



Nova et Aucta Orbis Terrae Descriptio ad Usum Navigantium Emendate Accommodata,
1569, Gerard Mercator

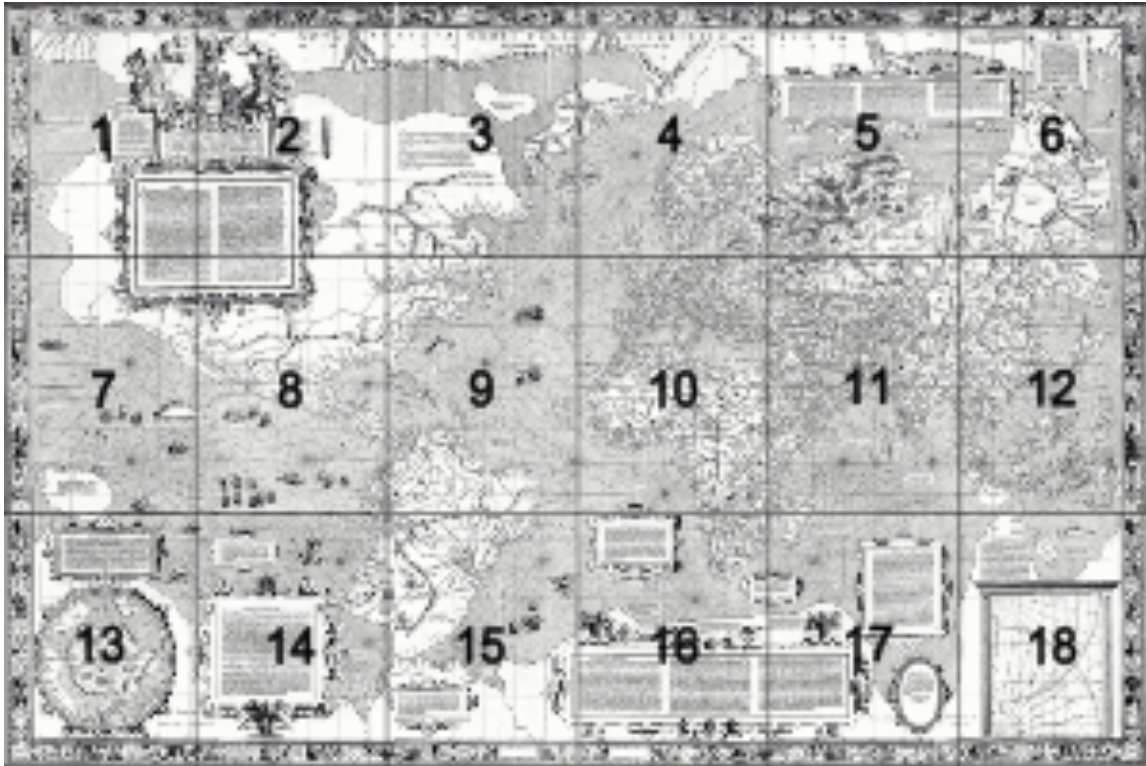
Description: Mercator's 1569 map was a large *planisphere*, i.e., a projection of the spherical earth onto the plane. It was printed in 18 separate sheets from copper plates engraved by Mercator himself. Each sheet measures 33 x 40 cm and, with a border of 2 cm, the complete map measures 202 x 124 cm (51 x 78 inches). All sheets span a longitude of 60 degrees; the first row of six sheets cover latitudes 80°N to 56°N, the second row cover 56°N to 16°S and the third row cover 16°S to 66°S: this latitude division is not symmetric with respect to the equator thus giving rise to the later criticism of a Euro-centric projection.

The title of this very famous world map, *Nova et Aucta Orbis Terrae Descriptio ad Usum Navigantium Emendata et accomodata* [A new and improved description of the lands of the world, amended and intended for the use of navigators], maybe freely translated, *A Nautical Chart of the World*. Mercator's projection, as it is the usually called, meant a huge step forwards for a safe and precise charting of a route at sea. But his map was far more than just a map for navigators. Mercator tried to incorporate all the new knowledge that seafarers and discoverers had brought back to Europe. His map represented the world as it was known in Europe. Not surprisingly, he put Europe in the middle of the map. At that time, it also was the continent that was best known to European geographers and mapmakers.

It is not known how many copies of the map were printed, but it was certainly several hundred. Despite this large print run, by the middle of the 19th century there was only one known copy, that at the Bibliothèque Nationale de France. A second copy was discovered in 1889 at the Stadt Bibliothek of Breslau along with maps of Europe and Britain. These three maps were destroyed by fire in 1945 but fortunately copies had been

made before then. A third copy was found in a map collection *Mappae Geographiae vetustae* from the archives of the Amerbach family which had been given to the library of the University of Basel. The only other complete copy was discovered at an auction sale in Luzern in 1932 and is now in the map collection of the Maritiem Museum Rotterdam. In addition to the complete copies there is a single page showing the North Atlantic in the Mercator Atlas of Europe in the British Library. Many paper reproductions of all four maps have been made. Those at full scale, providing access to the detail and the artistry of Mercator's engraving, and images of the Basil, Paris, and Rotterdam impressions can be found online.

The chief interest in this world map is the method of projection employed here for the first time, which came eventually into universal use under the name of "Mercator's projection." The problem of transferring areas, distances, and directions from the spherical surface of the earth to the flat surface of a sheet map was a difficult one for geographers to solve. Various schemes of accomplishing this end were employed by earlier map-makers, but none of these had proved satisfactory. Correct areas could be represented on a plane surface but only at the cost of inaccuracy in direction. To the navigator, however, the matter of direction is of supreme importance.



Mercator, on sheets 1, 2, 7, and 8, gives an explanation of his method and the purpose of his map which may be translated as follows: *To whosoever inspects this map, greeting. In this mapping of the world we have had three ends in view: first, so to spread out the surface of the globe into a plane that the places shall everywhere be properly located, not only with respect to their true direction and distance, one from another, but also in accordance with their due longitude and latitude; and further, that the shape of the lands, as they appear on the globe, shall be preserved as far as possible. For this there was needed a new arrangement and placing of meridians, so that they shall become parallels, for the maps hitherto produced by geographers are,*

on account of the curving and the bending of the meridians, unsuitable for navigation, and in the high latitudes the contour and position of localities, on account of the oblique cutting of meridians and parallels, are so strangely distorted that they cannot be recognized, and there can be no proper judging of distances. In the maritime charts for navigators, the degrees of longitude, measured along the parallels increase toward the pole beyond the proportion they have on the globe, for they always remain equal to the degrees at the equator, while the degrees of latitude do not increase at all, so that here, too, it is inevitable, that the shape of the lands is enormously distorted, and that not only longitudes and latitudes, but also directions and distances are far from correct. Great mistakes result for this reason; but the greatest is this, that if a mapping of three places on one side of the equator is made in the form of a triangle, and any intervening place is properly located, with correct direction and distance in respect to the corners of the triangle, it is impossible that the corner points agree in the same way. Taking all this into consideration, we have somewhat increased the degrees of latitude toward each pole, in proportion to the increase of the parallels beyond the ratio they really have to the equator. In this way, we have reached this result, that in whatever way one maps out two, three, or more places, provided that of these four things, difference in longitude, difference in latitude, distance, and direction, he keeps any two in anyone place with reference to any other, everything will be correct in comparison of one place with another; and no error will be found to have been made anywhere, such as must inevitably be made in the ordinary sailing charts, in many ways, particularly in the higher latitudes?

A second purpose that we had was to show the position of the lands, their size, and the distances between places as close to the truth as possible; on this we have spent extreme pains, comparing the marine charts of the Castilians and the Portuguese not only with one another but also with many accounts of voyages in print and in writing; and after having reconciled all these carefully with one another, we present this present mapping of the world and this outline of places as very accurately done in accordance with all that has been observed hitherto and has come within our reach.

The third aim that we had in view was to show what parts of the world were known to the ancients and to what extent, in order that the limits of ancient geography may not be unknown and that due honor may be paid to the earlier ages.

