

I.

The geographical atlas of Ptolemy.

The maps, connected with the oldest editions of the geography or cosmography of CLAUDIUS PTOLEMÆUS, constitute the prototype of almost all geographical atlases, published since the discovery of the art of printing. This is due not only to the circumstance, that the rules and directions, given by Ptolemy for drawing geographical maps, are still practised, in mapping continents and oceans, to which the surveyors' triangulation has not yet been extended; but also because the method of denoting boundaries between lands and seas, mountains, rivers, and towns, used in old manuscripts of Ptolemy's work and especially in its oldest printed editions, have up to this very day, with but slight variations, been followed by cartographers. They also, almost always use the Ptolemaic orientation (north above, east to the right), the graduation of Ptolemy, and also very often some of his projections. The principles of geography may be said still to be published with Ptolemy's alphabet. If we compare our atlases on the one hand with the maps of Ptolemy, and on the other with maps not influenced by the work of the Alexandrian geographer — for instance with *Tabula Peutingeriana*, with Arabic maps, with the maps in *Rudimentum Novitiorum* (Lübeck 1475), of which fac-similes will be given further on, with a Japanese, or a Chinese map, or with map-sketches of savages —, this alphabet will be found to be more conventional, than may have been imagined. Symbolically speaking, we have in the former instance to do with a well known, though perhaps somewhat antiquated writing, in the latter with types, or letters, as foreign to most people, as an oriental alphabet. Considering, further, that the only, or almost the only atlases, or collections of geographical maps, from the year (1472 or 1478) when the first edition illustrated with maps of Ptolemy's geography was printed, down to

1570, when the first edition of the *Theatrum Orbis terrarum* by Ortelius was published, consisted of editions of Ptolemy, generally augmented by some *tabulae novae*, drawn in his manner and provided with addenda, in which the latest discoveries had been cautiously noted, it seems proper, that the present work should commence with copies of Ptolemy's oldest printed maps, as well as with a brief exposition of their origin and influence on the development of cartography.

As regards the biography of Ptolemy, scarcely anything is known of his life. We do not know either the place, or year of his birth, or the year of his death. In some Latin translations of his works he is called CLAUDIUS PTOLEMÆUS PELUSIENSIS or PHELUSIENSIS, from which it has been deduced, that he may have been born in one or other of the cities, bearing the name of Pelusium. There are two places of that name known from antiquity, — one, a considerable city on the Delta of the Nile and the other a seaport in Thessaly. Later criticism however has shown, that the epithet »Phelusiensis» probably arose from a faulty latinizing of a faulty way of writing the Arabic version of the name *Claudius*. The last observations in his great astronomical work, *μαθηματικὴ σύνταξις*, which is generally known by the hybrid, Græco-Arabic name of *Almagest*, are for the year A. D. 141, which shows, that he lived during the first part of the second century of our era.

At the end of the 2:d book of the *Almagest* Ptolemy promises a work, which was to give the longitude from *Alexandria*, and the distance from the equator, of the most important places on the earth. Probably this promise was redeemed by the geographical work now under discussion, in which case that work was finished later than the year A. D. 141. At the end of Bk. V, Ch. 12 of the *Almagest* Ptolemy says that he made his observations on the parallel of Alexandria. On

the other hand it is stated in a fragment from OLYMPIODORUS, that Ptolemy resided forty years and made his observations in what was called the Pteron, which was probably intended to indicate the side-building of the temple in Canopus, a city situated 19 kilometers to the N. E. of Alexandria. The difference of latitude between these two places, being, according to Ptolemy's Geography, only $\frac{1}{2}^{\circ}$, the expression 'parallel of Alexandria' seems more applicable to Canopus, as the word 'parallel' formerly had a signification different from that accepted in modern geographical literature. The ancients understood by this word principally the circles parallel to the equator, which were supposed to separate the *climates*. Still Letronne is of opinion, that the assertion of Olympiodorus depends on a confounding of the temple of Serapis in Canopus with the Serapeum in Alexandria, and that Ptolemy's observations were made in the last mentioned place.¹

Accordingly the only events of Ptolemy's life which are known with certainty are that he lived during the first part of the second century of our era, and that he, during the greatest part of his life, resided at *Alexandria*, or in its vicinity. This is all, but slight as it is, it will be found to be of no small importance in the biography of a geographer. For Alexandria was at that time not only the richest city in the world with regard to learned institutions and treasures of scholarship, but also the wealthiest commercial place on the earth, a place where seafaring people and caravans from all parts of the then known world used to meet, and where, in consequence, better opportunities were offered for collecting knowledge respecting distant lands and seas than anywhere else.

The particulars that have been added by other biographers, for instance regarding his travels, his death A. D. 147, or 165, at an age of 78 years, and his social position appear to proceed from traditions without evidence, or from evident fables. Even his name is but seldom and only incidentally met with in the writings of his contemporaries or immediate successors.²

We should consequently have scarcely any notion of the most remarkable geographer of antiquity, had not some of his works been saved. The most important of these are his above mentioned manual of spherical and theoretical astronomy (*Almagest*) and his extensive geographical work. In Greek this last work bears the title of *γεωγραφικὴ δῆγησις*, which nearly corresponds to 'Geographical guide', but latin translators have sometimes abbreviated the name to *Geographia* and sometimes, though quite incorrectly, amplified it to *Cosmographia*. According to the mode of naming such works in our time, its most appropriate title would have been *Atlas of the world*.

