3] The ratio shows the relation between the lengths of, respectively, the equator and the two chief parallels, those of Rhodes (36º) and of the Island of Thule (63º). For the geographer of Ptolemy's time, these latitudes constituted three essential elements indispensable for constructing the framework of the world map, because it was a *communis opinio*, starting at least from the time of Eratosthenes,[4] that the equator marked the southern boundary of the known world,[5] the parallel of Thule the northern boundary, while the parallel of Rhodes served as its central axis.

As has been already noted by G. J. Toomer, J. L. Berggren and A. Jones, the most important property of the ratio 115/52 is that it allows one to plot an extremely simple and convenient scale for composing a map.[6] The ratio is chosen so that the difference between the lengths of the equator and the parallel of Thule (viz. 115 – 52 = 63), measured in conventional units, and the latitudinal interval between them (viz. 63º), measured in degrees, take the same value. This coincidence makes it possible to assume that the lengths of the parallels change with a constant step of $^{1}/_{115}$ part of the equator per 1º of latitude.[7] Hence the meridians can be represented on the map by straight lines inclined towards the north pole, but intersecting at an imaginary point above it in the plane of projection.

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3 On this projection see K. Cebrian, Geschichte der Kartographie. Ein Beitrag zur Entwicklung des Kartenbildes und Kartenwesens, Bd. I, Altertum, Gotha 1923, 94–101; F. Hopfner, Die Zylinderprojektion des Marinos. Die beiden Kegelprojektionen (I, II) des Ptolemaios, H. von. Mžik, Des Klaudios Ptolemaios Einführung in die darstellende Erdkunde, Teil I: Theorie und Grundlagen der darstellenden Erdkunde, Wien 1938, 92–105; Neugebauer (supra nt. 2) 880–886; J.L. Berggren, A. Jones, Ptolemy's Geography: an Annotated Translation of the Theoretical Chapters, Princeton 2000, 35–40.

4 The most comprehensive study of Eratosthenes' geographical fragments is H. Berger, Die geographischen Fragmente des Eratosthenes, Leipzig 1880. In what follows, Eratosthenes' fragments are numbered according to this collection.

5 On the equator as the southern limit of the oikoumene in Eratosthenes' geographical system see F. Gisinger, RE, Suppl.-Bd. 4, 1924, 607, 620, s.v. Geographie; K. Abel, RE, Suppl.-Bd. 14, 1974, 1049–1050, s.v. Zone; F.W. Walbank, A Historical Commentary on Polybius, Vol. 3, Commentary on Books XIX-XL, Oxford 1979, 575–576.

6 G.J. Toomer, The Chord Table of Hipparchus and the Early History of Greek Trigonometry, Centaurus 18, 1973, 23–25; Berggren, Jones, (supra nt. 3), 86 nt. 68.

7 As a matter of fact, the length of a parallel P changes according to the formula $P = E \cos \varphi$, where E is the length of the equator and φ is the latitude.

Such properties of the ratio 115/52 allow us to surmise that these figures were not an accidental result of an attempt to estimate the length of the parallel of Thule in relation to the length of the equator, but rather from the very beginning were deliberately designed to be used for constructing a grade grid and in order to simplify the method of projection in the way described above.

The adoption of the ratio 115/52 as a basis for constructing a map has one important consequence—namely, it brings the island of Thule in 63º lat.—which, I believe, makes it possible to cast some light on the origin of this ratio.

In antiquity, at least starting with Pytheas (F 8a, b, c Bianchetti) and Eratosthenes (F II C, 2 & 8 Berger), it was generally held that Thule was situated on the arctic circle (≈ 66º).[8] Hence, the location of Thule at the latitude of 63º appears to be one of the most striking innovations made in Ptolemy's geography and therefore demands a very strong explanation.

Unfortunately, Ptolemy gives us no direct clues as to what induced him to change the latitude of Thule, and even does not touch on this subject at all. The generally accepted view is that the shift of Thule was caused by some new information obtained as a result of Roman exploration of the Shetland Islands, one of which was arbitrarily identified with Thule.[9] A passage of Tacitus, in which an expedition of Agricola's fleet is described (*Agricola*, 10,6), is usually taken as the main evidence for this view:

> hanc oram novissimi maris tunc primum Romana classis circumvecta insulam esse Britanniam adfirmavit, ac simul incognitas ad id tempus insulas, quas Orcadas vocant, invenit domuitque. dispecta est et Thule, quia hactenus iussum, et hiems adpetebat.
>
> It was only under Agricola that the Roman fleet for the first time rounded this coast, the coast of the remotest sea, and established the insularity of Britain; by

8 For full bibliography on this point see S. Bianchetti, Pitea e la scoperta di Thule, Sileno 19.1-2, 1993, 9–24; eadem, Pitea di Massalia. L'Oceano. Introducione, testo e commento, Pisa, Roma 1998, 150–176.

9 An incomplete list of scholars supporting this view: 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^2 1959, 639; Berger, Eratosthenes (supra nt. 4), 149; idem, Geschichte der wissenschaftlichen Erdkunde der Griechen, Leipzig^2 1903, 345, 597; J. Fischer, Claudii Ptolemaei Geographiae Codex Urbinas Graecus 82, I.1, Leiden, Leipzig 1932, 66; J.J. Tierney, Ptolemy's Map of Scotland, JHS 79, 1959, 142; Abel (supra nt. 5) 1127, 1143; O.A.W. Dilke, Greek and Roman Maps, Ithaca, New York 1985, 136; G. Aujac, L'île de Thulé, mythé ou réalité, Athenaeum 66, 1988, 329–343; eadem, Claude Ptolémée astronome, astrologue, géographe. Connaissance et représentation du monde habité, Paris 1993, 117–118; Bianchetti, Pitea di Massalia (supra nt. 8), 154–155.

> the same voyage it discovered the islands called Orcades, up to that time unknown, and conquered them. Thule also was surveyed, their instructions taking them only so far: besides, winter was approaching.(trans. M. Hutton, revised by R.M. Ogilvie, LCL)

Ptolemy's map (fig. 1), where the extremity of Scotland, the Orcades, and Thule are situated one after another approximately on the same longitude, may well be seen as a good illustration of this passage. Taking into account such an agreement between Ptolemy and Tacitus, the assumption that Ptolemy's data about the location of Thule in relation to Scotland were based on the reports of roman explorers is likely to be true.

But even if this is true, it does not explain why Ptolemy departed from the centuries-old tradition and placed Thule not at the arctic circle, and why he put Thule precisely at 63º lat., rather than farther north or south. Neither Tacitus' report, nor other sources provide any grounds to think that roman explorers carried out real measurements of latitude at Thule. Likewise, it is very unlikely that Ptolemy's data about the latitude of Thule could have been based on the results of such measurements. It is notorious that in antiquity there was no regular practice of measuring geographical latitudes. It was only in few isolated cases that such measurements were made. This is why it seems highly improbable that roman explorers would have occupied themselves with the measurements of latitude in Scotland, let alone the islands in the ocean.[10] Despite the fact that Ptolemy specifies all his information about the location of various places in the form of coordinates (for more than 8,000 places), in effect only a handful of them (at best, a few tens of places) were based on the results of real measurements.[11] By far the greatest part of the coordinates in Ptolemy's geography were a product of various speculative guesstimates, which have

10 One has to keep in mind that there were only two methods of measuring latitude available in antiquity: to measure the length of the day or night at the solstice, and to measure the length of the shadow of a gnomon on the day of the solstice or equinox. Without a good knowledge of trigonometry, measurements carried out on any other day could only give a very rough result. An excellent illustration of this situation is a report of Julius Cesar (*De Bell. Gall*. 5,13) about a measurement of the night in Britain carried out by means of a clepsydra. Despite the alleged "precision" (certis) of this measurement, the only conclusion it allowed the observers to draw was the most trivial one, viz. that Britain indeed lay to the north of the continent.

11 It is almost agreed now that Marinus and Ptolemy could not have any such measurements for Thule and Britain: Tierney (supra nt. 9) 142–145; J. Mann, The "Turning" of Scotland, Proceedings of the Society of Antiquaries of Scotland 120, 1990, 61.

been so often resorted to by Ptolemy and other Greek intellectuals, many of whom never left their native cities.

All this inspires serious doubts as to whether the shift of Thule to the latitude of 63º could have been dictated by the reports of roman travelers.

Meanwhile, as has been already noted by some scholars, the location of Thule on Ptolemy's map is inseparably connected with its other and no less puzzling element: the turning of Scotland relative to England (fig. 1). This connection, as I shall argue, suggests that Ptolemy's latitude of Thule could not have been derived from the reports of real explorations, but was motivated by purely speculative reasons.