Another inscription, sheet 13, within the frame, above the map of the North Pole, explains the necessity of a separate map for the north-polar region, and gives the source of the author's information concerning the arctic: Since our map could not be extended to the pole, as the degrees of latitude run out to infinity, and since we have some description of the north, by no means to be neglected, we have thought it necessary to give here the extreme part of our mapping, and to join what is left as far as the pole. We have taken a figure which best suited that part of the world, and which would represent the position and appearance of the land as if it were on a globe. As for the mapping, we have taken it from the "Itinerium" of Jacobus Cnoyen of the Hague, who makes some citations from the Gesta of Arthur of Britain; however, the greater and the most important part he learned from a certain priest at the court of the king of Norway in 1364. He was descended in the fifth generation from those whom Arthur had sent to inhabit these islands, and he related that in the year 1360 a certain Minorite, an Englishman from Oxford, a mathematician, went to those islands; and leaving them, advanced still farther by magic arts and mapped out all and measured them by an astrolabe in practically the subjoined figure, as we have learned from Jacobus. The four canals there pictured he said flow with such current to the inner whirlpool, that if vessels once enter they cannot be driven back by any wind; and he said that nowhere was there wind strong enough for transporting grain. A very similar description is in Gerald de Barry's book on the marvels of Hibernia, for he writes as follows, "Not far from the islands [Hebrides, Iceland, etc.] on the north is a wonderful whirlpool, to which from distant

parts all the waves of the sea run and flow as if from a conduit. These, pouring there into the secret penetralia of Nature, are sucked down as if into an abyss. If it happens that a ship passes through this, it is drawn and hurried on by such violence of the waves that the power of the maelstrom sucks it down at once beyond recall."

The dedication of the map is provided on Sheets 1 and 2, under the figures of Pax, Justitia, and Pietas: *To the Most Illustrious and Most Gracious Prince and Lord, William, Duke of Julich, Cleves, and Berg, and of Rauensburg, Lord of Ravenstein, this work, begun and completed under his favoring care, is dedicated by Gerardus Mercator.*

On Sheet 17, within the oval frame: *Warning is given by copyright of his Imperial Majesty that no one in the empire or the kingdom and provinces connected with it is to reproduce this work within 14 years, or import it if reproduced elsewhere. That it be reproduced in Belgium in ten years is forbidden by command of His Royal Majesty. This work was published at Duisburg in the month of August, 1569.*

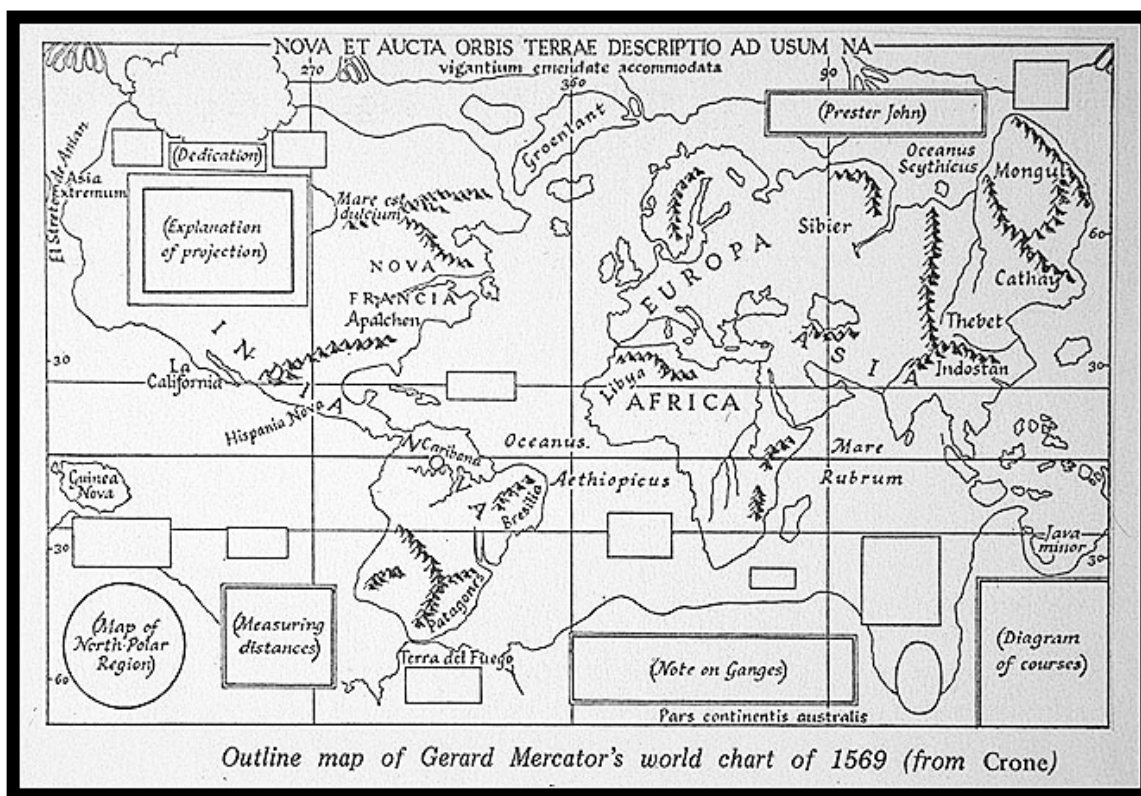
Sheets 1, 2, 7, and 8 contain the following legend: *The remainder of Africa, from the promontory of Pressus to the Sinus Hespericus, Pliny declares, Book 6, Chapter 29, on the testimony of King Juba, to be circumnavigable, even giving several stopping places on the voyage from India to Mauretania, and much earlier, as is stated in Herodotus, Book 4, at the command of Neche, King of Egypt, certain Phoenicians, starting out from the Sinus Arabicus in two years time sailed around Africa even to the Pillars of Hercules; and later, according to Mela, a certain Eudoxus, when he was escaping from Lathyrus, King of Alexandria, leaving the Sinus Arabicus, sailed as far as Gades. It is clear, then, that our continent is surrounded by the ocean, and that its extent was known to the ancients; and it is evident on their authority that it was in large part described. Plainly those persons are mistaken who make New India continuous with Asia.*

Sheet 3, on the northeastern coast of North America: *on Gaspar Cortereal, Verrazano, Cartier, and French fishermen in general.*

Sheets 5 and 6: *On the topic of Prester John of Asia and the earliest origin of the dominion of the Tartars: At the time when Antioch in Syria was besieged and taken by the allied forces of the Christians in the year 1098 the sovereign of the eastern parts of Asia was Coir Cham. At his death a Nestorian priest and shepherd seized the dominion of the Naiman people in the country of Naïam and thereafter became the absolute master of the whole Orient and he was called, as indeed he was, Priest and King John. When he died his brother Vuth, who reigned in the Carocoran, seized the power and called himself Cham, that is Master. As he feared the multitude and the growing power of the Sumongols, that is to say the aquatic Mongols who were properly called Tartars, from the name of the river Tartar of their homeland, though they had neither king nor state and were but shepherds who paid an annual tribute, he desired to disperse them into different countries thus breaking all power of rebellion; but they, unwilling to give up their right of kinship and of mutual association, made a vow and fled to the northward where they seized a very vast country, fortified by nature, in which they would be able to defend themselves, even though they refused to pay the tribute, and thus save their liberty. A few years later, as the other Mongols (as is related by William of Tripoli) were molested by the armies of their Emperor Vutcham, or else perchance were ill-treated on account of the suppression of the tribute of the Tartars, a Mongol working blacksmith called Chinchis, anxious to remove the common affront and to obtain liberation, invited the Jecmongols to rebel and called in the Tartars; after all had, with one accord, made resolutions he was elected king by unanimous*



decision in the year of Our Lord 1187. Shortly afterwards he invaded the countries beyond Mount Belgian and easily conquered the whole of this land for, being wise, he knew how to make full use of the victories, exercising no cruelties on the conquered and, to those who willingly gave their submission and who took service in his army, he granted their lives and allowed them to retain their wives and children and to have free enjoyment of all their goods. Thereafter, crossing Mount Belgian at the place where it meets the Ocean, he attacked the kingdom of Tenduc, the seat of the Emperor Vutcham. Having conquered him he became the monarch of the East. He lived six years after Vutcham during which he added numerous provinces to his empire. Thus the dominion passed to the Mongols and it is called the Empire of the Tartars, not only for that it was obtained because of and thanks to them, but particularly because all the Mongols who lived together under common laws were called Tartars. Vutcham and his descendants remained kings of Tenduc but paid tribute to and were under the dominion of the Tartars. We have briefly summarized this information gathered from Marco Polo, the Venetian, Hayton the Armenian and William of Tripoli, a Dominican of Ancona who, in the year 1275, was sent by Gregory X to the Tartars in order to ascertain the primal origin and the seat of the Tartar dominion and to determine the true personality of this Prester John who was believed to be still reigning in Asia and in order clearly to show that he was not the same as he who, till today, is called Prete Giam in Africa.