This atlas consists of 27 maps with an extensive text, evidently written hand in hand with the drawing of the maps. In order to understand and duly appreciate the only cartographical work which escaped from the general destruction of ancient literature, a short analysis of this text will be necessary.

It is divided into eight books.

In the first chapter of the first book Ptolemy explains the difference between *geography* and *chorography*. Geography has for its object to describe the habitable, known world, or at least its more important parts; chorography depicts particular localities, such as harbours, country-seats, villages, or rivers. Geography occupies itself with that which

is great and important, chorography with less important geographical details. Geography may be symbolized by the image of a head, chorography by that of an ear or an eye.

This chapter is only of interest to us, inasmuch as it seems, in preference to other parts of Ptolemy's geography, to have captivated the geographers of the sixteenth century, such as STOBNICZA, GLAREANUS, APIANUS, and others, who generally begin their works with a more or less complete recital of these definitions and distinctions, illustrated by naïve drawings, intended further to explain the meaning of the Alexandrian Geographer.

In the next chapter necessary directions are given how to collect materials for geographical maps, and how to make use of the material collected. In the first place Ptolemy says, it is advisable to procure access to the journals of intelligent travellers, who have visited distant countries. Their observations may be either of a geometrical character — i. e. only giving distances between different places —, or they may be founded on observations made of celestial bodies by means of instruments for the measurement of the altitude of stars, and the length of the shadow of the gnomon. *It is only with the aid of such instruments, that the bearings and distances between different places can be determined.*

Moreover, the distances, given by travellers, only become serviceable, when they have been corrected with reference to the unavoidable circuits, the difficulties met with, and the changes in direction and strength of the winds, during the voyages at sea. Finally it is essential, before inserting in the maps, thus reasonably reduced, the distances obtained from travellers, duly to consider that the surface of earth and sea is spherical. Even when the terrestrial distances are exactly known, the data are still insufficient for calculating the latitudes and the proportions between the traversed distances and the circumference of the earth. This, as well as the length of the circumference of the earth and the distances between the meridians at different latitudes, can only be ascertained by astronomical observations, the nature of which is explained in the L. I. C. III.

In the fourth and fifth chapters of the first book Ptolemy says, that a perfectly reliable map of the inhabited world would be obtained, if travellers made the observations mentioned in the foregoing chapter. But only HIPPARCHUS has determined the latitudes of a few places in the northern hemisphere, and mentioned the distances from the pole, at which some other places are situated.

Others had, with the help of voyages at sea, made with the wind either from the south or from the north, enumerated some places on the other side of the equator as situated on the same meridian. The distances east and west, depend, for want of actual observations, mainly on traditional suppositions. As for the determination of the difference of time between two places, it had only been possible to observe a few eclipses of the moon, simultaneously at different places of the earth, as was the case with the eclipse, seen in Arbelá at the 5:th and in Carthago at the 2:d hour. Anyone, who wishes to draw a geographical map, should found his work on trustworthy observations and then insert the remaining less reliable materials with as much accuracy as possible. As changes and variations often occur, the latest itineraries should

¹ Compare: G. M. RAIDELIUS, *Commentatio critico-literaria de Claudii Ptolemaei Geographia ejusque codicibus tam manuscriptis quam typis expressis*. Norimbergae 1737;

K. MANNERT, *Geographie der Griechen und Römer aus ihren Schriften dargestellt*. T. I. Nürnberg 1799, p. 135;

A. J. LETRONNE, *Composition mathématique de Claude Ptolémée; and Examen critique des prolégomènes de la géographie de Ptolémée in: Oeuvres choisies*, 2:e Sér. I. Paris 1883. P. 95 and 127 (First published 1818 and 1831);

F. A. UKERT, *Ueber Marinus Tyrus und Ptolemaeus, die Geographen*, in *Rheinisches Museum für Philologie*, VI. Bonn 1839, p. 173;

A. FORBIGER, *Handbuch der alten Geographie*, I. Leipzig 1842. P. 402.

² Such places in the ancient authors, where Ptolemy is mentioned, are to be found collected in the above cited works of UKERT, LETRONNE, etc., as well as in NOBBE, *Claudii Ptolemaei Geographia*. Ed. stereotypa. Lipsiae 1881. I. p. XX.

placed the southern limits too far from the equator. He bases this opinion on three different reasons, namely on astronomical observations, on journeys from northern Africa towards the south, and on voyages at sea along the east-coast. During a military expedition in Africa, SEPTIMIUS FLACCUS spent three months on a march from the Garamantes to the Aethiopes. On a similar expedition with the king of the Garamantes, JULIUS MATERNUS spent four months on the way from Garame to Agysimba, that is to the land where the rhinoceros is found. Then there was an Indian traveller, DIOGENES, who, during a voyage at sea, was drifted by a norther along the coast of the Troglodytes (the eastern coast of Africa); and, after 25 days he arrived at Rapta, a point of land, projecting from the territory where the swampy sources of the Nile are situated. Finally, a certain THEOPHILUS, during a voyage from Azania, ran under sail, before a southerly wind in 20 days from Rapta to Aromata.