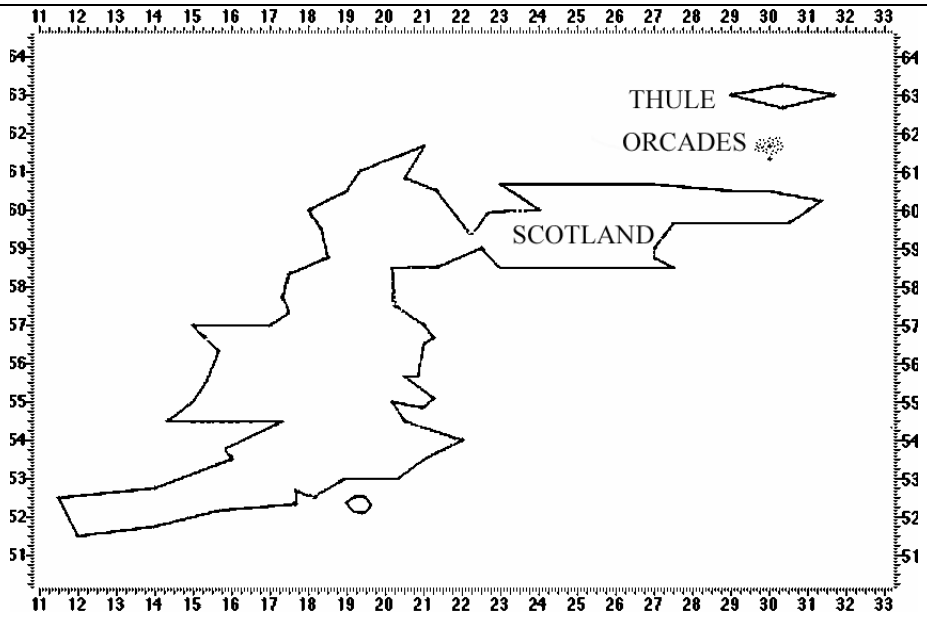

Figure 1. The "turning" of Scotland in Ptolemy's *Geography*

It has been long observed that the island of Great Britain on Ptolemy's map clearly divides into two parts: England and Scotland, with the boundary between them running approximately along Hadrian's Wall.[12] Whereas the configuration and orientation of England appear to be tolerably accurate, Scotland presents a real puzzle. For while Ptolemy's England is orientated along the

12 It was first noted by H. Bradley, Ptolemy's Geography of the British Isles, Archaeologia 48, 1885, 378–396. On the history of the question see A. Strang, Explaining Ptolemy's Roman Britain, Britannia 29, 1997, 1–7.

north–south axis, approximately so as it is in reality, Scotland, which should have formed a northward continuation of England, is turned abruptly to the east at a right angle to England (fig. 1). But apart from this, if one imagines Ptolemy's Scotland twisted round to about its true direction, i.e. at an angle of approximately 50º–90º counterclockwise, one can see that its general configuration do not differ very widely from the truth, as well as the configuration of England.[13]

What attracts our attention is how strikingly the rude and artificial turning of Scotland contrasts with the accuracy with which Ptolemy depicts the outlines of England and Scotland. Taking this contrast in view, it is difficult to avoid the assumption that the information about the configuration of England and Scotland and the idea of the turning of Scotland have different origins. Whereas the description of England and Scotland, as most scholars believe, must have been based on the results of Roman explorations, the turning of Scotland could hardly have originated from the experience of explorers. Much more reasonable is the assumption that this turning appeared only at the stage of transformation of explorers' reports into the form of mathematical map, under the pressure of some speculative reasons.[14] If this is the case, it is legitimate to surmise that initially, in the source from which ultimately Ptolemy's information derives, and which accumulated the results of Roman explorations, Scotland must have been orientated along the north-south axis, as well as England.

The same conclusion has been reached by Barry Jones and Ian Keillar who have argued that the turning of Scotland on Ptolemy's map is intimately connected with the shift of Thule to 63º lat. As a matter of fact, it seems revealing that the eastern extremity of Scotland, the Orcades and Thule are situated nearly in the same longitude. If we move Ptolemy's Thule back on the latitude of 66º, and at the same time retain the distance between Thule and the extremity of Scotland, this inevitably makes Scotland pivot counterclockwise, so that the unnatural angle between its position and that of England disappears, and the outline of the island takes the shape which fits the reality much better. This

13 It was noted by Bunbury (supra nt. 9) 584; I.A. Richmond, Ptolemaic Scotland, Proceedings of the Society of Antiquaries of Scotland 56, 1921, 288–301; Mann (supra nt. 11) 62; A.L.F. Rivet, C. Smith, The Place-Names of Roman Britain, London 1979, 112–114; B. Jones, I. Keillar, Marinus, Ptolemy and the Turning of Scotland, Britannia 27, 1996, 43. As compared with the modern map of Great Britain, Ptolemy's map certainly involves many other, but less noticeable distortions. For a thorough attempt to detect and analyze these distortions see Strang (supra nt. 12) 1–30. However, all these distortions cannot be even remotely compared with the turning of Scotland.

14 Mann (supra nt. 11) 61–62; Jones, Keillar (supra nt. 13) 45.

thought experiment leads us to accept the general conclusion made by Jones and Keillar that the turning of Scotland was motivated by the shift of Thule to 63º lat.[15]

If this is true, we may conclude that the general outline of England and Scotland on Ptolemy's map, including the relative position of Scotland, the Orcades, and Thule, was actually based on the reports of Roman expeditions. But the turning of Scotland and—what is most important for us—consequently, the shift of Thule to the south, being inseparably connected with each other, must have been of a purely speculative nature.

So what reasons might have prompted Ptolemy (or his source) to shift Thule to 63º? On balance, I suppose, the most plausible hypothesis one may suggest to explain this shift is that 63º was the latitude required in order to construct a more simple map projection based on the ratio of 115/52 between the bottom and the top parallels.

This conclusion raises the question of whether it is possible to determine precisely when the island of Thule was shifted to 63º lat., and, accordingly, who was responsible for this shift and for the invention of the projection based on the ratio of 52/115? Two reasons enable us to give a tentative answer.

Firstly, in *Geography* 1,7,1 Ptolemy openly states that it was Marinus of Tyre, his immediate predecessor in the field of geography, who had demonstrated that Thule should be placed at the latitude of 63º.[16] Taking into account the nature of relations between Marinus' work and Ptolemy's *Geography*, this statement is tantamount to the confession that Ptolemy has simply borrowed the new latitude of Thule from Marinus.[17] Consequently, the ratio 115/52 must also have been derived either from Marinus or from even earlier geographers.

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15 A similar explanation for the turning of Scotland was put forward by Berger (supra nt. 9) 631; Mann (supra nt. 11) 61. They supposed that Scotland was turned to the east because otherwise it would run the risk of coming out of the inhabitable zone. But they did not take into account that in antiquity the limit of this zone was traditionally placed at the arctic circle (66°), so that, if Ptolemy placed Thule in this latitude, Britain would not necessarily project outside the limit.

16 Ἐπὶ τοίνυν τοῦ πλάτους πρῶτον ὑποτίθεται μὲν καὶ αὐτὸς τὴν Θούλην νῆσον ὑπὸ τὸν παράλληλον τὸν ἀφορίζοντα τὸ βορειότατον πέρας τῆς ἐγνωσμένης ἡμῖν γῆς, τὸν δὲ παράλληλον τοῦτον ἀποδείκνυσιν ὡς ἔνι μάλιστα ἀπέχοντα τοῦ ἰσημερίνου μοίρας ξγ΄ - "First, in the case of the latitudinal dimension, [Marinus], too, assumes [as we do] that the island of Thule is on the parallel that marks the most northerly limit of our known world and shows, as best as one can, that this parallel is 63° from the equator" (trans. J.L. Berggren and A. Jones, modified). B. Jones and I. Keillar strangely ignore this unambiguous testimony and argue that Marinus must have placed Thule at 69º, which is wholly unconvincing.

17 On Marinus and his relation to Ptolemy see Bunbury (supra nt. 9) 519–545;

The method of projection used by Marinus (1,20) presents a strong evidence against the first of the two possibilities. In modern terms, it was the equirectangular cylindrical projection in which all parallels were drawn as straight, equidistant, and parallel lines, and the meridians were also parallel to each other and perpendicular to the parallels. In Marinus' projection the parallel of Rhodes (36º) was the only one which was marked off true to scale for meridians, so that the east-west spacing of places was progressively expanded the further south of Rhodes they were and contracted the further north they were.[18] All this means that it was absolutely useless for Marinus' method of map-construction to give an exact ratio between the lengths of parallels, such as Ptolemy's 115/93/52.[19]

E. Honigmann, RE 14.2, 1930, 1767–1794, s.v. Marinos 2.; A. Wurm, Marinus of Tyre (Some Aspects of His Work), Chotěboř 1931; E. Polaschek, RE, Suppl.-Bd. 10, 1965, 809–813, s.v. Klaudios Ptolemaios. Das geographische Werk; N.G. Photinos, RE, Suppl.-Bd. 12, 1970, 792–838, s.v. Marinos von Tyros. All that we know about Marinus of Tyre we owe to Ptolemy's comments. Scanty as they are, these comments make it clear that Marinus published his work several times, and it was the last edition that Ptolemy took as the basis and the main source for his own *Geography*. Interestingly, Ptolemy has placed Thule at 63° already in the *Almagest* (2,6,29 Heiberg I 114), in the so-called Shadow Table, a list of 39 major parallels which are drawn according to the length of the longest day. The geographical information of this table, with rare exceptions, agrees with that of the *Geography*. On this basis, it has been argued that the Shadow Table also rests on the information borrowed from Marinus' work, most probably, from its earlier revision: Berger, Erdkunde (supra nt. 9), 612; A. Wurm, Mathematické základy mapy Ptolemaiovy (in Czech: Mathematical Foundations of Ptolemy's Map), Chotěboř 1937; idem, O vzniku a vývoji mapy Ptolemaiovy (in Czech: The Origin and Development of Ptolemy's Map), Chotěboř 1940, 6–16; D. A. Shcheglov, Ptolemy's System of Seven Climata and Eratosthenes' Geography, Geographia Antiqua 13, (2004) 2006. Against such background, Ptolemy's remark that it is Marinus who has demonstrated that Thule should be located at 63º lat., may be seen as an additional argument in favour of this assumption.

18 On this projection see Hopfner (supra nt. 3) 87–89; Neugebauer (supra nt. 2) 879–880; Berggren, Jones (supra nt. 3) 33–34.

19 Another important point is that, though Ptolemy in the *Geography* extended the oikoumene southwards beyond the equator up to the parallel of anti-Meroe (16º 25′), he did not try to estimate its length in relation to the length of the equator, taken as 115, in the way in which he expressed the lengths of the parallels of Thule and Rhodes. This fact may be taken as a sign that, when the ratio of 115/93/52 was invented, the southern boundary of the oikoumene was placed at the equator. As E. Polaschek has observed in Ptolemy's *Geography* in a New Light, Imago Mundi 14, 1959, 21, there are some other indications that in the description of Ptolemy's first projection the southern limit was initially drawn along the equator. Ptolemy himself openly shared this view about the equator in *Almagest* 2,6 (Heiberg I 101, 103). Marinus in the last revision of his treatise was the first geographer to extend the scope of the map beyond the equator up to the tropic of

All this leads us to conclude that the shift of Thule to the latitude of 63º, as well as the invention of a map projection based on the ratio of 115/52, should be traced back either to Marinus's predecessors, or to the earliest stage of Marinus' own work.