Sheet 6, near the top: on some islands near the North Pole, within the frame: About the beginning of longitude and the magnetic pole. Francois of Dieppe, a skilled navigator, declares that in the Cape Verde Islands, Sal, Bonavista, and Mayo, sensitive magnetized needles point straight toward the earth's pole. His statement has recently been confirmed by those who say that this happens in Terceira or in Santa Maria, islands of the Azores group; and a few believe that this occurs in the westernmost of the Azores, Corvo by name. Since it is fitting that

the reckoning of longitude should, for good reasons, begin at the common meridian of the magnet and of the earth, I have followed the testimony of many men and have drawn the prime meridian through the above-mentioned Cape Verde islands. As elsewhere the magnet deviates more or less from the pole, there must be some other especial pole, to which magnets point from every point of the earth, and this I have learned exists in the place to which I have assigned it by aid of the magnetic deflection observed at Ratisbon. I have computed the position of the pole also with respect to the island of Corvo, so that near the extreme positions of the prime meridian, the extreme limits also within which it is inevitable that the pole be found, may be plain, until the observation of mariners shall have brought forward some more definite information.

Sheet 14, within the small frame: on the circumnavigation of the globe by Magellan, within the larger frame: here the author gives an abstruse mathematical dissertation on the methods of measuring distance between places. Ferdinand Magellan, sailing from Spain on the 20th. September of the year of Grace 1519, arrived on 21st of October of the following year at the straits called after him the "Straits of Magellan" and was the first to enter them; thence he reached the Moluccas and was killed, with 8 Spaniards, in the Barusse Isles. The remainder of the fleet scattered and damaged, then returned to Spain.

Sheet 15, within the small frame: In the year 1493, when the feverish rivalry in distant navigation was at its height between the Castilians and the Portuguese, Pope Alexander fixed a meridian circle distant 100 leucæ from any of the Cape Verde Islands, or from any of the Azores, to mark off for each faction its rights in navigation and conquest, allotting the western hemisphere to the Castilians, the eastern to the Portuguese. This boundary, however, was set aside by both factions on account of the disputes that arose, and in 1524 there was established as their common boundary the meridian distant 370 leucæ to the west of San Antonio, the westernmost of the Gorgades.

Sheet 16, within the small frame: a long account of how the Niger flows into the Nile. We had thought that the Niger River, with the other rivers which flow into the swamps of Libya, continues thence by the Gir River, not holding this opinion by the resemblance of the name only but also, partly, in that it is incredible that so many rivers which flow over so great distances should be finally absorbed by a single lake without being turned in some other direction, and partly also, above all, because Solinus, in chapters 30 and 33 states, without equivocation, that the waters of the Nile are thus formed and because, returning to the question in greater detail in chapter 5, relying on the authority of Carthaginian books and on the tradition of Juba, King of Mauritania, he says that the Nile has its source in a mountain of lower Mauritania near the Oceans and that its overflow is greater in Egypt when more copious melting snow or when more heavy falls of rain flow off from this source and from the mountains of Mauritania. He states, further, that at two places it disappears from view into subterranean channels, first when, having come from Lake Nilis, it grows larger from its exit from the Cesarian Grotto (which I assume to be near Mt. Usargala) and a second time before it joins the Niger River (which Ptolemy calls the Gir) which separates Africa from Ethiopia. Ptolemy says, in Book 4 of his Geography, chapter 6, that it loses itself yet a third time and that passing through subterranean channels coming from the Nuba swamp it rises again in another river. Pliny, in Book 5, chapter 9 gives nearly the same information as Solinus.

Sheets 16 and 17, within the large frame: about the true location of the Ganges and the Golden Peninsula. And, with reference to Ptolemy's cartographic description, the outcome of that which is set out in the present work on the subject of the position of the Ganges is that, including therein the islands there mentioned on the eastern side, it extends as far as Thamus, a promontory of Cathay where, as maintained by Mela, is the extremity of India, the end of the Southern side and the beginning of the eastern side. On the South there from, in truth as

far as Cape Prassum in Africa and to the Isle of Madagascar, thence to the Hippodrome of Ethiopia, it ends in the middle of the Gulf of Hesperia. The extreme of the northern coast after the Cape of the Cimbri is Livonia, but including as well the isles of Scandinavia, Albion, Ireland, the Hebrides, Orkney and Iceland, which evidently is Thule according to Pliny, Book 2, chapter 75 and Book 4, chapter 16, Solinus chapter 25, and Pomponius Mela Book 3, chapter 6. The remainder of the northern boundary after crossing the Riphei Mountains is described by Pliny and on the left hand shore of the Scythian Ocean, he discusses Norway, Sweden and Finland under the names of Balthia, Basilia, Scandinavia and Eningia in Book 4, chapter 13, but he described them as islands for he was unaware of the isthmus which separates the Gulf of Finland from Grandvic. Then, following the right hand shore in Book 6, chapter 13, he places first, after the Hyperborean nations, Lytarmis, a promontory of Mount Rypheus, then the Arimpheans and most of the other nations who dwell around the Caspian Sea and its mouths, in fact he believed that it flowed into the Scythian Ocean; thence, having enumerated and described, in chapter 17, the position and the peoples of the rest of the shore, he rounds Cape Tabis and arrives at the Seræ by that side of the shores which faces the summer sunrise; thereafter he reverts to India.

That which long experience teaches, in order to advance with the object of a perfect knowledge of truth and not to be blinded by error, should be so established that, after discarding all which obvious reasons reveal to be false, that which is probable is retained until, every test and every reasoning being in agreement, the facts themselves in their very truth are placed before the eyes. It is so in geography. Should we, at the first incidental occasion, transpose, modify or discard the discoveries of the ancients, not only will we not improve but, by correcting a single error we will alter a hundred truths and, in the end, we will have an extremely confused mass of lands and names in which neither the parts will appear under their true names nor the names on their proper parts. Somewhat in this fashion has been done today by geographers in the map of India, in that, most absurdly, they place this very celebrated River Ganges further west than the promontory of Singapore and than Taprobana, though, according to the ancients, it lay much further to the eastward; then, also, they upset and confound the whole map of India, as given by Ptolemy, by not allotting to it anything beyond the said promontory. But we must most strongly rebut this opinion in order that Ptolemy's authority be not shaken and that the geographical truth be made manifest, which truth requires no less accuracy in the names than in the positions of places. And it is most clearly evident that the representation was not compiled in a superficial manner by Ptolemy but that it received the form which has been given to it since the time of Alexander the Great thanks to the expeditions of numerous travelers by land and sea and to many observations and that it had been corrected by Marinus and entirely restored by Ptolemy. Hence, since it is the result of the labor of so many centuries and so many workers, it is impossible that it should so hugely vary from the truth and that it should be false by the displacement of a coast of such great extent. And verily the succession could not be unknown of parts of the shore, on the one hand, as considerable as those which extend from Comara Promontory as far as Taprobana, and the adjacent headland and thence as far as the Ganges and the Golden Chersonese and, on the other hand, so greatly frequented (as is proved by the abundance of the names of places inscribed thereon), to the extent that that which is before could be placed after and that the Ganges, which (according to these men) should come a long way before, should have been placed a great distance after Taprobana. In laying down directions the ancients might well be wrong on account of the imperfection which then vitiated the art of navigation and because, direction being almost disregarded, they were accustomed to hug the shores. Likewise they might err by the transposition of particular places but, of a truth, they could not mistake the order of the positions of which we have spoken. Arrian, who was a thorough writer, clearly shows us the truth in his Periplus. According to him, starting from the Indus, Comara is to the Southward, thence, taking the coasts