These reasons are carefully examined by Ptolemy, who shows that the astronomical observations had been incomplete or wrongly interpreted, and that the distances traversed during travels by land, or by sea, had been overestimated, due regard not having been given for circuits, days of rest, and baffling winds under the equator. If the data given by Marinus were accepted without further examination, these countries, where Aethiopes (negroes) and rhinoceri dwell, would have to be removed as far as to the cold zone of the southern hemisphere. This would be an absurdity, for animals and plants should resemble each other in countries of the same temperature and the same atmospherical conditions, or in other words, under parallels with the same polar-distance. The truth of this objection was also perceived by Marinus himself, who, in consequence, arbitrarily removed the southern limits of the «*antioikumenæ*» to the southern tropic. But Ptolemy is not satisfied even with this reduction, for black people and rhinoceri, or elephants, are not met with in our hemisphere at the northern tropic; it is only farther south, that the human complexion darkens. Ptolemy therefore placed Agysimba and Cape Prasum at the same distance to the south of the equator, as Meroe is to the north, or on $16^{\circ} \frac{1}{2}$ ($= 16^{\circ} 25'$). It is remarkable that Ptolemy, although his map in many places is said to embrace the whole inhabited part of the globe, nowhere produces any facts to prove that Africa is uninhabited beyond Agysimba. On the contrary, one might, as a corollary to his reflections on the influence of the climates, arrive at the conclusion, that the zone between the southern tropic and the south pole were inhabited by races of white people and by European species of animals.

This part of Ptolemy's criticism of the geographical work of Marinus is of special interest, because it shows that the mapping of distant countries by the former geographer rests on actual accounts from travellers, and is not, as some people have imagined, made up of fancy-sketches. Here we find, that the marshes whence the Nile springs, were very well known at the time of Ptolemy; and that voyages had been made from the Red sea, along the eastern coast of Africa, towards the south.

In chapters XI—XIV Ptolemy discusses in detail the length, or extent from east to west, of 15 hours or 225°, that Marinus had assumed for the inhabited part of the earth. He divides the space between the eastern and western limits of land into two sections: the first from the *Insulæ Fortunatæ* to the crossing of the Euphrates at *Hieropolis*, and the second one from thence to *Sera*, *Sinæ* and *Cattigara*.

Ptolemy approves of the length, given by Marinus for the first section, along the parallel of Rhodes, as based upon

long experience. He says that Marinus, in forming his estimate of the distance, appears to have taken into proper consideration the reductions rendered necessary by circuits and stoppages during the voyages, and that he, assuming the length of the equatorial degree to be 500 stadia, quite properly supposes the length of a degree of the parallel at Rhodes, or in a latitude of 36°, to be 400 stadia.¹

On the other hand Ptolemy considers the extent of land to the east of Hieropolis, as conjectured by his predecessor, to be a great deal too large, which is to be accounted for partly from the circumstance, that, passing from Hieropolis to Sera, a long circuit northwards had to be made, as far as to the *Stone-tower* (*λιθίνος πύργος*, not a tower or a town, but a mountain, situated, according to Ptolemy's maps, near to the western part of Altai) and partly from intentional exaggerations in the accounts of merchants. One merchant, a Macedonian, had communicated some notes on such a journey. Yet he had not made the journey himself, but sent one of his clerks there, and the only remarkable circumstance in his account was the extreme length of the journey, which lasted seven months.

Finally Ptolemy (Ch. XII) adopts the following differences of longitudes:

	Difference of longitude according to:	
	Ptolemy.	modern maps.
Insulæ Fortunatæ to Sacrum Promontorium (Cape St. Vincent).....	2½°	9°
Sacrum Prom. to the mouth of Baetis (Guadalquivir).....	2½°	2½°
Mouth of Baetis to Calpe (Gibraltar).....	2½°	1°
Calpe to Caralis (Cagliari) on Sardinia.....	25°	14½°
Caralis to Lilybæum on Sicily (Marsala).....	44°	3½°
Lilybæum to Pachynum Prom. (C. Passaro on Sicily).....	3°	2½°
Pachynum Prom. to Taenarum Prom. (C. Matapan).....	10°	7° 23'
Taenarum to Rhodes.....	84°	5½°
Rhodes to Issus.....	114°	8°
Issus to Euphrates.....	2½°	13°
Euphrates to Turrus lapidea.....	60°	78½°?
Turrus lapidea to Sera.....	45½°	
	Sum 177½°	

Out of these data, the first ten — the distances between *Insulæ Fortunatæ* and the Euphrates — agree with the distances assumed by Marinus. As for the considerable reduction Ptolemy adopts for the two last distances, he gives further reasons in a critical examination of the accounts from navigators, communicated by Marinus.