3. Map projections before Marinus

The conclusion made in the end of section 2 is confirmed by Ptolemy's straightforward statement (1,20,3 Nobbe 41):

> Ὅπερ Μαρῖνος εἰς ἐπίστασιν οὐ τὴν τυχοῦσαν ἀγαγὼν καὶ πάσαις ἁπαξαπλῶς μεμψάμενος ταῖς μεθόδοις τῶν ἐπιπέδων καταγραφῶν, οὐδὲν ἧττον αὐτὸς φαίνεται κεχρημένος τῇ μάλιστα μὴ ποιούσῃ συμμέτρους τὰς διαστάσεις.
>
> Marinus paid considerable attention to this problem [viz. of map projection], and found fault with absolutely all the [existing] methods of making plane maps. Nonetheless, he himself turns out to have used the one that made distances least proportionate (trans. Berggren, Jones).

This statement implies that in Marinus' time there were a number of map projections which Ptolemy found to be much more consistent with his own method than the one used by Marinus.[20]

The only account of a map projection which survived from the pre-Ptolemaic geography is given by Strabo (2,5,10 C. 116–117):[21]

> It will make little difference if instead of the circles, i.e., the parallels and meridians with which we show the climata and directions and other variations and placements of the parts of the earth relative to each other and to the heavens, we draw straight lines, with parallel lines for the parallels, and perpendicular lines for the [meridians] perpendicular to them. [This is permissible] because the intellect is able easily to transfer the shape and size seen by the sight on a planar surface to the [imagined] curved and spherical [surface]. The same will apply to oblique circles [on the globe] and straight lines [corresponding to them on the map]. And though it is true that the meridians everywhere, since they are all described through the pole, all converge (συννεύουσιν) to one point on the globe, nevertheless it will not matter if on the planar surface one makes the straight

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Capricorn. Ptolemy in the *Geography* was influenced by this conclusion, but cautiously chose to move the boundary well to the north.

20 Cf. also Berger (supra nt. 9) 478; Berggren, Jones (supra nt. 3) 32.

21 References to Strabo are to the most recent edition: Strabons Geographika mit Übers. und Kommentar hrsg. von Stefan Radt, Bd. I, Prolegomena. Buch I–IV. Text und Übersetzung, Göttingen 2002.

> lines for the meridians converge only a little (τὰς εὐθείας μικρὸν συννευούσας ποιεῖν). For even this is not necessary in many situations when the lines [representing the meridians and parallels on the globe] are transferred to the planar surface and drawn as straight lines (εὐθειῶν), nor is the convergence (ἡ σύννευσις) [of the meridians] as conspicuous as the curvature [of the globe].[22]

Berggren and Jones have rightly noted that here "Strabo has in mind two different ways of drawing the lines representing the circles of latitude and longitude".[23] In the first, parallels of latitude are represented by horizontal straight lines, and meridians by vertical straight lines, so that every parallel intersects every meridian exactly at right angles. In other words, this is the same equirectangular cylindrical projection that was used by Marinus. In the second, the parallels of latitude are again drawn as horizontal lines, but the meridians converge a little at the north end of the map.

Further, Berggren and Jones point to a real difficulty in Strabo's description of the second type of projection. There is an ambiguity in his words in that, on the one hand, the verb συννεύω implies that the meridians are no longer parallel to each other, but on the other hand, Strabo failed to confirm this implication *expressis verbis*. To find a way out of this difficulty we have to choose between two possible interpretations: either Strabo conceives the meridians as straight, but unparallel lines, though he does not make it clear that they are not parallel, or, as Berggren and Jones have suggested, "Strabo may merely have in mind a slight inward curvature of the meridians only at the very top of the map, as if to suggest schematically their ultimate convergence while keeping them otherwise perpendicular to the equator and parallel to each other." Berggren and Jones regard both interpretations as equally possible.

To substantiate the plausibility of their interpretation of the verb συννεύω, they refer to another passage of Strabo, and argue that "the curvature" of the two otherwise parallel lines "only at their very top" "is definitely what Strabo has in mind when he applies the same vocabulary to the courses of the Rhine and the Pyrenees in 4.5.1":[24]

> ἀλλ᾽ εἰκὸς εἶναί τινα σύννευσιν ἐκ τῆς παραλλήλου θέσεως τῷ ποταμῷ πρὸς τὸ ὄρος, ἀμφοτέρωθεν ἐπιστροφῆς τινος γινομένης κατὰ τὰς πρὸς τὸν ὠκεανὸν ἐσχατιάς.

22 The translation is taken from Berggren, Jones (supra nt. 3) 32.

23 Berggren, Jones (supra nt. 3) 32.

24 Berggren Jones (supra nt. 3) 33, nt. 47. One has to bear in mind that in Strabo's view the Rhine and the Pyrenees were oriented along the north-south line.

> …it is reasonable to suppose that there is a convergence from the parallel position which the river and the mountains occupy with reference to each other, since at the ends where they approach the ocean there is a curve in both of them. (trans. H.L. Jones, LCL)

But it is hardly legitimate to take Strabo's words as an argument to this effect. For, in fact, nothing in his words allows us to think that ἐπιστροφή in the courses of the Rhine and the Pyrenees was held by Strabo as the only way by which their σύννευσις could have come about.

The interpretation of Strabo's description of the second projection suggested by Berggren and Jones does not seem tenable for many other reasons as well. Firstly, this interpretation simply ignores the fact that Strabo unambiguously refers to the meridians as straight lines (τὰς εὐθείας μικρὸν συννευούσας ποιεῖν). Secondly, the verb συννεύω which Strabo uses to describe the convergence of the meridians could hardly be reconciled with the idea of a sudden bend of a straight line at one of its ends. Rather, this verb should have referred to a gradual convergence of either straight lines,[25] or arcs.

The closest and undeniable parallel to Strabo's use of the verb συννεύω at 2,5,10 is a passage of Ptolemy (8,1,6 Nobbe 194) which also addresses the question of whether it is necessary to represent the meridians as converging towards the pole, or not:

> Οὐ παρὰ πολὺ δὲ ἔσται τῆς ἀληθείας, καθάπερ ἐν ἀρχῇ τῆς συντάξεως εἴπομεν, κἂν εὐθείας γραμμὰς ἀντὶ τῶν κύκλων, ἐπὶ γοῦν τῶν κατὰ μέρος πινάκων παραγράφωμεν καὶ προσέτι τὰς μεσημβρινὰς μὴ συννευούσας, ἀλλὰ καὶ αὐτὰς παραλλήλους ἀλλήλαις.
>
> It will not be very inaccurate, as we said at the beginning of the compilation, if we inscribe straight lines in place of the [meridian and parallel] circles for regional maps at least, and if moreover the meridians are [drawn as] not converging, but also parallel to one another. (trans. Berggren and Jones)

The comparison of this passage with Strabo 2,5,10 allows us to pin down with more certainty the meaning of the verb συννεύω as applied to the converging meridians. Since Ptolemy admits only two ways of representing the convergence of the meridians—by straight lines or by circular arcs[26]—and he never

25 For example, in ancient sources on optics, the term σύννευσις and the verb συννεύω are standardly used to refer to the convergence of the reflected rays: Ch. Mugler, Dictionnaire historique de la terminologie optique des Grecs. Douze siècle de dialogues avec la lumière, Paris 1964, 382.

26 See his description of the first and the second projections, respectively: *Geography* 1,24.

allows that it may be conveyed by a sharp bend, it is reasonable to think that Strabo and his sources for 2,5,10, insofar as they use the same vocabulary as Ptolemy, could hardly conceive the meridians as straight lines which suddenly bend together at the top.

On balance, if this is true that in the second type of projection described by Strabo the meridians were conveyed as converging straight lines, it seems most probable that this projection was, in fact, nothing else but a sort of the trapezoidal projection, named so because its graticule takes the form of a trapezium.[27] In this projection, both parallels and meridians are drawn as straight lines and the meridians converge towards the north pole so that distances measured along the top and bottom parallels can be in correct ratio to each other.[28]

As a corollary, one can easily see that Ptolemy's praise of the projections that were unfairly discarded by Marinus could well have been addressed to the trapezoidal projection described by Strabo.[29] For, from Ptolemy's point of view, this projection had two advantages over that of Marinus in that two parallels of the map rather than one are correct to scale, and the meridians are shown converging. These features make the trapezoidal projection similar to Ptolemy's first projection and, what is most important for the purposes of the present inquiry, imply that the ratio of 115/52 used by Ptolemy can be equally well applied to the trapezoidal projection.

4. Agathemerus on the Shape of the Oikoumene in Hipparchus' Geography

Agathemerus, the otherwise unknown author of a small treatise the *Sketch of Geography*, begins his work with an account of various views on the shape of the oikoumene listed in chronological order.[30] In particular, he states that according to Hipparchus the oikoumene was trapezoidal in shape (τραπεζοειδής; *Hypotyp*. 1,2 = Hipp. F IV 4 Berger).[31]

27 Cf. Berggren, Jones (supra nt. 3) 32; On this type of projection see Snyder (supra nt. 2) 8–10.

28 Berggren, Jones (supra nt. 3) 33; Snyder (supra nt. 2) 8-9.

29 As was noted already by Cebrian (supra nt. 3) 87; D.R. Dicks, The Geographical Fragments of Hipparchus, London 1960, 206.