in succession by Colchos, Camara, Poduca and Sopatma, he arrives at Taprobana and in the adjacent region of Azania, which for us is now Malacca, for Ptolemy the river Mesclus and for Arrian the region of Mazalia; hence by Desarena, the Cirrades, the Bargises and the Hippoprosopes finally he reaches the river and the emporium of Ganges. And, further, the Royal Road of 20,000 stadia, which runs from the Indus to the Ganges and Palibotra, according to Strabo, Book 15, would not permit the Ganges to be placed elsewhere than where we, with Ptolemy, have put it. In fact, the most deeply indented part of the Bay of Bengal, to which the old Ganges is transferred today, cannot be sufficiently distant from the Indus, if the directions and their dimensions be maintained, for Palibotra, situated on the Ganges, to be at the stated distance, taking into consideration at the same time that the Ganges, from Palibotra, flows towards the sea in an Easterly direction. And again, if we consider the journey of 38 days, which the Venetian Nicolas de Conti made from the head of the Bay of Bengal, and the Ava River, at which he arrived, which was much greater than the Guenga of Bengal, we may deem with sufficient reason that he reached the Ganges, the greatest of the rivers of India and that which was best known to the ancients, even though, there, it were known by another name; it is even likely that the city of Ava, nigh unto this river, may be Palibotra, not only on account of its greatness - for the city has a compass of 15 miles - but also for its distance from the mouth, which is in close accord; actually Nicolas sailed for 17 days thereon to reach the sea whilst Strabo speaks of a distance of 6000 stadia. And, truly, since the sources of the Guenga of Bengal are in the parts where we have placed them and as its course is that which we show, as witnesses Jodo de Barros, what more absurd could be said than that this be the Ganges of the ancients, of which it is shown that the sources are in the same mountains as those of the Indus and that it is but 280 paces distant from the River Zaradrus, the most easterly of the tributaries of the Indus according to the testimony of Pliny, and, yet again, that, over a large part of its course, it runs to the southward. Therefore, since neither the sources of the Guenga, nor its position, nor its length are in accord with the descriptions of the ancients, we deny that this is the Ganges of the ancients though its name may appear to refer thereto. Still more, those who were the authors of this opinion do not seem to maintain their position with confidence when they imagined another Ganges falling into the Bay of Bengal by the same mouth as the Guenga, this displacement alone being sufficient to refute their argument. If to this be added that they have transferred several towns and the kingdom of Moin or Mien, or Mein, which are connected with this river which we hold to be the Ganges, to their fictitious Ganges, it will be clearly understood that this true Ganges, which is also the Ganges of the ancients, must be sought elsewhere than in the Bay of Bengal. Besides these valid reasons, the shapes of the coasts themselves and the names which appear nearly everywhere would show the truth. Our geographers, in fact, place the headland of Comara as do Ptolemy and Arrian; besides, has not the name Cabo de Colle the same sound as the Collaicum of Ptolemy or the Colchicum of Arrian? Is there anything which is nearer than Jameri and Chaberis or Camara, Pogu or Pegu and Poduca, Tavay and Tava, Malanga and Mallacca, Cantan and the town of Gange with the very great river which the ancients also attest to be the Ganges? Finally, if the Ganges be not there where we have placed it, to whither shall so many isles placed by Ptolemy in the Gangetic Gulf be referred, since they are not in the Bay of Bengal? We maintain therefore that the very great river Cantan is the celebrated Ganges of the ancients and that the Golden Chersonese is not that which is now Malacca but the isle of Japan, as is clearly evident from the texts of Arrian and of Mela, though Ptolemy makes it a peninsula, but in Ptolemy the present emporium of Sabana seems also to be called an island. Marco Polo, of Venice, says, in Bk.3, chapt.2, that, consistently with its ancient name, it abounds greatly in gold.[46] Besides we are obliged to admit that the island of Borneo is that which Ptolemy calls the isle of Good Fortune, that Celebes, Ambon and Gilolo are those which are called Sindes and that Mindanao and the

neighboring 4 great islands are called the Barusses. Likewise I find, on some fairly recent charts, certain names which manifestly indicate that Ptolemy knew of the kingdoms of Mangi and Cathay and that they touch on the Sinus Magnus which Pliny calls Chryse, such as, in the kingdom of Mangi, Pagrasa, Done, Caracaran, Agonara, and Tartaho, and in the kingdom of Cathay Aspicia and Brema, to which, in Ptolemy, Pagrasa, Daona, Lariagara, Aganagara, Cortacha, Aspithara and Bramma correspond, thus there is no doubt but that the Ganges lies more to the eastward than Taprobana and that, thereafter, it flows straight towards the isle of Chryse and the Sinus Magnus beyond which Cattigara, a station of the Sinae, the extreme limit of the Ptolomaeian chart, appears to lie at the extremity of our continent and to coincide with the kingdom now called Tenduch.

Sheet 17, within the frame toward the middle of the sheet at the right: concerning the use of the *Organum Directorium*, the diagram in the lower right hand corner of the map; within the smaller frame at the left: a notice of the voyage of Vasco da Gama.

Sheet 18: *About the approach of the southern continent to Greater Java.* Ludovico di Varthema, book 3 of his *India*, chapter 27, tells that on the southern side of Greater Java toward the south there are certain peoples that navigate by constellations directly opposite to our Septentriones, and this to such a degree that they find a day of 4 hours, that is, in the 63rd degree of latitude; all this he repeats from the lips of an Indian skipper of his. Marco Polo of Venice, however, saw several provinces and islands facing this continent, and noted their distances from Lesser Java. That Lesser Java is neither the island of Borneo, nor any east of Greater Java (for different men incline to one view or the other), is clear beyond question from this consideration that he says it bends so far to the south that neither the Arctic Pole or the stars, that is, Ursa Minor, can be seen; and in chapter 16 he declares that in one kingdom of it, which is called Samara, neither Bear is visible. Therefore, if we consider the circuit of the island, which he states is 2,000 miles, it is certain the northern end of it comes about the 20th degree of south latitude. We gather, then, that a southern continent juts out far to the north, and leaves only a narrow passage of water between it and Lesser Java. Sir John Mandeville, an author inclined to tell unreliable stories, still a man not to be disregarded in the location of places, agrees with this, chapter 103, saying that the Red Sea, near Taprobana and the neighboring regions and islands, is cut off from the Eastern Ocean.

Sheet 1, at the mound or pole near the edge: *The magnetic pole. This you see at the other end of the map, located in its proper latitude; as also the remaining extremities of the map that bound this edge. This has been arranged in this way, in order that the continuation of each edge with the other might be brought before the eye more distinctly.*

Certain facts concerning Mercator's mapping of America are to be noted. He accepts the southern or Antarctic continent, the Northwest Passage, the Northeast Passage, the strange islands of Zeno, other mythical islands in the Atlantic such as St. Brendan; and the *Strait of Anian*. The statement seems fair that Mercator was not a practical navigator and critical student of geography, but a rather uncritical student who relied too much on the statements of others. In the north central part of North America, on the edge of the large frame, is an inland sea of fresh water, perhaps a survival of the *Sea of Verrazano* (#347), perhaps a hint of the Great Lakes derived from the Indians. The inscription here says, *Here is a sea of sweet water, the limits of which the Canadians, on the authority of the Saguenay Indians, say they do not know.*

There is a St. Lawrence River, as demanded by the voyages of Cartier, though the limits of the river are unknown; a probable Hudson River, to comply with the requirements of the story of Verrazano's voyage, in which Mercator believed, as may be judged from the inscription on Sheet 3; no Mississippi River, though the *r. de spiritu*

santo may be intended to represent that river; a southwestern United States delineating the scenes of the expeditions of Coronado and others in these parts.

The general region of New England is called *Norumbega*, a term, says John Fiske in his *Discovery of America*, which is loosely applied sometimes to the regions of the Penobscot, sometimes to those of the Hudson, and sometimes to the regions between the two rivers. The *Apalchen Mountains* [Appalachian], which are made to run parallel to the Atlantic coast, are probably derived from Le Moyne's map (#431). Zalteri's map (#391) applies the term to a confused mass of mountains in the interior.

There are no English names on North America. Rather, on both sides of the St. Lawrence, one sees the French claims, in *Nova Francia*, *St. Lawrence*, *Canada*, *R. de Chaleur*, *C. de Razo*, and *Bel Ysle*. Newfoundland is *Terra de Baccalaos*. In support of the French claims to the eastern part of the United States, Mercator, Sheet 3, cites the discovery of the mouth of the St. Lawrence by the French fishermen in 1504, the voyage of Verrazano along the east coast in 1524, and that of Cartier in 1534. He does not mention the English claims founded on the work of the Cabots.

Mercator's projection sought to spread on a plane the surface of the sphere in such a way that the positions of places shall correspond on all sides with each other both in so far as true direction and distance are concerned and as concerns correct longitudes and latitudes; then, that the forms of the parts be retained, so far as is possible, such as they appear on the sphere.

Although this projection was invented by Mercator, it was first worked-out in its practical details by Edward Wright of Oxford in his Certain Errors of Navigation. London, 1599.

This projection was a revolutionary invention of tremendous importance. "Mercator's projection", as it is the usually called, meant a huge step forwards for a safe and precise charting of a route at sea. But his map was far more than just a map for navigators. Mercator tried to incorporate all the new knowledge that seafarers and discoverers had brought back to Europe. His map represented the world as it was known in Europe. Not surprisingly, he put Europe in the middle of the map. At that time, it also was the continent that was best known to European geographers and mapmakers.

Like all renderings of three dimensional objects into a two dimensional form, his map distorted reality. The effect of the projection was that the size of Europe was exaggerated whereas, for instance, South America and Africa were both downsized. That would become a bone of contention in the twentieth century when the Eurocentric 'mindset' of the map was questioned.