It is not known for certain what modern town in eastern Asia corresponds with Ptolemy's *Sera*. The latitude of 38° 35', stated by him, possibly indicates the present Peking (lat. 40° 36').² Whilst Ptolemy in this case assumes 62°, instead of 41½°, for the well known distance between Calpe and Issus, he assumes 107½°, instead of 80°, for the distance between Issus and Sera. In the former instance, he differs from the real distance by 50 %, in the latter, by 35 %. This considerable error in the maps of the part of the globe which was best known to Greeks and Romans, arose from the circumstance, that the sailors reported their distances in stadia, and that Ptolemy assumed only 500 instead of 700 stadia for each degree of longitude, at the equator.

In the chapters XV—XVIII the work of Marinus is examined from other points of view. There are incorrect and contradictory statements respecting the positions of many places. The limits of land and the directions of the coast-lines are often erroneously given. According to the accounts of merchants, who had travelled from Arabia to Aromata, the marshes, which form the sources of the Nile, are situated

¹ The 36:th parallel actually crosses Rhodes. The length of the degree of latitude being assumed = 500 stadia, one degree of the parallel of Rhodes is = 404,5 stadia. The difference (4,5 stadia) is obviously of no material influence on maps so rude as those of the old Alexandrian Geographer.

² F. VON RICHTHOFEN identifies *Sera* with Hsi-ngan-fu in lat. 30° 6' and long. 109° 22'. The diff. of lat., 8½°, however seems to contradict this assumption.

rather far in the interior, and not on the coast; at Promontorium Rapta a river of the same name, on which a town is situated, disembogues; the eastern coast of Africa here makes a considerable bend to the west. Maps were entirely wanting in the last edition of the works of Marinus, but to make them with the assistance of his tables, would have been impossible on account of their contradictory and confused arrangement. In one place the latitudes are given, in another the longitudes. For several localities Marinus only supplies one of these important data, and for others, especially for those in the interior of the continents, neither of them. These circumstances induced Ptolemy to compose a geographical work, in which the statements of Marinus, which were not in need of correction, were to be preserved, inexact data

correspond as nearly as possible with reality. Understanding this, Marinus had criticized all the projections of maps on a plane, but nevertheless he employed exactly that method of projection, which most distorted the proportions. He drew the parallels and meridians as straight lines, forming right angles with each other, maintaining all over the map the same relation between the degrees of latitude and longitude as on the parallel of Rhodes. He consequently disregarded the attainment of proper proportions in the other parts of the map, as well as the spherical aspect of the whole. The distances between the meridians to the north of Rhodes becoming too large and those to the south too small, considerable errors arose.

To avoid, or at least to lessen these errors, Ptolemy proposed to employ, what is now called a *conical* projection,



3. Map of Palestina from Rudimentum Novitorum, Lübeck 1475. (Orig. size 580 X 400 m. m.).

corrected, and that which had been unknown to Marinus, added by the aid of the best maps and the most reliable itineraries. He also promised a more practical and convenient arrangement of the work.

In the remaining chapters (XX—XXIV) of Book I. Ptolemy treats of the construction of the maps. The easiest and most appropriate method would have been to have delineated the map on a sphere, for which purpose directions are given in Ch. XXII. But it would have been difficult to give to a sphere a size, sufficient for the insertion of the names of all the more important places. Nor would it have been possible to get such a view, as would comprehend the whole, if the map were drawn on a sphere. These difficulties would be avoided, if the map was projected on a plane surface. To do this, however, some special method was required in order to preserve the resemblance to the sphere, and to make the distances on the plane

i. e. to project the map, with equidistant parallels, on a conical surface developed round the axis of the earth, and passing through the parallels of Rhodes and Thule. When such a conical surface is extended on a plane, a network with circular parallels and rectilinear, converging, meridians arises. Lest the proportions of certain parts of the mapped territory should be too much deformed, only the northern or the southern hemispheres should be laid down on the *same map* by this projection, which is consequently inconvenient for maps, embracing the whole earth. Ptolemy only rigorously applies the conical projection to the northern part of his map of the world (N. T. I). To represent the known parts of the southern hemisphere on the same sheet, he describes an arc of a circle parallel to the equator, and at the same distance to the south of it, as Meroe is to the north, and then divides this arc in parts of the same number and size, as on the

parallel of Meroe. The network is then obtained by joining the intersections to corresponding points on the equator.

At the end of the last chapter of the first book Ptolemy describes a still more correct method of projecting the map of the earth on a plane. Half the equator is here represented by the arc of a circle, the chord of which is to its height as 180:23 1/4 (23,833), i. e. as the length of the half of the equator (180°) is to the latitude of this point, Syene, where the mean-meridian of the known or inhabited world was supposed to cross the mean-parallel. The parallels are then laid out as equidistant arcs of circles, concentric to the equator, and placed at such distances, that the middle of the chord of the equatorial arc obtains a latitude of 23° 50'. The mean-meridian will then form a straight line, and the other meridional curves are drawn in such a manner, that a proper relation will be maintained for the parts of parallels between neighbouring meridians and the scale of latitudes. Ptolemy himself never made use of this projection, but it is used for the general map in several printed editions of Ptolemy, and after the discovery of the new world it was sometimes employed for maps embracing the whole world on a single sheet, as, for instance, by BERNARDUS SYLVANUS 1511 (N. T. XXXIII) and APIANUS 1520 (N. T. XXXVIII). STOBNICZA also employed this projection in his correctly constructed, but badly executed maps of the old and new hemispheres (N. T. XXXIV).