30 For the edition and translation see A. Diller, Agathemerus, Sketch of Geography, GRBS 16, 1975, 20.

31 Certainly, we cannot be completely sure that this term was really used by Hipparchus, and was not ascribed to him by Agathemerus or any other author. Equally, we have no direct confirmations of many other of Agathemerus' testimonies, for example, that Democritus

Two essentially different interpretations of this vague simile have been suggested by H. Berger and D. Dicks, two scholars who have made the most significant contribution to the study of Hipparchus' geographical fragments.[32] In what follows, I shall argue that these two interpretations, in fact, do not contradict each other, but on the contrary, being joined together give us a clue to understanding the implication of Agathemerus' statement.

Berger links Agathemerus' statement with Strabo's description of the trapezoidal projection (2,5,10 C. 116–117), taking them to be mutually illuminating.

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called the oikoumene προμήκης, and Crates ἡμυκύκλον (see below). Nevertheless, independently of Agathemerus, we know that Strabo and Eratosthenes used the term χλαμυδοειδής for the shape of the oikoumene (Strab. 2,5,6, 9, 14, 18 C. 113, 116, 118, 122; 11,11,7 C. 519), and in Dionysius Periegetes (7) we encounter the comparison of the oikoumene with a sling, which Agathemerus attributes to Posidonius. These facts confirm that ancient geographers really had a practice of using such specific metaphors for the shape of the oikoumene ending in -ειδής. One should also take into account that Hipparchus' work was an attempt of systematic revision of Eratosthenes' geography, and that Hipparchus therefore, following the steps of Eratosthenes, must have considered the question of the shape of the oikoumene too. With all this in mind, I see no sufficient grounds to distrust Agathemerus' testimony. Another question is what geometrical figure could have been implied by the term τραπεζοειδής? Remarkably, Posidonius (F 198 EK = Procl. *In Euclid. elem*. 170 Firedlein) took τραπεζοειδής as a technical term denoting a quadrilateral which has no parallel sides. This definition was repeated by Heron (*Defs*. 61) and Proclus, who accepted the Posidonius' classification of quadrilaterals. In view of these facts, it would be tempting to suppose that Hipparchus, being a professed mathematician, could also have used the term τραπεζοειδής in this meaning. But this supposition is contradicted by the fact that, so far as we can judge, Posidonius' classification, of which the definition of the trapezoid was an element, was his own invention which came about as a result of a re-examination of the previous classification suggested by Euclid; see I.G. Kidd, Posidonius, Vol. II, The Commantary, Part 2, Testimonia and fragments 150–293, Cambridge, New York, Melbourne 1988, 712. Besides, it would be more proper to assess the meaning of Hipparchus' term τραπεζοειδής by analogy with the other similar definitions of the shape of the oikoumene: χλαμυδοειδής and σφενδονοειδής. Insofar as Eratosthenes and Posidonius used these terms in the apparently literal and simplest sense—as "chlamys-shaped" and "sling-shaped"—the term ascribed to Hipparchus should in all probability be taken in the same way: "similar to a trapezium". Similarly, when Strabo said that Libya has τραπέζιόν πως τὸ σχῆμα (2,5,33 C. 130; cf. Dionys. Perieg., 175: τραπεζίῳ εἶδος ὁμοίη), and Eratosthenes called India ῥομβοειδῆ (F III B 5, 7, 11 Berger = 2,1,22, 31, 34 C. 78, 84, 87; cf. Dionys., 1131: ἀλιγκίη εἴδεϊ ῥόμβου), they hardly could invest these terms with any deeper geometrical sense than simply "looking as a trapezium" and "similar to a rhomb". It is not likely that in the context of a purely geographical treatise these words could refer to such specific and unknown to the common reader geometrical concepts, as Posidonius set forth in fragment 198.

32 H. Berger, Die geographischen Fragmente des Hipparch, Leipzig 1869; Dicks (supra nt. 29).

On this basis he argues, on the one hand, that the simile τραπεζοειδής was an attempt to define the shape of a graticule similar to the one described by Strabo, and, on the other hand, that Strabo's description goes back ultimately to Hipparchus.[33]

Against Berger's assumption Dicks objects that Agathemerus' testimony cannot be linked directly with Strabo's description, because Agathemerus apparently speaks not of the form of a graticule, but of the shape of the oikoumene, viz. the inhabited part of the world.[34]

One cannot but agree with this observation, which, I believe, will eventually be of crucial importance for our understanding of Agathemerus' testimony. However, the question remains open as to what shape Hipparchus had in mind. In contrast to Berger who tended to draw too far reaching conclusions from the single word τραπεζοειδής, Dicks finds it very unlikely that this simile could convey anything other than a rough, general idea of the north edge of the oikoumene as being shorter than the southern one due to the sphericity of the earth.[35]

This explanation seems reasonable.[36] But one could hardly agree that all Hipparchus wanted to convey by his τραπεζοειδής was only "a rough, general idea". One should rather take into account that there was a long tradition for ancient geographers to give one-word definitions of the shape of the oikoumene. Insofar as τραπεζοειδής was apparently supposed to be a part of this tradition, we can only have a chance to clarify its meaning if we consider it against the background of other definitions which circulated in antiquity. As we shall shortly see, all of them were intended to give not a rough and partial, but clear and precise idea of the shape of the oikoumene. It is legitimate to expect, therefore, that the same must have been true of Hipparchus' τραπεζοειδής. Let us discuss the issue in detail.

Agathemerus, the main source for this subject, gives a brief survey of various views about the shape of the oikoumene. He states that the "ancients" believed the oikoumene to be round (στρογγύλης) with Delphi at the centre. Democritus was the first to perceive that the oikoumene must have been oblong (προμήκης), and all later authors adhered to his opinion. Crates described this oblong shape as "semicircular" (ἡμικύκλιον), Hipparchus as "trapezoid", Posi-

33 Berger, Hipparch (supra nt. 32), 35–37; idem, Eratosthenes (supra nt. 4), 200; idem, Erdkunde (supra nt. 9) 478.

34 Dicks (supra nt. 29) 206.

35 Dicks (supra nt. 29) 148, 206.

36 True, one has to admit that Berger's hypothesis explained the meaning of τραπεζοειδής in basically the same way.

donius as "sling-shaped" (σφενδονοειδής), and some unnamed authors as "shaped like a tail" (οὐροειδής). In addition to these instances, one more attempt to describe the shape of the oikoumene, which has fallen out of Agathemerus' doxographical account, is referred to by Strabo (2,5,6, 9, 14, 18 C. 113, 116, 118, 122; 11,11,7 C. 519). According to him, Eratosthenes called the oikoumene χλαμυδοειδής - "shaped like a chlamys (short Greek mantle)".

What did these descriptions imply? The first and—as we shall see—the most important thing that one can confidently say about them is that all the mentioned authors,[37] in proposing their definitions, proceeded from a common assumption that the oikoumene was an island surrounded by the single ocean.

The "ancients", who believed that the oikoumene was round, evidently regarded it as an island. For this is precisely the view of the oikoumene that was criticized by Herodotus (4,36) and Aristotle (362b 12–30).

According to Crates, the ocean consisted of two enormous rings encircling the globe crosswise, one passing along the equator and occupying the whole zone between the tropics, and the other being perpendicular to the former and crossing through the arctic zones.[38] Further, he supposed that each of the four sectors left on the globe between the circles of the ocean was wholly occupied by the land, that is, there were four continents situated symmetrically, of which one was our oikoumene. In other words, the shape of the oikoumene, according to Crates, was formed by two circles which served as the boundaries for the equatorial and the meridional rings of the ocean: by the tropic of Cancer on the south, and by a circle perpendicular to the equator, but not passing through the pole, on all other sides. Most probably, this form of the continent was precisely the one that Agathemerus (or even Crates himself) had in mind, while speaking of the oikoumene as "semicircular".

The meanings of the terms χλαμυδοειδής and σφενδονοειδής are clarified by Agathemerus and Strabo themselves. From their testimonies it appears that by means of these similes Eratosthenes and Posidonius sought to describe basically the same configuration of the continent.[39]

37 Except for Hipparchus, whose opinion we shall consider separately, and the unnamed authors of the expression οὐροειδής, about whom nothing is known.

38 On the geographical views of Crates see Berger, Erdkunde (supra nt. 9) 453–454; H.J. Mette, Sphairopoiia. Untersuchungen zur Kosmologie des Krates von Pergamon, München 1936, 58–96; J.O. Thomson, History of Ancient Geography, Cambridge 1948, 202–203.

39 Cf. Kidd (supra nt. 31) 718.

So, according to Agathemerus (*Hypotyp*. 1,2 = Posid. *FGrH* 87 F 98a = F 200a EK = F 68a Theiler), the term σφενδονοειδής suggested that the oikoumene was

> μεσόπλατον ἀπο νότου εἰς βορρᾶν, στενὴν πρὸς ἕω καὶ δύσιν, τὰ πρὸς εὖρον δ' ὁμοίως πλατύτερα [τὰ] πρὸς τὴν Ἰνδικήν.
>
> wide in the middle from south to north, narrow to the east and west, wider, however, to the southeast, towards India (trans. A. Diller).

Dionysus Periegetes (7) too compares the shape of the continent to a sling and explains what he means. In his view (271–278; 620–623), such a shape is formed by two great "cones" (viz. isosceles triangles), of which the eastern one is Asia, and the western is Europe joined together with Libya. These "cones" have therefore a common basis, and their vertices are directed, accordingly, to the east and to the west.[40]

A similar picture was implied, according to Strabo, by the term χλαμυδοειδής. Strabo states that the continent riches its greatest "breadth" - viz. the north-south extension - along the meridian through Rhodes and Alexandria, and the greatest "length" - viz. from west to east - along the parallel of Rhodes and Gibraltar (2,5,14 C. 118). Then he emphasizes that precisely this feature is the one that makes the oikoumene similar to a chlamys:[41]

> Λέγεται δὲ καὶ χλαμυδοειδές πως τὸ σχῆμα· πολλὴ γὰρ συναγωγὴ τοῦ πλάτους πρὸς τοῖς ἄκροις εὑρίσκεται - καὶ μάλιστα τοῖς ἑσπερίοις - τὰ καθ' ἕκαστα ἐπιόντων ἡμῶν. (2,5,9 C. 116)

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40 For a good discussion of the meaning of the comparison with a sling see K. Zimmermann, Libyen. Das Land südlich des Mittelmeers im Weltbild der Griechen, München 1999, 123; idem, Eratosthenes' *Chlamys*-shaped World: A Misunderstood Metaphor, in D. Ogden (Ed.), The Hellenistic World. New Perspectives, London 2002, 23, 36.