By 1569 Mercator already had a long experience as a maker of globes and maps. Born in a small town near Antwerp, he received his first education with the brethren of Common life in Hertogenbosch. In 1530 he moved to the University of Leuven, where he became a pupil of Gemma Frisius, the leading theoretical mathematician of the Low Countries who also was a cosmographer of repute. He joined Frisius' workshop of scientific instruments as well and aided him in constructing a globe in 1535. Later Mercator started his own business as an engraver and maker of instruments. His first map in 1537 depicted the Holy Land. A year later he produced a world map, or rather a map on which the southern and northern hemisphere were depicted in a double-heart shape. In 1541 he built a globe, replicas of which were much in demand, ten years later followed by a celestial globe (representing the stars in the night sky). In 1544 there was a setback when Mercator was arrested and imprisoned for seven months on a charge of heresy by the inquisition. His frequent absences from Leuven to gather information had

aroused suspicions. In 1541 he swapped Leuven for Duisburg, in the duchy of Cleve. In 1564 he was appointed court cosmographer to Duke Wilhelm of Cleve.

Gerard Mercator's Southern Continent

Although Franciscus Monachus (*see* #337) pioneered the representation of a continent-sized southern landmass, it was Mercator who developed and promoted the concept. It seems likely Mercator encountered the debate about the southern continent during his formative years in Louvain studying philosophy. The southern continent featured in popular textbooks on cosmography such as those published by Peter Apian (1495–1552) and Mercator's teacher Gemma Frisius (1508–1555). Possibly Mercator was aware of Monachus's *De orbis situ*. Some scholars even suggest that they knew each other and that Monachus was responsible for introducing Mercator to the principles of geography. It was Mercator, however, who delved into the available literature searching for information about southern continent's position and outline and who formulated a theoretical justification for its existence.

Mercator, like Monachus, although aware that much of Ptolemy's Geography was being superseded, sought to reconcile ancient knowledge with more recent discoveries, and his own philosophy with current interpretations of earlier data. According to his friend and first biographer, Walter Ghim (1530–1611), Mercator had intended to address such issues in a comprehensive study on cosmography. He began work on this in the 1560s and dedicated the remaining years of his life to it, although it was never fully realized. Ghim stated that the work was to have had five books and that the fifth was to have been devoted to geography. It would, according to Ghim 'have adopted a revolutionary arrangement which no one had thought of or attempted before', namely,

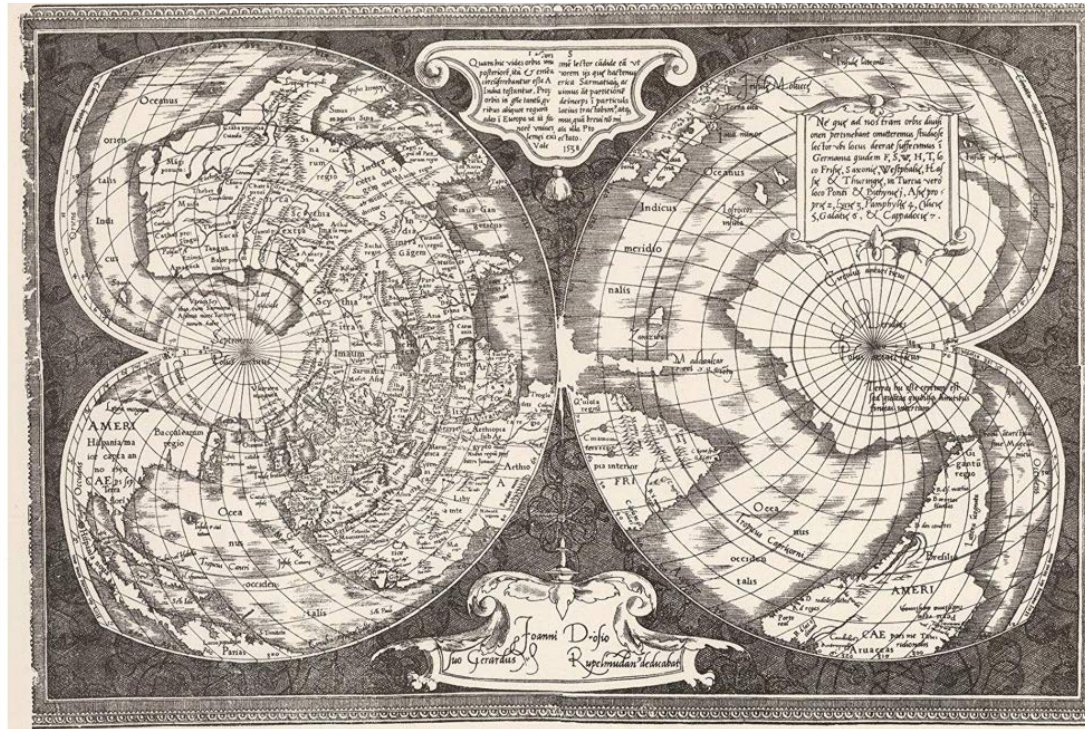
to divide the world into three equal continents, one comprising Asia, Africa, and Europe, the other West India with all its adjacent kingdoms and provinces, and a third, which he realized was unknown and still awaiting discovery, but whose existence he thought he could clearly prove by solid reasoning and argument. It could not be less in its geometric proportions, size, weight, and gravity than the other two, otherwise the world would be unable to remain balanced on its axis. Writers call this the Southern Continent

Mercator's explanation for this belief is set out in Chapter 10 of his *essay 'De mundi creatione ac fabrica liber'* [On the Creation and Fabric of the World], incorporated into his *Atlas, sive cosmographicae meditationes de fabrica mundi et fabricati figura* and published posthumously by his son in 1595. Here it is explained:

Furthermore, since the lands known ancients are contained in 180 degrees of longitude, occupying, that is, only half of a sphere, it was necessary for as many lands to exist in the other half. And since Asia, Europe, and Africa are located for the most part beyond the plane of the equinox, to the north, it was necessary for such a continent to exist below the Antarctic pole, which, along with the southern parts of Asia and the New Indies (or America) would balance the other lands.

Mercator argued that, for the equilibrium of the earth to be sustained, it was necessary to have landmasses of equal weight in all its parts and that, had the ancients recognized this, they would have determined the size and position of the southern continent lying beneath the Antarctic Circle. With this line of reasoning, Mercator became the first person to articulate a cosmological theory of terrestrial balance.

Over the course of his life Mercator presented three different versions of the southern continent. On each representation he employed text. In 1538, it was an inscription in the form of a brief statement while, in 1541, his globe carried toponyms and inscriptions in the form of references. The 1569 version includes toponyms, references, cartouches, an inset map and a diagram.



Gerard Mercator, World Map (1538)

No sooner was Mercator's *Orbis imago* published in 1538 than it was out of date. The world view was changing so rapidly that, around 1540, he wrote to his university friend, Antoine Perrenot de Granvelle (1517–1586), Bishop of Arras, explaining that he had devoted his 'spare hours' to 'comparing the old geography with the new', and '[t]he more carefully I examine, the more errors I find in which we are enmeshed'. Mercator had come to the view that the currently accepted continental outlines of the world needed to be revised and updated, including the southern continent, and that he would publish this new information on a terrestrial globe.



Mercator globe, 1541



Comparison of the southern continent.

Left: World map, Gerard Mercator, 1538. Right: Terrestrial globe, Gerard Mercator, 1541.

The new Mercator projection presented in 1569 increasingly distorted the shape and size of those landmasses further away from the equator. Unlike the single inscription on his *Orbis imago* and the three toponyms and four inscriptions on his terrestrial globe, Mercator employed toponyms, inscriptions, cartouches, an inset map and a diagram on this map. While he continued to reference the voyages of Polo, Varthema and Cabral for the shape of the southern continent, he also included more information from three other

sources: Abraham Ortelius, John Mandeville (fl. 1357–1371) and Martin Fernandez de Enciso (ca. 1470–1528).



Detail of the Southern Continent by Mercator 1569

In addition to the toponyms and inscriptions explaining the southern continent's coastline, Mercator also included information on topics other than the southern continent. He included this information in five cartouches, as well as an inset map of the northern regions on polar projection in the lower left corner, and an '*organum directorium*' [diagram of routes] in the lower right corner.