Ptolemy's exhaustive criticism of the imperfect methods of drawing maps, adopted by Marinus, would lead to the expectation that he himself would have used some of the projections recommended by him as more correct. But such was not the case. For his first general map Ptolemy certainly employs his conical projection, but for the remaining 26 special maps he uses the rectangular projection of Marinus with due observance of the ratio between the longitude and latitude at the base of the map. This inconsistency of Ptolemy seems to have astonished his publishers in the 15th and 16th centuries. With one exception only (BERLINGHIERI's Italian translation in terza-rima, of which a description will be given further on), every editor of Ptolemy's geography has published, not the original maps, but a modification of them by NICOLAUS GERMANUS (DONIS), who, with praiseworthy exactness and without any further alterations, reproduced the originals on a projection with rectilinear, equidistant parallels and meridians converging towards the pole. For want of a better name, this projection will henceforth be called *Donis' projection*. In one of the oldest, or perhaps the oldest printed edition of Ptolemy's maps — the one which bears the incorrect date of 'Bononiae 1462' — these are reproduced on a *conical projection*, a circumstance which hitherto seems to have escaped his numerous commentators.

In connection with his description of different map-projections, Ptolemy gives in B. I, Ch. XXIII, an exposition of the division of the surface of the earth into *climates* and *parallel zones*. The importance of this division to cartography, induces me here to devote a few lines to the subject.

The latitude, or the distance from the equator, was generally calculated from the length of the longest and the shortest day. The earth was accordingly divided into a number of

zones, parallel to the equator and within which these days had a certain length, for instance of 12 to 13, or 15 to 16 hours. These zones were termed *climates*, from the Greek word *κλίμα* = inclination. Different from what is now usual, this word in the old maps had a purely geographical, not a meteorological signification, though the ancient geographers early perceived that, what is now termed the climate of a place, depended to a considerable extent on its distance from the equator, i. e. on the 'κλίμα' in the old sense of that word. The lines that separated the climates were termed *parallels*.

This division into climates, however, suffered from the defect of not permitting a rigorous application without causing a considerable difference in the breadth of the zones, into which the surface of the earth was divided. That zone, for instance, within which the longest day is from 14 to 15 hours, had a breadth of 10° 32' or 632 miles, while the zone with the longest day from 19 to 20 hours only had a breadth of 2° 53' or 173 miles. It was probably this circumstance, that made the different writers vary to such an extent as to the limits of the zones. Several passages in STRABO, cited by FORBIGER (I p. 199) show, that HIPPARCHUS had divided the surface of the earth into eight lines parallel to the equator, the northernmost of which crossed the mouth of the Borysthenes. Following his predecessors, PLINY divided that part of the earth, which was well known to the Greeks and Romans, or the surface of the earth from the southern limit of the known world to 46° Lat. N., into seven 'segments', parallel to the equator. For the wilderness yet further north three others were added, the total number of 'segments', accepted by PLINY, thus amounting to ten. This number was further augmented by Ptolemy, who divided the northern hemisphere into 21 parallels, noted in the margin of his maps, but not drawn across it.

The following table, the last column of which is calculated by WILBERG (*Cl. Ptolemaei Geographiae libri octo*, Essendiae 1838, I, p. 70) for an inclination of the ecliptic of 23° 50', gives the positions of the climates and parallels, enumerated by Ptolemy in Lib. I, Cap. 23, as well as the errors committed by him in the evaluation of the latitude, corresponding to a certain length of day during the summer-solstice.

Parallels.	The longest day.	Corresp. polar altitude according to Ptolemy.	Corresp. polar altitude corrected.	
Klima I { 1	12 1/2	4 1/4	4° 14'	These parallels also exist in the southern hemisphere.
2	12 1/2	8 1/2	8° 25'	
3	12 1/2	12 1/2	12° 31'	
4 (through Meroe) 2	13	16 1/2	16° 28'	
Klima II { 5	13 1/2	20 1/4	20° 15'	
6 (through Syene)	13 1/2	23 1/2	23° 50'	
Klima III { 7	13 1/2	27 1/4	27° 12'	
8 (through Alexandria) ..	14	30 1/4	30° 22'	
Klima IV { 9	14 1/2	33 1/4	33° 18'	
10 (through Rhodes)	14 1/2	36°	36° 2'	
Klima V { 11	14 1/2	38 1/2	38° 34'	
12 (through Rome)	15	40 1/2	40° 54'	
Klima VI { 13	15 1/2	43 1/2	43° 3'	
14 (through Pontus)	15 1/2	45°	45° 2'	
Klima VII { 15 (through the mouth of Borysthenes)	16	48 1/2	48° 32'	
16 (through Montes Riphæi) ..	16 1/2	51 1/2	51° 31'	
17	17	54°	54° 2'	
Klima VIII { 18	17 1/2	56 1/2	56° 11'	
19	18	58°	58° 0'	
20	19	61°	60° 53'	
21 (through Thule)	20	63°	62° 58'	