41 Recent Zimmermann's attempt to elucidate what Eratosthenes could have implied by the term χλαμυδοειδής does not seem successful: Zimmermann, Eratosthenes' *Chlamys*-shaped World (supra nt. 40), 23–40. Zimmermann attaches decisive importance to the fact that Strabo's explanation of the term χλαμυδοειδής does not tally with what we know independently about the shape of chlamys. On this basis he argues (page 33) that Strabo's explanation is no more than his own conjecture which "may at best be regarded as an example of his helplessness in the face of the Cyrenean's theories". One cannot help admitting that Zimmermann draws attention to a real problem - viz., it remains frustratingly unclear, what Eratosthenes and Strabo had in mind while comparing the shape of the oikoumene to a chlamys—and has made a number of interesting observations. Nevertheless, his claim that Strabo's explanation has nothing to do with Eratosthenes' conception remains unsubstantiated, so far as no reason whatsoever is given for it.

> Its shape is described as about like that of a chlamys; for when we visit the several regions of the inhabited world, we discover a considerable contraction in its width at its extremities, and particularly at its western extremities.
>
> ὅτι δ' αὐτῆς χλαμυδοειδὲς τὸ σχῆμά ἐστιν, ἐκ τοῦ τὰ ἄκρα μυουρίζειν τὰ τοῦ μήκους ἑκατέροθεν, κλυζόμενα ὑπὸ τῆς θαλάττης, καὶ ἀφαιρεῖν τοῦ πλάτους. (2,5,14 C. 119)
>
> …that its shape is like a chlamys is apparent from the fact that the extremities of its length, being washed away by the sea, taper off on both sides and thus diminish its width there. (trans. H.L. Jones, LCL)

The obscure and anonymous οὐροειδής, "shaped like a tail", is likely to refer again to the tapering or "tailing off" of the oikoumene at its western and eastern extremities.[42]

As a result, we can see that the choice of such similes as στρογγύλης, ἡμικύκλιον, χλαμυδοειδής, σφενδονοειδής, and probably οὐροειδής was directly conditioned by the fact that the oikoumene was regarded as an island. To return to Hipparchus, it is evident that his τραπεζοειδής sharply contrasts with all the other similes. In view of all that we have said above one cannot fail to note that it would be quite puzzling if Hipparchus also regarded the oikoumene as an island, but at the same time asserted that it was quadrilateral in shape. It would be too embarrassing for him to substantiate such a quaint idea, as well as very difficult for us to understand how he could have come to it.

On the contrary, a chance to explain the term τραπεζοειδής appears if we suppose that Hipparchus regarded the oikoumene not as an island, but as a quadrilateral area on the globe's surface, not surrounded by the ocean, but cut off by conventionally chosen parallels and meridians.

One may try to avoid the difficulty created by the word τραπεζοειδής by assuming that it referred not the continent, but to the part of the globe which could be inhabitable in virtue of its climatic conditions, regardless of whether it is entirely occupied with the land or not. This part of the globe may indeed be aptly descried as trapezoidal in shape. For it was a received opinion in antiquity that the inhabitable zone is bounded by the arctic circle on the north and a parallel on the south, which marked the limits of the hot and cold zones, and that the length of the oikoumene from west to east does not exceed 180º of

42 As was suggested by Kidd (supra nt. 31) 717, who pointed out that Strabo, when speaking of the western and eastern ends of the "chlamys-shaped" continent, uses the word μύουρος (2,5,6 C. 113; 11,11,7 C. 519) and the verb μυουρίζειν (2,5,14 C. 119, see the text quoted above).

longitude. Thus the inhabited part had the shape of a spherical quadrilateral, which may be represented on the plane map as a trapezium.

But this assumption is flatly contradicted by the meaning of the term οἰκουμένη, provided that we may secure the credence to Agathemerus' testimony that all the mentioned authors, including Hipparchus, spoke of the shape of the oikoumene. To judge from the corpus of classical texts collected in the TLG-E (2001), the term οἰκουμένη was never used to refer to a part of the globe that could be inhabitable *in principle*, but always to the land that is inhabited *de facto*. The same meaning is implied by the very origin of the term, which is an abbreviation of the initial prase ἡ οἰκουμένη γῆ - "the inhabited land".[43] It is indicative that Agathemerus uses the words οἰκουμένη and γῆ synonymously.

It seems reasonable to suppose therefore that Hipparchus' concept of τραπεζοειδὴς οἰκουμένη refers to the same or a similar quadrilateral area of the globe as we have described above, but, unlike all other geographers, Hipparchus considered this area to be wholly occupied with the land. It means that in Hipparchus' view the oikoumene was not bounded by the ocean.

As a matter of fact, Strabo reports that Hipparchus indeed refuted the doctrine of the single circumambient ocean, with all the seas that were known in his time (the Atlantic and Indian Oceans and the Caspian Sea) being its parts (1,1,9 C. 5–6 = Hipp. F VIII 1 Berger = F 4 Dicks):

> Hipparchus is not convincing when he contradicts this view [viz. that the oikoumene is an island] on the ground, first, that the ocean does not behave uniformly throughout, and, secondly, that, even if this be granted, it does not follow that the Atlantic Ocean runs round the earth in one unbroken circle. (trans. H.L. Jones, LCL)

However brief is this report, it makes clear that, unlike some other authors (e.g. Hdt. 4,45; Polyb. 3,38) who only referred to the lack of empirical data and on this basis expressed some doubts about whether the oikoumene was surrounded by a single ocean from everywhere, Hipparchus was the first to put forward a positive argument which undermined the doctrine of the circumambient ocean.[44] Unfortunately, Strabo's report does not allow us to determine how far Hipparchus advanced in developing these ideas: whether he contented himself with rejecting the traditional views, or he worked out an alternative conception of the oikoumene.

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43 See F. Gisinger, RE, Suppl.-Bd. 4, 1937, 2123–2174, s.v. Oikoumene.

44 This argument, as well as other passages dealing with Hipparchus' views on the ocean, deserves further consideration, which lies beyond the scope of the present paper.

Interestingly, precisely the same ideas - that the oikoumene is not an island, and the Caspian Sea, the Atlantic and Indian Oceans are isolated one another - have formed the foundation of Ptolemy's geography. Taking into account that Ptolemy's geography in many other respects depends on Hipparchus,[45] we are tempted to suppose that it was Hipparchus' ideas that found their realization in Ptolemy's map.

What is the most important for our inquiry in this situation is that when we look at Ptolemy's map it is not hard to see that his geographical system is the one in which the shape of the oikoumene can be best described as trapezoidal,[46] and that this trapezoidness is caused by the type of projection which Ptolemy adopted. For, in contrast to the conceptions of other geographers, in Ptolemy's conception the limits of the oikoumene coincide with the boundaries of the map (except for the western limit which is formed by the Atlantic Ocean), and the configuration of the map, in its turn, is determined by the projection. This enables us to suppose that, insofar as Hipparchus, as well as Ptolemy, did not consider the oikoumene as an island and characterized its shape as τραπεζοειδής, this simile was most probably motivated by the fact that in his view, as well as in Ptolemy's, the limits of the oikoumene coincided with the boundaries of the map projection which was trapezoidal in shape. As a result, it turns out that, notwithstanding the objections of Dicks, Berger's suggestion that the term τραπεζοειδής in Agathemerus is to be considered jointly with the description of the projection in Strabo not only proves to be justified, but affords us a unique opportunity to explain why Hipparchus' oikoumene had such a strange shape.

All this points to the high probability of the assumption that Hipparchus' use of the word τραπεζοειδής to describe the shape of the oikoumene is a sign that he used a kind of trapezoidal projection.

5. The shape of the continent in Pomponius Mela

In this section I shall argue that the two above mentioned fundamental elements of Ptolemy's geographical conception - the oikoumene is quadrilateral in

45 Particularly, Hipparchus was the only one who set forth the idea that the inhabited land stretched from the equator to the arctic circle (Strabo 2,5,34 C. 131–132 = Hipp. F III 3, V 1 Berger = F 39 Dicks), and composed a table of geographical latitudes which covered the whole of this area, of which Ptolemy has arguably drawn much material.

46 If we neglect the fact that Ptolemy's map includes a part of the southern hemisphere, whereas earlier geographers set the limit of the known world at the equator.

shape and is not an island - are found again in the *Chorography* of Pomponius Mela (ca. 43 A.D.).[47]

At first sight, the *Chorography* is no more than a superficial compilation which has very little in common with such studies in mathematical geography as those of Ptolemy and Hipparchus. Mela's work is completely devoid of such concepts - which have been of paramount importance for mathematical geography - as latitude and longitude, parallels and meridians, let alone graticule and projection.[48] The same is true of all other popular works of the similar kind, viz. the *Periplus* of pseudo-Scymnus, Books III-VI of Pliny, Agathemerus' *Sketch of Geography*, and the poem of Dionysius Periegetes, etc.

The geographical information in Mela's *Chorography* is mostly presented in the form of *periplus* ("a sailing round").[49] This type of geographical narrative may be defined as "the description of the coast seen from the ship in the sequence enjoined by the course of the voyage".[50] After a brief introduction, the main body of Mela's narrative fells into two parts. The first describes the Mediterranean coasts, proceeding counterclockwise from the Pillars of Hercules along Africa, then Asia and Europe (Books I-II). The second part goes on to describe the shores of the ocean, preceding this time in a clockwise direction from the Pillars again, along Europe, then Asia and Africa (Book III).