Two cartouches deal with geographical issues related to his map. One is above the inset map; it explains that 'as our chart cannot be extended as far as the pole' a suitable alternative was used. In 1538 and 1541, Mercator had represented the region as a massive northern landmass. On this map, he presented four large islands separated by four large, inward-flowing rivers. The islands form a ring around a large rock. Each island includes an inscription and the rock is labelled '*Rupes nigra et altissima*' [black and very high rock], as Mercator believed it was the source of the Earth's magnetic field. (Catherine Akeroyd provides an in-depth analysis of this map in her doctoral dissertation)

Mercator published various maps, for instance in 1554 he made an influential map of Europe, *Europæ descriptio*. Mercator was a scientific man, whose dream was to compile a work which contained the geographic knowledge of the universe as well as the history of geographical science. This dream was not fulfilled, but in 1569 he published the *Chronologia* (1569); a chronology of the world until 1568. Between 1585–1595 the first part of *Atlas, sive cosmographicae meditationes de fabrica mundi et fabricate figura* (1585–1595), containing 51 maps was published; after Mercator's death, his son Rumold completed the set in 1602 with another 34 maps. Though Mercator invented the term *Atlas* for such a collection of maps, he was not the first to publish the first, uniformly bound collection of printed maps: Abraham Ortelius of Antwerp had already done that in 1570. In 1604 the cartographer Jodocus Hondius bought the original Mercator plates. Two years later he published a revised edition of the atlas, including new maps. Hondius also published an edition in a smaller size, the *Atlas minor*. These atlases became very popular and were translated into a great many languages.



Though Mercator's atlas is very important, it is his world map of 1569 that really constitutes a milestone in modern geography: for the first time in history the problem of direction was solved. The map consists of 18 individual sheets measuring in total 134 cm by 212 cm. Today, the only copy of the map as a whole, pasted together, is in the Bibliotheque National in Paris; two other copies are kept in Amsterdam and Basel.

Locations:

The 18 copper plates from which the world map was printed, engraved by Mercator himself, did not survive, and only three exemplars of the chart are extant: one at the French National Library, one at the University Library of Basel and one at the Maritime Museum of Rotterdam. This last copy has been hand colored and

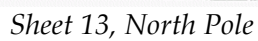
the original sheets were cut and re-assembled to make an atlas.

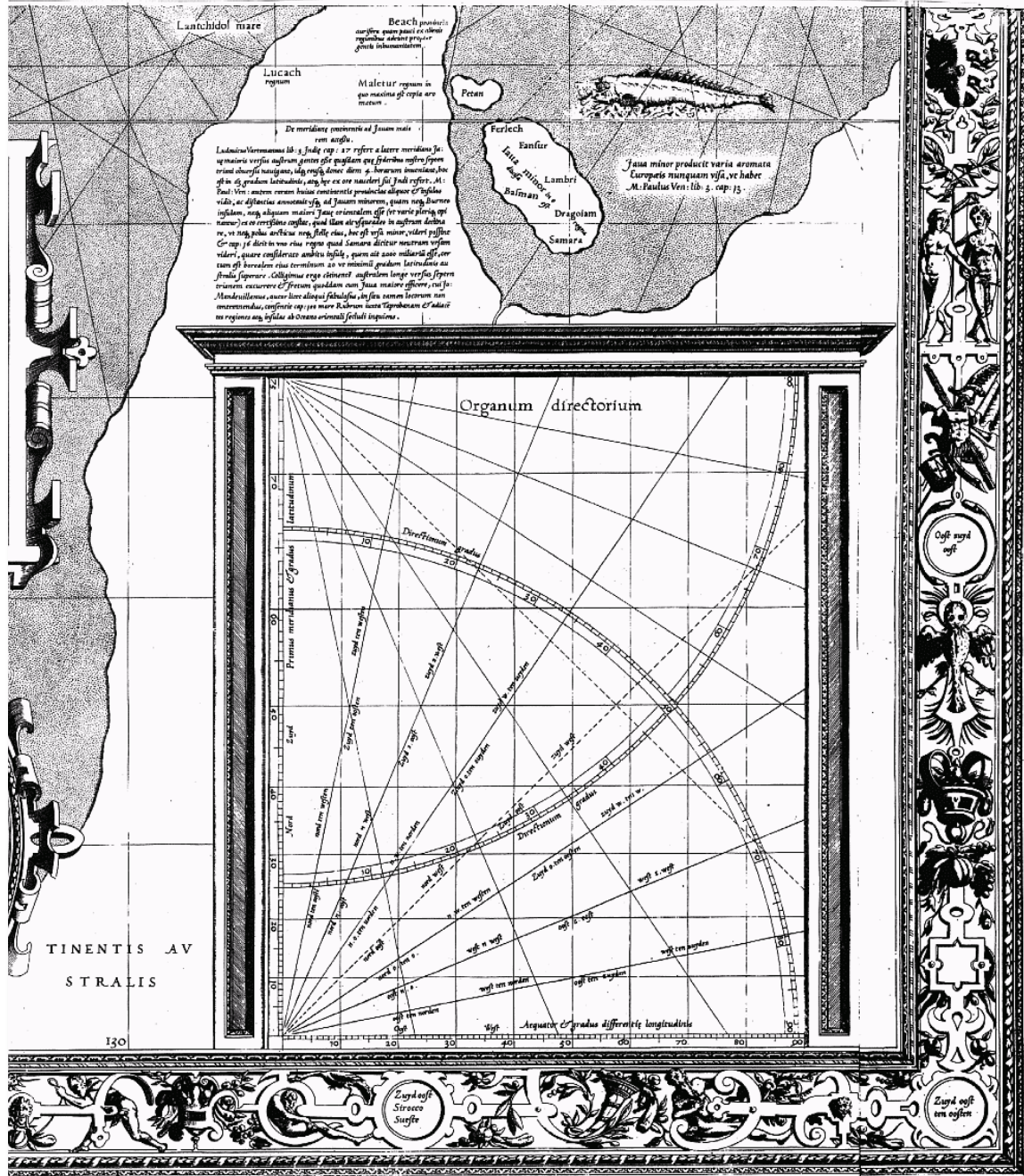
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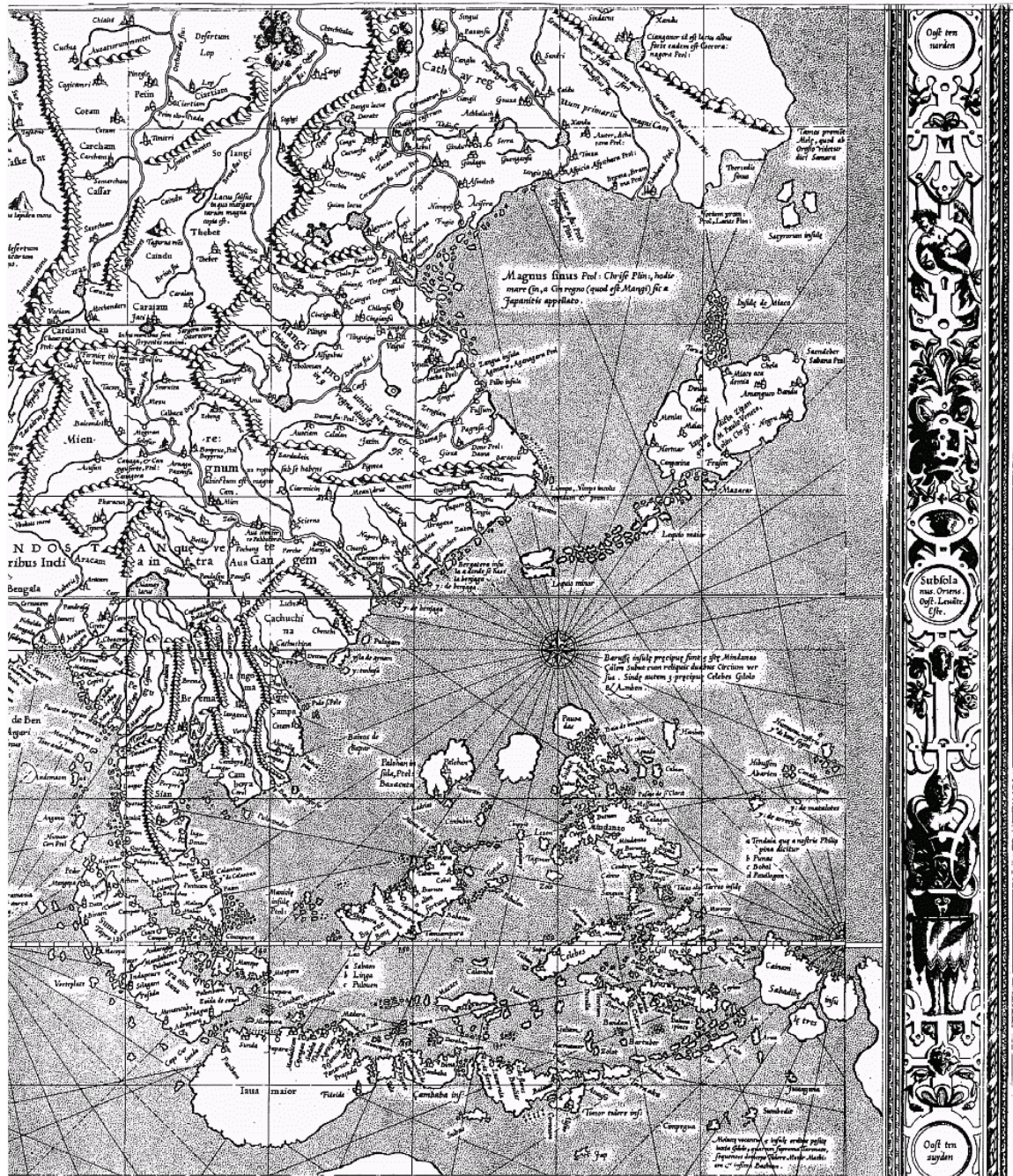