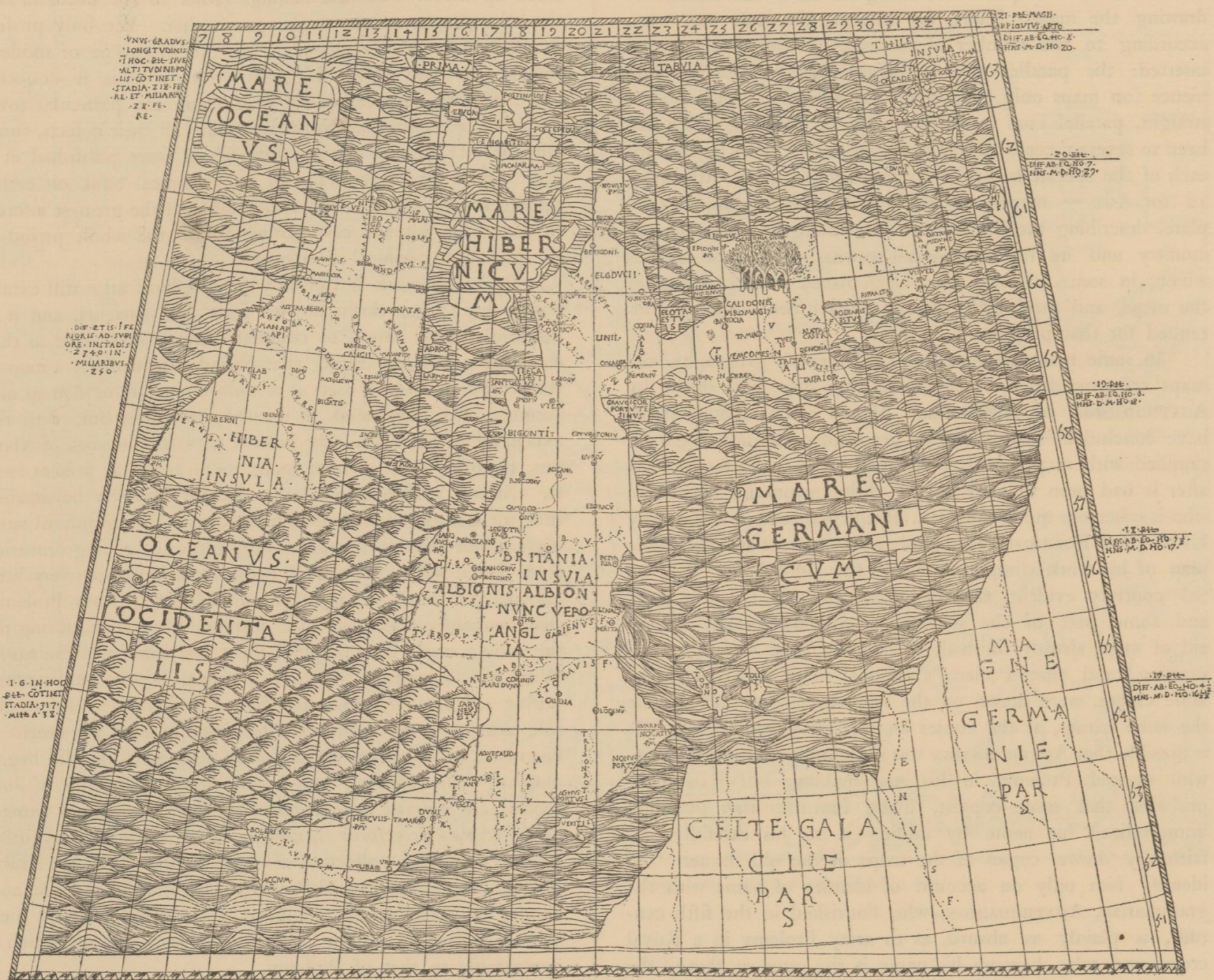
² When a parallel is said to pass through Meroe, Syene, etc. it only signifies, that it passes near to one of these places. The latitudes of these places, stated in the text of Ptolemy's atlas (Lib. II—VII), consequently depart a little from corresponding parallels, viz.

Ptolemy.	Corresponding data from Phillips' Library Atlas.
Meroe	16° 25'
Syene	24° 7'
Alexandria	31° 11'
Rome	41° 54'

As Ptolemy himself, in his geography, exclusively employs the system still in use for defining geographical positions by means of latitude and longitude, this division of the surface of the earth into a number of parallel zones seems to have been already obsolete in Ptolemy's time, and to have been continued by him for the same reason that sometimes causes antiquated standards of length to be employed in modern maps. His practice of inserting the ancient climates and parallels in the margins of the maps was, however, adhered to for a long time. It is, for instance, used in the map of CLAUDIUS CLAVUS of 1427; in the map of RUYSC of 1508 (N. T. XXXII) — with 30 parallels, of which the

river. It is an exception when geographical or descriptive remarks are added to this bare enumeration of names.¹

The fifth chapter of book VII contains a description of the map of the world, together with an enumeration of the oceans and of the more important bays and islands. The Indian ocean, which is assumed to be bordered on the south by an unknown continent, uniting southern Africa with eastern Asia, is stated to be the largest sea surrounded by land. The Atlantic ocean is not mentioned among the seas. It is remarkable that such questions never seem to have occurred to the Alexandrian geographer, as: What is there to be found beyond Serica and Sinarum Situs? What, to the north of Thule,



4. Map of Britannia from Ptolemy, Bononiæ 1462 (1472). (Orig. size 505 X 405 m. m.).

northernmost one has a summerday of four mouths —; in the map of APIANUS of 1520 (N. T. XXXVIII); in the large map of OLAUS MAGNUS of 1539 (extending to the pole, with 34 parallels and 16 climates); in the Basel-edition of the map of OLAUS MAGNUS of 1567; and in some maps of still later data.