Periplus was normally designed as a strict linear sequence of harbors, capes, cities, rivermouths, islands, etc., often with distances between them, but without any indication of the sailing directions.[51] As a result, it was almost impossible to gain from the *periplus* a clear idea of the configuration of the region in question as a whole. To convey the spatial shape of a geographical region through written words ancient authors often resorted to various similes, such as e.g. "Iberia is like an ox-hide" (Strabo 3,1,3 C. 137) or "Italy is like an oak-leaf" (Plin. N.H. 3,43), and to the geometrical metaphors of the kind consid-

47 I use the most recent edition of the text by A. Silberman (Ed.), Pomponius Mela. Chorographie, Paris 1988, and English translation by F.E. Romer, Pomponius Mela's Description of the World, Ann Arbor 1998.

48 Only in the introductory section Mela briefly refers to some of the concepts pertinent to scientific geography: the position of the earth in the universe, the division into hemispheres and five zones, and the outline of the three continents. But he does not resort to these concepts in the following detailed description.

49 Silberman (supra nt. 47), XVI–XVIII; K. Brodersen (Ed.), Pomponius Mela. Kreuzfahrt durch die Alte Welt. Zweisprachie Ausgabe. Darmstadt 1994, 5.

50 A. Lesky, A History of Greek Literature, New York 1966, 66.

51 The periplus of pseudo-Scylax may be taken as a typical sample of this genre of geographical literature: see A. Peretti, Il Periplo di Scilace. Studio sul primo portolano del Mediterraneo, Pisa 1979.

ered in section 4 (see above).[52] As a rule, these similes formed a self-sufficient element of the geographical account and had no influence on and even no points of contact with the description of the coast arranged in the form of *periplus*.[53]

Against this background, the *Chorography* of Pomponius Mela turns out to be unique among other classical sources that follow the scheme of *periplus* in that, in spite of all limitations of this scheme, Mela managed to convey to the reader a sufficiently clear idea of the shape of the oikoumene, as well as particular regions.[54] This in itself is an indication that Mela's world-picture deserves our special attention. Understandably, Mela regards the oikoumene as an island surrounded by the ocean. But, what seems quite unusual in his world-picture is that he describes this island as having the artificial shape of a quadrilateral.

Let us consider this point in detail. Admittedly, Mela does not speak of the continent as a quadrilateral *expressis verbis* and never tries to give a general description of its shape in geometrical terms at all, but there is ample evidence that he imagined it in this way.

Firstly, Mela distinctly states that the overall shape of the continent is formed by four promontories which serve as the turning points of the coast in the north-west (Celtic Point; 3,1,9), north-east (Scythian Point; 3,1,12, 59),

52 D. Dueck, Definition of Geographical Shapes in Greek and Roman Geography on the Evidence of Strabo, Ancient Society 35, 2005, 20–39.

53 Mela is no exception to this rule. Only few such similes are mentioned in his work: the shape of the Black Sea is compared to that of the Scythian bow (1,19,102), Peloponnese to the leaf of a plane tree (2,3,38), the Persian Gulf to a human head (3,8,73).

54 I see no grounds for assuming that Mela described a real map anywhere in his work, but no one would deny that he had in his mind a sufficiently clear mental map of the world, and this map indeed could have been ultimately, but not directly, derived from the real one. The recent attempt by E. Weber to prove that Mela could have used a real map does not seem convincing: E. Weber, Pomponius Mela und die Tabula Peutingeriana, K. Strobel (Hrsg.), Die Geschichte der Antike aktuell: Methoden, Ergebnisse und Rezeption. Akten des 9. gesamtösterreichischen Althistorikertages 2002 und der V. Internationalen Table Ronde zur Geschichte der Alpen-Adria-Region in der Antike (Klagenfurt, 14.11-17.11. 2002), Wien 2005, 231–240. Weber refers to a number of correspondences between verbal geographical descriptions in Mela and images on the Tabula Peutingeriana. But in fact one may equally well explain all these correspondences as a sign that the Tabula Peutingeriana depended on a written source which was closely related to Mela's *Chorography*. For other skeptical notes concerning a map allegedly used by Mela see K.G. Sallmann, Die Geographie des älteren Plinius in ihrem Verhältnis zu Varro. Versuch einer Quellenanalyse, Berlin, New York 1971, 232, 234.

south-east (Point Colis in southern India, viz. Cape Comorin; 3,7,59, 67–68), and south-west (Hesperu Ceras; 3,10,100); see fig. 2.[55]

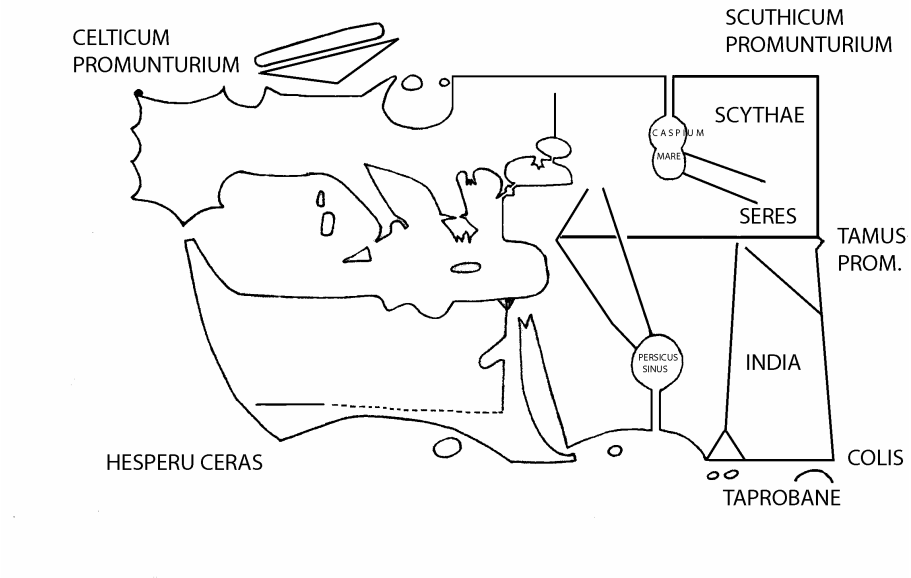

Figure 2. Map of the world according to Pomponius Mela

Particularly significant is that Mela departed from the traditional view on the shape of Africa. This view was first put forth by Eratosthenes (F III B 55 Berger) who described Libya as a right-angled triangle, in which the Nile and the Mediterranean coast from Egypt to the Pillars of Hercules served as two sides, while the shore of the ocean between Ethiopia and Maurusia constituted the hypotenuse.[56] This scheme of Libya was then accepted by Strabo (17,3,1 C. 825), Dionysius Periegetes (7, 18, 184, 230, 271–278, 281, 334; cf. 620–623), and most probably Posidonius[57] and Juba (Plin. N.H. 6,175).[58] Mela describes

55 I take as a basis the reconstruction published by Silberman, Les employs de "frons" et de "latus" dans la Chorographie de Pomponius Mela et le promontoire Scythique (III, 12), RPh 57, 1983, 105.

56 For further details see Berger, Eratosthenes (supra n. 4), 310f.; idem, Erdkunde (n. 9), 400; cf. also Zimmermann (n. 5), 120f.

57 See my forthcoming article: Posidonius on the Dry West and the Wet East: Fragment 223 EK Reconsidered, Classical Quarterly.

58 J. Desanges, Recherches sur l'activité des Méditerranéens aux confines de l'Afrique, Rome 1978, 60.

Africa in a similar way: it "is widest where it abuts the Nile" and then "becomes gradually more contracted from its original width and is narrowest right where it ends" in the west (1,4,20). But nevertheless he clearly conceives its shape as a quadrilateral with Hesperu Ceras being the forth corner.[59]

Furthermore, Mela emphasises that each side of the continent faces to the north, south, west, and east, respectively, and refer to these sides in terms of *frons* and *latus*. So, he uses the term *frons* to denote the eastern side of Asia from Scythian Point to Point Colis,[60] and the western side of Africa from Hesperu Ceras to the Pillars of Hercules,[61] and the term *latus* to refer to the northern side of the continent from Celtic Point to Scythian Point,[62] the southern side of Africa,[63] and the southern side of Asia.[64]

The terms *frons* and *latus* are particularly indicative of the role the the coasts Mela is talking about play in the overall scheme of the continent. *Frons* and *latus* are technical terms which Mela consistently uses throughout his work to refer to, respectively, the short and the long sides of a geographical region.[65] The distinction between the two terms enables the geographer to cut the linear and sequential space of the periplus into separate segments and to describe how they relate to one another in the two-dimensional space of the map. This original technique makes it possible to describe complicated and irregular configuration of the real coast in terms of the linear one-dimensional periplus. As applied to the shape of Mela's continent, the terms *frons* and *latus* imply that the coasts between Celtic Point, Scythian Point, Hesperu Ceras, and Colis were not merely segments but the sides of the whole continent, which was thus envisaged as a great quadrilateral.[66]

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59 Cf. J. Desanges, La face cachée de l'Afrique selon Pomponius Méla, Geographia Antiqua 3–4, 1994–1995, 81; Romer (supra nt. 47) 39 n. 19.

60 1,2,9: [Asia] ingenti ac perpetua fronte versa ad orientem.

61 3,10,100: Inde incipit frons illa quae in occidentem vergens mari Atlantico adluitur.

62 3,1,12: Deinde ad septentriones toto latere terra convertitur a Celtico promunturio ad Scythicum usque.

63 1,4,22: [Aethiopes] totum latus quod meridiem spectat usque in Asiae confinia possident.

64 3,7,68: Colis alter Eoae partis angulus initiumque lateris ad meridiem versi; 3,7,67: A Colide ad Indum recta sunt litora.