From Sheet 14, South America





Sheet 18, diagram of courses



Sheet 12, Asia

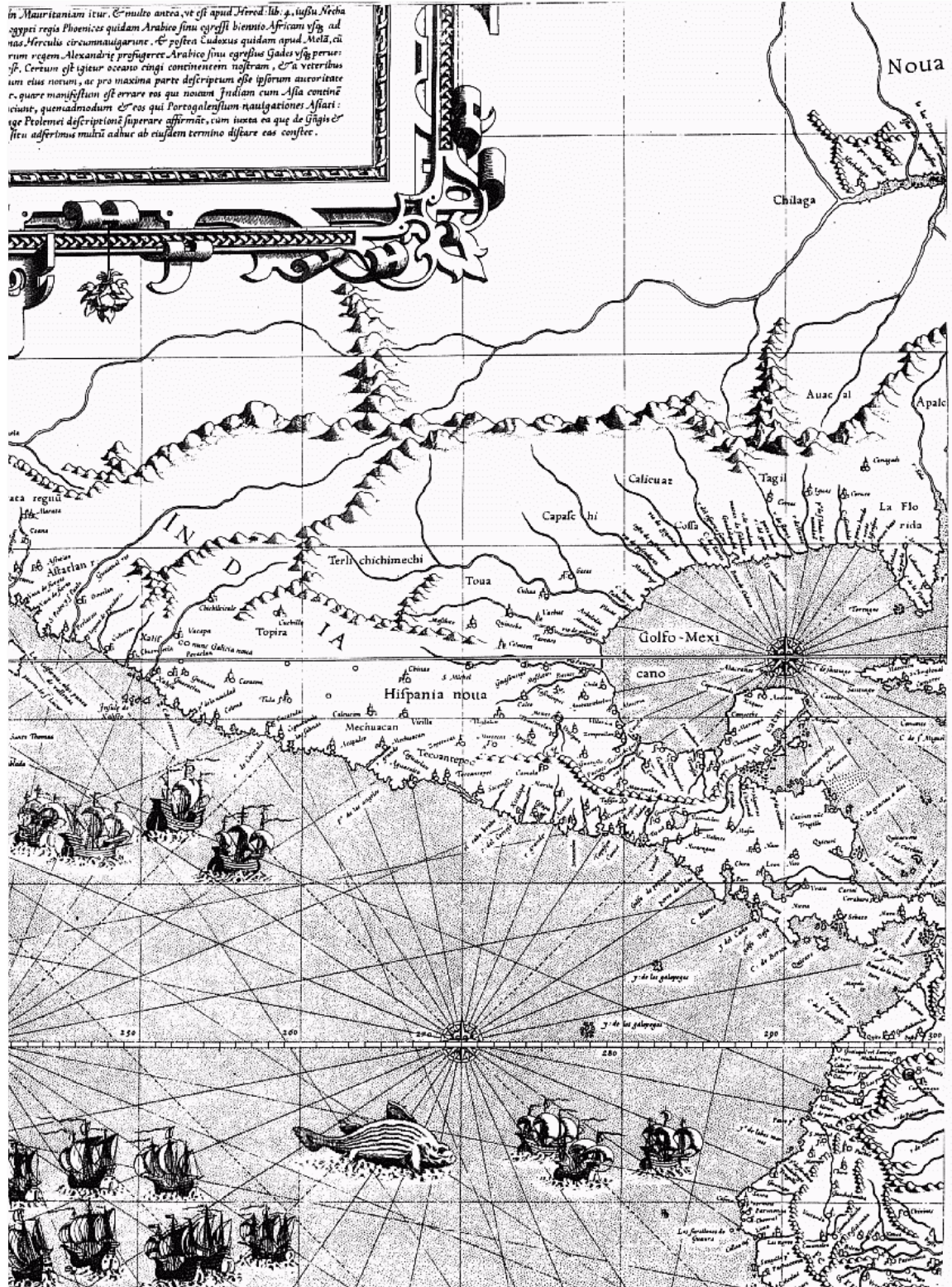




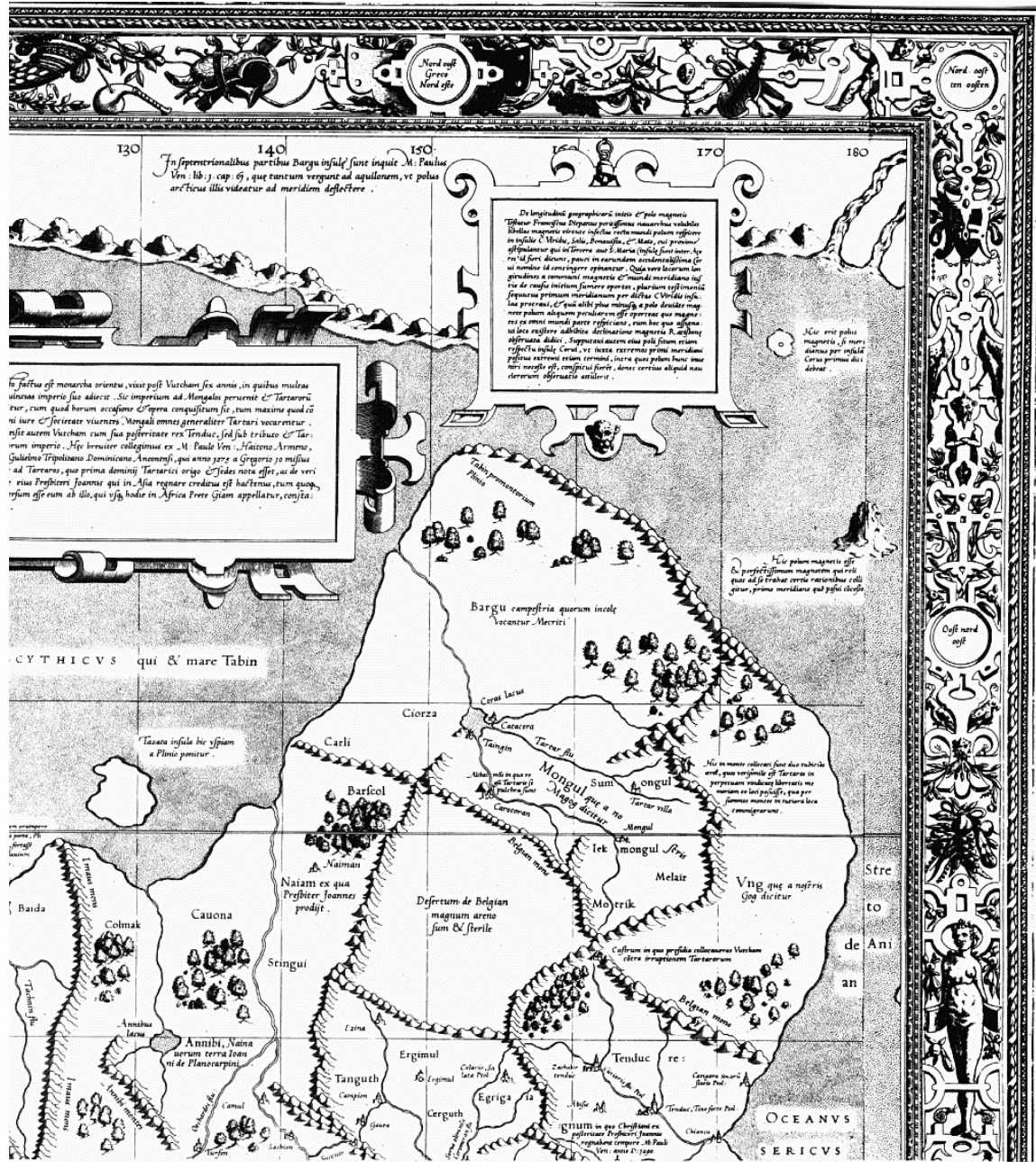
Sheet 15, Patagonian Giants



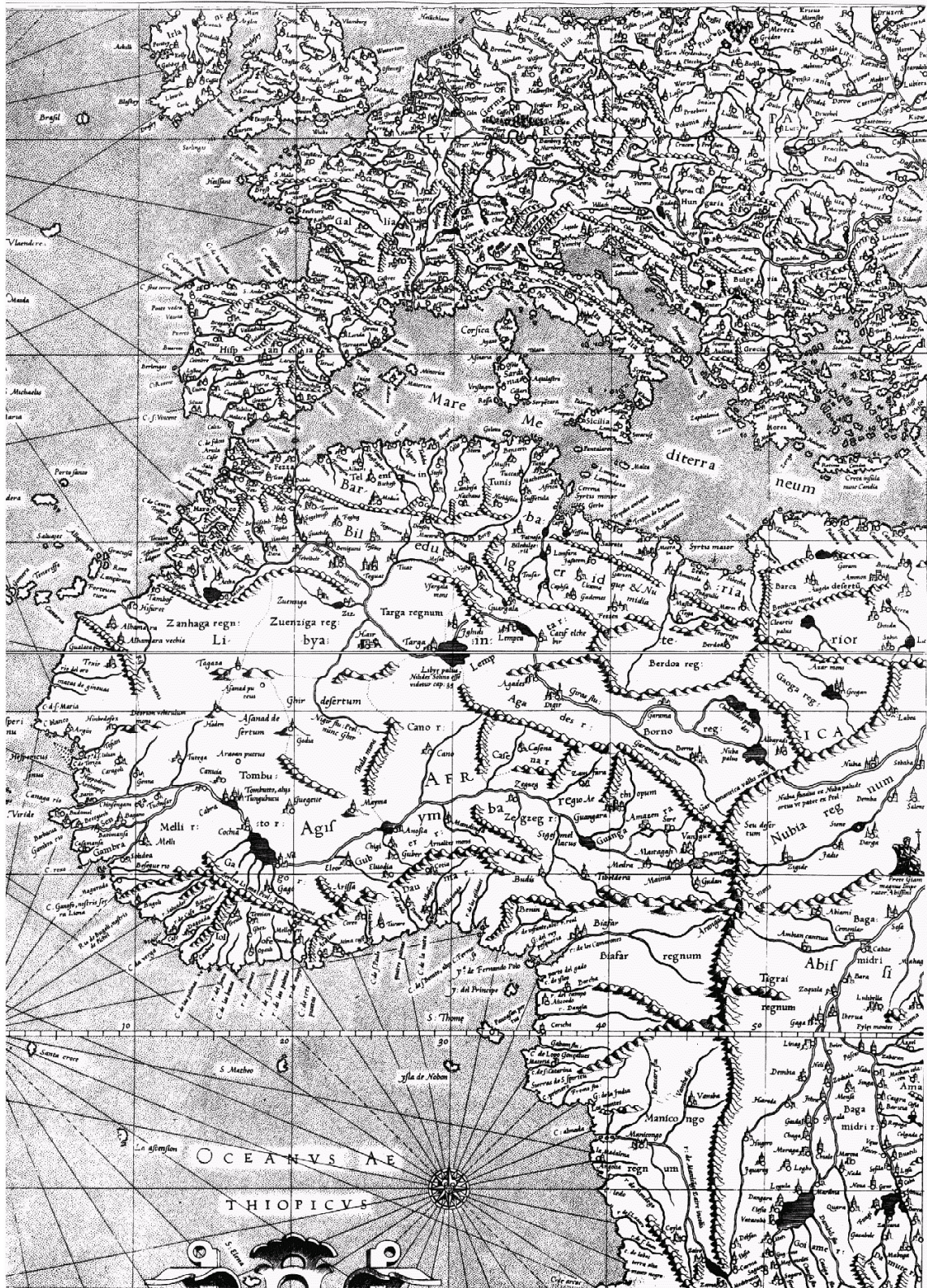
Sheet 15, Cannibals



Sheet 8 Central America



Sheet 6, Mongolia



Sheet 10 Europe & Africa



Sheet 9 North and South America







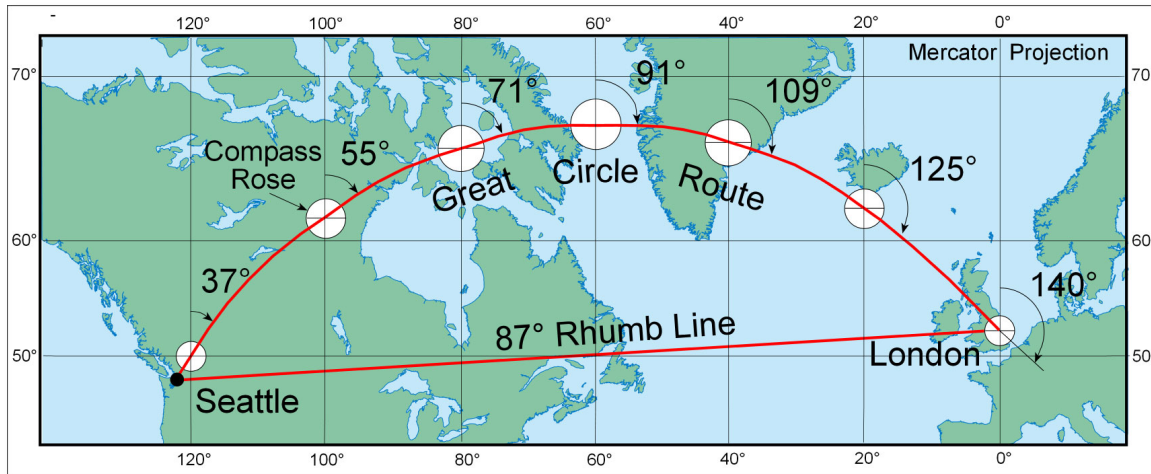




The outline of Africa and the shores of the Indian Ocean and Southeast Asia from a modern Mercator map, overlaid on Mercator's planisphere of 1569. Notice the longitudinal displacement and stretching of all the lands to the east of the Strait of Gibraltar, and the error in the position of the Moluccas. (Photo of a copy of the planisphere previously kept at the municipal library of Wrocław, Poland, destroyed in 1945).



The accuracy of Africa by Mercator compared with Google Earth.



On the above Mercator map, the Rhumb Line between Seattle and London crosses each line of longitude at a constant compass bearing of 87°. The Great Circle air route from Seattle changes continually along the course until arrival at London

Mercator left no explanations on how he calculated the spacing of the parallels in the new projection that bears his name. Knowing that the mathematical tools permitting an analytical solution had not been developed at his time, he must have resorted to some ad-hoc graphical or numeric process. Various solutions have been proposed since, at least, the end of the 19th century, but none of them reproduces the errors affecting Mercator's graticule. Only very recently was it possible to demonstrate, both numerically and historically, that the projection was most likely calculated using a '*table of rhumbs*', that is, a table of geographical coordinates aimed at representing *rhumb* lines on a globe – a tool that had been previously discussed by the Portuguese mathematician Pedro Nunes and was already known in Europe at Mercator's time.