Books II—VI and the first four chapters of book VII are devoted to a complete catalogue of all the places laid down in the 26 special maps of the geography. For every place, mentioned in the catalogue, latitudes and longitudes are given, and also for the more important capes and mouths of

or to the south of Agysimba and Cape Prasum? Where would you come to, if you sailed on, westward, from the Insulæ Fortunatæ? It seems, as if the consequences of the spherical shape of the earth were not clearly seized by Ptolemy himself. Even Strabo (for instance in Lib. II, cap. 4) only touches questions, regarding the inhabitants and physical aspects of countries beyond the Greek or Roman world, incidentally and with the same scornful dismissal, with which a modern savant would probably treat questions about organisms on Jupiter.

In the last two chapters of book VII a description is given of a projection of the inhabited hemisphere on a plane,

¹ MANNERT (cited work p. 137 & 193) calls in question, whether not Ptolemy, beside his γεωγραφικὴ ἐπιγήρησις, the text of which mainly consists of name-lists, also has written a descriptive geographical work, now lost. As a support for this supposition, he quotes a passage of EUSTATHIUS, in which Ptolemy is cited regarding the shape of the Caspian sea, which passage however is not to be found in the geography.

by which it would retain its circular outline, or globular aspect. Ptolemy himself never employed this manner of projection, which has since, though more or less modified, been preferred by geographers for maps, representing one of the hemispheres. The words, with which Ptolemy concludes this book, are characteristic of the idea of the ancients concerning the extension of the inhabited world. He there says, that the inhabited part of the surface of the earth is nowhere bordered by oceans, excepting at the northwestern parts of Africa and Europe (Comp. N. T. I, or the metallo-type p. 1).

The eighth and last book begins with a short preface, in which further explanations are given as to the manner of drawing the maps. Thus, for instance, the scale may vary, according to the number of names and other details, to be inserted; the parallels and meridians may, without inconvenience (on maps only embracing less extensive regions) form straight, parallel lines (as in the maps of Marinus, which had been so severely censured). Then there follow short legends for each of the special maps — 10 for Europe, 4 for Africa and 12 for Asia — mentioning the countries laid down on each plate, describing the limits and enumerating the tribes of each country and its most important towns. It is these legends which, in some editions, have been placed on the reverse of the maps, and they really appear to have been originally intended for that purpose.

In some manuscript-codices of Ptolemy's geography, the maps are preceded by the remark, that they were drawn by AGATHODÆMON of Alexandria. Hence some commentators have concluded, that Ptolemy's geography was not originally supplied with maps, but that the maps were drawn for the text after it had been finished by the above mentioned draftsman, who is otherwise quite unknown. But, it has been established by UKERT and FORBIGER, that Ptolemy's own text and the whole plan of his work completely refute this suggestion. It is on the contrary evident, that the text, excepting the first book and some part of the seventh, is composed either by the aid of maps already finished, or hand in hand with the map-drawing, and that Ptolemy's original maps had exactly the same extent, were drawn on the same projection and contain the same names, as the copies ascribed to Agathodæmon. It is possible that AGATHODÆMON was the name of some draftsman, who assisted Ptolemy in his map-making, but it is more probable that some copyist, living centuries after Ptolemy, immortalized his name by adding it to his carefully and faithfully drawn copies of the maps of the old master. To identify him only on account of identity of name with the grammarian, AGATHODÆMON, who flourished in the fifth century, is plainly as absurd, as to array Ptolemy in a Royal crown and robe, because his name is the same as that of the Greek dynasty of Egypt.¹

The metalotype on page 1 gives a diagram of the parts of the earth, embraced by each special map of Ptolemy. It shows, that the known world had been systematically divided into 26 fields, each of which is mapped on a separate sheet. Generally these sheets are of about the same size, but the scales vary according to the space required for the legends. As the diagram shows, each special map embraces, besides its own proper territory, some parts of the neighbouring countries. But, as is also usual in modern atlases, these parts of the map are only roughly sketched: for instance, the regions of north-eastern Gallia, which appear on the map of Britannia, or the part of Britannia, which enters the map of Gallia. Ptolemy's maps are never disfigured by such sketches of animals, mon-

sters, savages, ships, kings etc. as adorn the manuscript-maps of the middle-ages, and many of the printed maps of the 16:th century. This and the manner of denoting boundaries between land and sea, rivers and towns, almost give a modern appearance to Ptolemy's maps.