65 On this technique see Silberman (supra nt. 55) 100–105; cf. also H. Stürenburg, Relative Ortsbezeichnung zum geographischen Sprachgebrauch der Griechen und Römer, Leipzig, Berlin 1932, 12–14.

66 Consequently, the well-known reconstruction of Mela's map by John Murray (reproduced e.g. by Bunbury [supra nt. 9] 369 and Romer [supra nt. 47] ii) is faulty in that it places Scythian Point too close to the inlet of the Caspian Sea and instead makes Mt. Tabis the north-eastern corner of Asia, i.e. the starting point of its eastern *frons*.

What is most remarkable is that Mela (1,2,9) emphasizes that the length of the eastern side (*frons*) of Asia from Scythian Point to Point Colis is equal to the distance from the northern extremities of Europe to the southern parts of Africa (cf. fig. 2):

> Ipsa ingenti ac perpetua fronte uersa ad orientem, tantum ibi se in latitudinem effundit quantum Europe et Africa et quod inter ambas pelagus inmissum est. Inde cum aliquatenus solida processit, ex illo oceano quem Indicum diximus, Arabicum mare et Persicum, ex Scythico Caspium recipit; et ideo qua recipit angustior, rursus expenditur et fit tam lata quam fuerat.
>
> Asia itself, reaching eastward with a huge and continuous coastline, spreads there in latitude as wide as Europe, Africa, and the sea that extends between them. Then, after its coastline has advanced uninterrupted for some distance, it lets in the Arabian [Red] and the Persian Seas from what we call the Indian Ocean, and from the Scythian Ocean it lets in the Caspian. Therefore, being narrower where it lets them in, Asia expands again and becomes as wide as it had been (trans. F.E. Romer slightly modified).

Making the continent take such a shape, Mela sharply departs from the view, which was generally accepted in antiquity, that the continent riches its maximum north-south extent along the meridian of Rhodes and thence tapers off towards the east and the west. This opinion was shared, as has been already pointed out in section 4, by the majority of the Hellenistic geographers: Eratosthenes,[67] Posidonius,[68] Strabo,[69] and Dionisius Periegetes.[70] According to this view, the eastern side of Asia could in no way be said to be "as wide as Europe, Africa, and the sea that extends between them". Compare this quotation with the description of the north-eastern part of Asia in Strabo 11,11,7 C. 519, which presumably derives from Eratosthenes:[71]

> παριόντι δ᾽ εἰς τὸ βόρειον πλευρὸν ἀεί τι τοῦ μῆκος ὑφαιρεῖ καὶ τοῦ πλάτους ἡ θάλαττα, ὥστ᾽ ἀποφαίνειν μύουρον πρὸς ἕω τὴν νῦν ὑπογραφομένην μερίδα τῆς ᾽Ασίας, ἣν ὁ Ταῦρος ἀπολαμβάνει πρὸς τὸν ὠκεανὸν τὸν πληροῦντα τὸ Κάσπιον πέλαγος.

67 Berger, Erdkunde (supra nt. 9), 403–404; G. Aujac, Eratosthène de Cyrène, le pionier de la geographie, Paris 2001, 81.

68 F 200a Edelstein-Kidd = F 68a Theiler = Agathem. 1,1 Diller pp. 60–61.

69 2,5,9, 14, 16 C. 116, 118, 120.

70 Berger, Erdkunde (supra nt. 9), 575; K. Brodersen, Dionysios von Alexandria. Das Lied von der Welt, Hildesheim, Zürich, New York 1994, 14–15.

71 As argued by Berger, Eratosthenes (supra nt. 4), 212, 317.

> But that, as one passes to the northern side, the sea gradually reduces the length and breadth of the country [India], and therefore causes to taper towards the east the portion of Asia now being sketched, which is comprehended between the Taurus and the ocean that fills the Caspian Sea.
>
> μυούρου δ' ὄντος τοῦ τμήματος τούτου τῆς γῆς ἐπὶ τὰ πρὸς ἕω μέρη, γίνοιτ' ἂν τὸ σχῆμα προσόμοιον μαγειρικῇ κοπίδι, τοῦ μὲν ὄρους ἐπ' εὐθείας ὄντος καὶ νοουμένου κατὰ τὴν ἀκμὴν τῆς κοπίδος, τῆς δ' ἀπὸ τοῦ στόματος τοῦ Ὑρκανίου παραλίας ἐπὶ Τάμαρον κατὰ θάτερον πλευρὸν εἰς περιφερῆ καὶ μύουρον γραμμὴν ἀπολῆγον.
>
> Since this segment of the earth tapers towards the eastern parts, its shape would be like a cook's knife, the mountain [Taurus] being in a straight line and conceived of as corresponding to the edge of the knife, and the coast [of the ocean] from the mouth of the Hyrcanian Sea to Tamarus as corresponding to the other side of the knife, which ends in a line that curves sharply to the point. (trans. H.L. Jones, LCL)

Against this backdrop, Mela's quadrilateral continent cries out for a substantive explanation.

The hypothesis which I believe is able to provide such an explanation has been set forth by Igor V. Piankov in relation to the outlines of the north-western corner of the continent.[72] Piankov argues that Mela's description of Scythian Point (cf. figure 2) is crucial for our understanding of the origin of his geographical conception. No other source reports of such a cape, or whatever cape, in this region, and this is not surprising.[73] For it is fairly obvious that the description of the north-eastern coast of Asia was completely fictitious, either in Mela, or in other ancient geographers. In this situation, the simplest and the most secure way for the ancient geographer to visualize the outline of this non-existent coast was the one taken by Strabo (11,11,7 C. 519): to describe it as a "circular truncated line" (περιφερῆ καὶ μύουρον γραμμῆ) without any further details. Therefore, when Mela describes this coast as formed by two straight lines intersecting at an almost right angle, he must have had very strong reasons for that, and the reasons must have been of purely speculative nature.

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72 I. V. Piankov, Srednyaya Aziya v antichnoi geograficheskoi traditsii (in Russian: Central Asia in Classical Geographical Tradition), Moscow 1997, 115–116, 170–172.

73 The only exception is Paulus Orosius (1,2,47) who mentioned a promontory Boreum precisely in the same place of the ocean shore where Scythian Point lies. This coincidence is most probably due to the fact that Orosius follows roughly the same tradition as Mela; cf. Piankov (supra nt. 72) 175, 299.

The most evident and tempting approach to this problem is to link Mela's rectangular continent with Hipparchus' "trapezoid" oikoumene and Ptolemy's quadrilateral map.[74] Piankov takes this approach and argues that initially (in Mela's source) the oikoumene must have been considered not as an island, but rather in the same way as in Ptolemy's geography, i.e. as an area of land cut off by a conventionally chosen meridian on the east and a parallel on the north. Beyond these limits the Terra Incognita began, and only on the west the oikoumene was supposed to be bound by the ocean. Later on, this image was brought into accord with the dominating insular conception of the oikoumene, and, as a result, the conventional boundaries have become the coasts of the ocean. Accordingly, the right angle between the eastern meridian and the northern parallel has turned into the mysterious Scythian Point, and the emergent continent has retained its original quadrilateral shape. One may add that the quadrilateral shape of Africa, with the straight coast facing south and then abruptly turning to the west at Hesperu Ceras, can also be explained by this hypothesis. One may suppose that the southern coast of Africa could have appeared on the place of another conventional boundary which was drawn along a parallel.

However, I would not press this point too far if it were not that Mela himself gives us a strong confirmation of this hypothesis.

In Mela's work there are three closely interrelated passages which refer to a long-standing debates over the question of what kind of natural barriers form the boundaries of the oikoumene at its outer edges - in northern Asia (3,5,44–45), southern Africa (3,9,89), and on the island of Taprobane (3,7,70) - whether the land is bounded by the ocean, or it extends far beyond the scope of the explored part of the world. In the first case, the ocean encircles the oikoumene from all sides, while in the second the oikoumene turns out to be bounded only by impassable snows on the north and deserts on the south, as well as by the abilities of travelers to surmount these obstacles. Let us quote the main parts of these passages, leaving aside Mela's detailed argumentation in favour of the insular theory:

> (1) Mela. 3,5,44–45: Ultra Caspium sinum quidnam esset, ambiguum aliquamdiu fuit, idemne oceanus an tellus infesta frigoribus sine ambitu ac sine fine proiecta. Sed praeter physicos Homerumque qui universum orbem mari circumfusum esse

74 Similarly Silberman (supra nt. 55) 104 saw the closest parallel to Mela's shape of the continent in Strabo's description of a quadrilateral in which the island of the oikoumene lies (2,5,5–6 C. 112–113). This quadrilateral is bounded on the north by a half of the parallel next to the pole, on the south by the half of the equator, and the two remaining sides are the segments of the same meridian.

dixerunt, Cornelius Nepos ut recentior, auctoritate sic certior … Restat ergo pelagus, sed reliqua lateris eiusdem adsiduo gelu durantur et ideo deserta sunt.

For quite some time it was unclear what lay beyond Caspian Bay, whether it was the same ocean or a hostile, cold land that extended without a border and without end. But in addition to the natural philosophers and Homer, who all said that the entire known world was surrounded by sea, there is Cornelius Nepos, who is more dependable as an authority because he is more modern … Ergo, the sea is continuous, but the rest of that same coast is frozen by the unremitting cold and is therefore deserted.

(2) Mela. 3,9,89: Dubium aliquandiu fuit, essetne ultra pelagus caperetne terra circuitum an exhausto fluctu sine fine se Africa extenderet.

For quite a long time it was uncertain whether there was sea beyond and whether the earth had a periphery, or whether, with the seawaters eliminated, Africa extended without end.

(3) Mela. 3,7,70: Taprobane aut grandis admodum insula, aut prima pars orbis alterius Hipparcho[75] dicitur, sed quia habitatur nec quisquam circum eam isse traditur, prope verum est.

Taprobane is said to be either a very large island, or, by Hipparchus (?), the first part of another world, but because it is inhabited, and because no one reportedly has circumnavigated it, [the latter interpretation] is as good as true (trans. F.E. Romer modified).