The Mercator world map, 1569. Rotterdam, Prins Hendrik Maritiem Museum. Mercator's map is one of the most important and influential in the history of mapmaking; this importance is not based on the topographical accuracy of his maps, however, but on the value of the projection which he evolved for portraying the spherical earth on a two-dimensional surface. Mercator produced a chart on which a straight line joining any two points on the chart determines the compass direction a navigator must steer in sailing the most direct route from one place to another. The value of Mercator's projection is shown in its continued use to this day.

The most obvious distortion in this projection is the increased size of an area the farther it is from the equator; the most famous illustration is that Greenland on a Mercator map is larger than South America, whereas it is actually only one ninth the size. Any projection of the earth on a flat surface must be a compromise; Mercator's great achievement was to make his maps conformal in shape and to aid the navigator in

plotting his course. It was not until the end of the 16th century, however, that sailors began to accept and use maps with this projection; they were skeptical of the distortions and of parallels and meridians drawn at right angles to each other. In 1599 an Englishman, Edward Wright, made another chart and explained the projection in terms and tables of calculations that navigators could understand and use.

Mercator's world map of 1569 is the first map to show the Appalachians as a continuous mountain range stretching parallel to the east coast in a southwest/north-easterly direction. The New England/Nova Scotia coast extends too pronouncedly east-west, as in most 16th century maps; this is the result of the declination of the magnetic compass at this latitude, which caused the navigators to err in recording their direction along the coast.