Ptolemy's 27 maps seem to be the same in all complete manuscripts of his geography. Important as these maps are to the history and geography of antiquity, yet they have not been subjected to any exhaustive critical analysis, with reference to their geographical details, their division into countries and provinces, and the names of nations and towns found on them. It cannot be expected that this defect in literature should be filled up here. The task belongs rather to the historian and the ethnographer, than to the geographer. We only profess to deal with Ptolemy's work, as the prototype of modern cartography and *from this point of view*, it is, in doubtful cases, of little importance by what name any particular town or nation is indicated. Notwithstanding all their defects, those editions of Ptolemy's geography which were published at a time when his work was still the canonical book on cartography among all civilized nations, are of the greatest interest to us. This was the case during almost the whole period of the great geographical discoveries.

Ptolemy's work is the only geographical atlas still extant which has come down to us from the ancients, and it is doubtful, if any other, so complete and so systematic as this, was ever composed during that period. Incidentally a map of the world, or a map used as a wall-ornament, or a map of a country, are mentioned in ancient literature, but, with the exception of what Ptolemy himself says of the work of Marinus, no other collection of maps, such as we at present term an 'Atlas', is ever alluded to. It may however be possible that such works existed, for Ptolemy's great geographical work itself is but seldom mentioned during the succeeding centuries. But, if that was the case, such works must have been very little known and used, for it is almost exclusively from Ptolemy, that geographers derived their learning when they, during the succeeding centuries, compiled their descriptions of the world. With the exception of some personal experience, acquired during journeys in Africa and Syria, Ptolemy's work was the sole source of information in the description of the world in chapter 2 of OROSIUS, *De Miseria Mundi* (from the beginning of 5th century), and in the leading chapters of JORDANES, *De origine actibusque Getarum*, Ptolemy is named: *orbis terre descriptor egregius*. Nor is there any other Roman or Greek collection of maps, mentioned by the Arabic geographers, than that of Ptolemy and Marinus of Tyre, and, among the excellent geographical treatises of the Arabs, there is not a single map or collection of maps extant, which is comparable to that of Ptolemy.

During the darkness of the middle-ages even Ptolemy and his method of map-drawing were forgotten, at least in the west. Instead of his clear and intelligible maps, drawn in proper proportion and based on astronomical observations, maps were produced, drawn without a vestige of proportion, covered with figures of princes in mantle and crown, of monsters and fantastic legends, borrowed from the mythic world of christian and heathen legends. The only exceptions are some charts, made in the beginning of the fourteenth century in Italy and at the Balearic Islands, exclusively for the use of mariners and ship-owners, and from materials collected by them. These 'Portolanos' or 'loxodromic charts', to which I will return in a future chapter, often represented the coasts better than the old maps of Ptolemy. But gene-

¹ In his above mentioned work RAIDEL gives a copy of the title-page of a splendid Greek manuscript of Ptolemy, belonging to the Bibliotheca Marciana in Venice. Ptolemy is here seen standing arrayed in royal crown and mantle, in the open court of a splendid palace.

rally they represented only the coasts of the Mediterranean and Black seas, with the western and north-western parts of Europe. They have in our days been studied with deep interest and have become the subject of an extensive literature, but from the 14th to the 18th century they were but little cared for by learned geographers, and scarcely acknowledged by them as any real contribution to geographical literature. When Ptolemy's geography, with its systematically and clearly drawn maps of the *whole world* then known, was divulged in the west by means of manuscripts, imported at the beginning of the 15th century from the expiring Byzantine empire, it had the effect of an important discovery, which seized on men's minds, at first with even more force than the

rediscovery of the New World by Columbus. Not a new world, but the very world in which one was living, had been extricated from the darkness, in which it had been hidden during a whole millenium. Characteristic in this respect is the circumstance that, while Ptolemy's geography, even before the end of the 15th century, was published in not less than seven bulky folio-editions, expensively illustrated, and liberally provided with maps, the works printed during the same period on the voyages of the Portuguese along the coasts of Africa and on the discovery of the New World by the Spaniards, only formed insignificant and scantily illustrated pamphlets, whose combined contents would easily find room in a few folio-pages of the editions of Ptolemy.



5. Germania from SCHEDEL, *Liber conicarum*, Nuremberg 1493. (Orig. size 595 x 397 m. m.).

II.

Editions of Ptolemy's geography.

At the commencement of the fifteenth century the knowledge of the Greek language was very slight, even among learned men in the west. The immense influence that Ptolemy's great geographical work exercised, thus commenced at the time, when its spread had been facilitated by translation into Latin.¹ Such a translation had already been begun by EMANUEL CHRYSOLORAS, a Byzantine scholar whose

merit in promoting the spread of Greek literature in the west was very great. He had been employed by his sovereign as an ambassador to the other European courts during the last period of the Oriental Empire, and he then settled in Italy as a teacher of Greek. He died in 1415 at Constance, at the age of sixty. The translation was finished some years earlier by one of his pupils, JACOBUS ANGELUS, under whose name the

¹ It is stated that Ptolemy's geography already had been translated into Latin at the beginning of the 6th century by the celebrated philosopher and statesman BOËTIUS. The letter by CASSIODORUS (*Variarum liber I: XLV*), on which this statement is founded, contains only: *» Translationibus tuis (sc. Boëtii) Pythagoras Musicus, Ptolemaeus astronomus leguntur Italii*, and is consequently rather to be referred to Ptolemy's astronomical, than to his geographical works.