It seems that scholars have tended not to pay due attention to these passages. The passages, however, occupy key positions in the structure of Mela's work and are remarkable in many respects.

Firstly, apart from these passages, there are only three other places in which Mela deals with theoretical and controversial issues.[76] Even more striking is

75 *Hipparcho* is an emendation introduced by H. Barbarus in Pliniae castigationes item emendatio in Melam, Cremona 1495 for the meaningless MSS *ipparchus*. The emendation was met with universal approval until it was replaced by a new conjecture *id parcius* advocated by R. Hansen, *De Chorographia* des Pomponius Mela, Jahrbücher für classische Philologie 24, 1878, 497–498 and W. Kroll, Hipparcheum, AJP 59, 1938, 349–350. However, most historians of ancient geography support the old view; for bibliography see D.A. Shcheglov, Hipparchus on the Latitude of Southern India, GRBS 45, 2005, 370–371. The most recent editions avoid both emendation and choose to leave the MSS text unchanged: P. Parroni (Ed.), Pomponii Melae De Chorographia libri tres, Rome 1984, 167, 420–421; Silberman, Mela (supra nt. 47), 87, 298, nt. 3; Brodersen (supra nt. 49) 170.

that, whereas in the rest of his work Mela never refers to other authors by name (the only exception is Homer: 1,9,60; 2,7,104), the three passages involves eight references: to Homer, natural philosophers, and Quintus Metellus Celer (on the circumnavigation of Asia), Hanno and Eudoxus (on the circumnavigation of Africa), Cornelius Nepos (twice, both on Asia and Africa), Hipparchus (on Taprobane, provided that the emendation is secure).[77] All this indicates that the discussion about the insular nature of the oikoumene was of particular importance for Mela.

It is revealing that Mela refers to Cornelius Nepos as the main authority for the insular conception, and in two of the three passages - on northern Asia and southern Africa - it is Nepos who provides the decisive arguments for this conception (the stories of Eudoxus and of the Indian merchants taken away by a storm to Germany). Hence we may safely agree with the majority of other scholars that all three passages derive from a work of Cornelius Nepos.[78] If so, then it seems most probable that to prove that the oikoumene is an island was the task that Nepos deliberately and systematically undertook in this work.

But what is the most puzzling and conspicuous in the three passages is the particular emphasis that Mela (or rather Nepos himself) lays on the "long-standing doubt" about the idea of the oikoumene's insularity. He tends to make the matter look as if it was not certain for a very long time whether the oikoumene is an island, and only recently, namely in the time of Nepos, the issue has been solved. The reader who knows the history of ancient geography only from Mela would get the impression that, except for Homer, natural philosophers, and Nepos, no one else in antiquity believed that the oikoumene was an island.

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76 The general description of the earth, its hemispheres, and the five climatic zones (1,1,1–4), the discussion of the Nile's sources and floods (1,9,53–54), the account of the problem of tides (3,1,1–2).

77 Cf. Silberman, Mela (supra nt. 47), XXX.

78 R. Hansen, De Chorographia des Pomponius Mela, Jahrbücher für classische Philologie 24, 1878, 499–506; C. Wagener, Zu Cornelius Nepos und Pomponius Mela, Commentationes Woelfflinianae, Leipzig 1891, 1–6; E. Schweder, Über die Weltkarte und Chorographie des Kaisers Augustus, Philologus, 1895, 538–539; A. Klotz, Quaestiones Plinianae geographiae, Berlin 1906, 16–18; D. Detlefsen, Die Anordnung der geographischen Bücher des Plinius und ihre Quellen, Berlin 1909, 74, 143; Sallmann (supra nt. 54) 122–126; Piankov (supra nt. 72) 115–116, 170 A. Luisi, Cornelio Nepote Geografo, M. Sordi (Ed.), Geografia e storiografia nel mondo classico, Milano 1988, 41–51; especially on the passage about Taprobane see Sallmann (supra nt. 54) 123-124, Anm. 90.

But this course of events is sharply at odds with what we know from other extant sources. It is true, on the one hand, that the doubts about whether the oikoumene is bounded by the ocean in the north and south are attested in Herodotus (4,45) and Polybius (3,38). Even Strabo, though he was an advocate of the insular conception, regarded it only as a plausible conjecture which leaves room for doubt and disagreement (1,1,8, 26 C. 5, 32; 2,5,5 C. 112). There are good reasons to suppose that, to a degree, such doubts always remained. But this should not be allowed to obscure the fact that these doubts were expressed only as few and occasional remarks. To judge from the extant source, these remarks did not form either a continuous tradition, or a self-substantial doctrine. On the other hand, it is clear that the insular conception of the oikoumene dominated geographical thought throughout antiquity, at least from Hecataeus' time right up to the Middle Ages. No one of classical authors, except Mela, mentions any "long-standing doubts" about whether the oikoumene is an island.[79] In the time of Nepos and Mela, particularly, the insularity of the oikoumene was considered to be an established fact, so that there was no need at all for them to discuss this case, let alone to argue for it.

There is a further puzzle in Mela's discussion of the "long-standing doubts". Whereas other sources (Hdt. 4,45; Polyb. 3,38) confirm his assertion that there were some doubts about whether the circumnavigations of Africa and Asia from the Caspian Sea to India were possible, the case of Taprobane was quite different. Extant sources give us a considerable amount of reports about Taprobane, but no one of them confirms that there has ever been any doubt about its insular nature.[80] On the contrary, starting from the very first report of Onesicritus (FGrH 134 F 12 = Strab. 15,1,15 C. 691) Taprobane was invariably considered as an island. It also does not seem reasonable to take Mela's words as a reference to some otherwise unattested pre-Hellenistic views of Taprobane,[81] because there is no evidence whatsoever that the Greeks had any knowledge of it before Alexander's Indian campaign and Onesicritus' report.[82] Therefore, (even if we ignore the reference to Hipparchus as spurious) it seems

79 Each of the tree passages of Mela has its counterpart in Pliny (2,167–168; 6,81). But this fact, I suppose, is to be explained by Pliny's direct borrowing from Mela. This case, however, needs more detailed discussion.

80 S. Faller, Taprobane im Wandel der Zeit: Das Sri-Lanka-Bild in griechischen und lateinischen Quellen zwischen Alexanderzug und Spätantike (Stuttgart 2000 = Geographica historica, 14).

81 As Faller (supra nt. 81) 28 assumes.

82 Pliny N.H. 6,81 repeats Mela's note that Taprobane "was long considered to be another world (alterum orbem terrarium)", but then adds that it has been regarded as an island since the time of Alexander the Great.

altogether more economical to suppose that what Mela's passage on Taprobane reflects was not the views of unknown explorers of pre-Alexandrian time, but rather the speculations of an armchair geographer who worked from well-known reports of Hellenistic explorers of the Indian Ocean. If this is true, the fact that this armchair geographer took pains to depart from the traditional view of Taprobane as an island is a sign that he must have had enough strong theoretical grounds to discard the insular conception even in those cases where it was never contested before.

The crucial question therefore is: what lies behind Mela's (resp. Nepos') reference to the "long-standing doubts"? All the mentioned facts allow us to conclude that if such authors, as Herodotus or Polybius, were the only ones whose doubts could be implied here, then there would have been little or no point for Mela in discussing this issue and defending the insular conception. Rather, Mela's defense of this conception as well as his reference to the "long-standing doubts" in its validity would make sense if, and only if his defense was leveled against a much stronger opponent hidden behind this reference. So far as we can judge from the extant sources, the only one such opponent was Ptolemy's geographical system which is traced back to Hipparchus, as I have argued in section 4. In this connection, it may have been not an accident that Hipparchus is the only authority to whom Mela refers to substantiate the claim that Taprobane is probably not an island (yet I shall not press this point, insofar as the emendation of MSS text remains spurious).

Summing up, all that we have stated above confirm our assumption that the framework of the world-picture in Mela's source was formed by the same design of the map as adopted by Ptolemy. To bring together the results of our analysis of the shape of continent in Mela, on the one hand, and of the three Mela's passages, on the other, the history of his geographical description may be most plausibly reconstructed as follows. The nucleus of this description goes back to an unknown source which shared the main principles of Ptolemy's system: the oikoumene was not an island, but was bounded by conventional parallels on the north and south and a meridian on the east, and thus came to be quadrilateral in shape. Later, this source was reworked in accordance with the insular conception, either by Cornelius Nepos, who was Mela's immediate source in that case, or by Mela himself who probably used only Nepos' argumentation in order to correct his main source. This reconstruction suggests that the quadrilateral shape of the continent in Mela's source has the same origin and meaning as Agathemerus' definition of Hipparchus' oikoumene as τραπεζοειδής, and that they both stem ultimately from the mode of

projection similar to the one described by Strabo (2,5,10 C. 116–117), which was supposedly exploited by Hipparchus.

Conclusions

Our investigation yields the following results. The analysis of several reports of Ptolemy shows that already before Marinus of Tyre ancient geographers used a kind of projection, similar to the first Ptolemy's projection. This could well have been a kind of trapezoidal projection, which is described by Strabo. The comparison which was ascribed to Hipparchus of the oikoumene's shape with a trapezium, when viewed against the backdrop of similar comparisons offered by other geographers, may be considered as a hint that Hipparchus, firstly, shared the same views on the shape, boundaries, and nature of the oikoumene, which have been fully developed in Ptolemy's geographical system, and, secondly, employed a kind of trapezoidal or similar projection. Finally, Pomponius Mela's description of the continent as a quadrilateral makes it possible to assume that his geographical conception was based ultimately on the same ideas about the shape and limits of the oikoumene which were held by Ptolemy and which supposedly originated with Hipparchus. It is legitimate, accordingly, to see the work of Pomponius Mela as a reflection, however faint it seems to be, of an intermediate stage in the development of geography between Hipparchus and Ptolemy.