

From a discussion of the mapping of the world before the 15th century period of discovery one learns that the concept of a land-enclosed Indian Ocean that was accepted by Claudius Ptolemy and passed on by him in the text and maps of his *Geography* was little more than an inherited scientific hypothesis, of interest chiefly to the learned men of his day. Before Ptolemy's time popular knowledge and conjecture pointed to an open Indian Ocean and a peninsular Africa, and there is reason to believe that this conception of world geography was a commonplace in the minds of the sailors and merchants of Europe when this great book was put into print with maps in 1477. Though little more than conventionalized pictures of the earth and its waters, the ecclesiastical maps of the Middle Ages retained the truth in respect to a junction between the Indian Ocean and a continuous ocean stream surrounding the land mass which made up the known world of Europe, Asia, and Africa. The most reliable maps of the period were the *portolan* charts, constructed upon the basis of the actual experiences of mariners. Upon certain of these, proceeding from the period

before the revival of the Ptolemaic maps, was shown a clear understanding of the Indian Ocean, of the peninsular character of Africa, and of the Far East as seen by Marco Polo, an embodiment of the best knowledge of the day. The Martellus Germanus 1489 map of the world (#256) and the 1492 globe of Martin Behaim (#258), the earliest terrestrial globe known to us, show before the discovery of America a picture of Africa, the Indian Ocean, and the Far East little different in its broadest features from the actuality with which we are familiar.

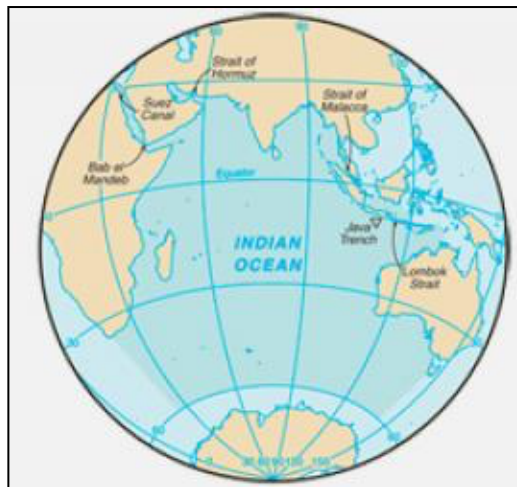
The possibility of ocean navigation between Europe and Asia tended to be dismissed by late-medieval geographers and cartographers for a range of not always consistent reasons. According to Lawrence C. Wroth in his book *The Early Cartography of the Pacific*, the European maps which have come down from the centuries before the Age of Discovery period fall into three broad categories: the maps of Claudius Ptolemy (#119), the ecclesiastical maps, and the *portolan* charts, respectively the learned, the popular, and the utilitarian modes of representing on a plane the picture of the earth and its parts. Throughout the first fifteen centuries of the Christian era these three distinct types of map production are seen as parallel streams of which the first served the scholar, the second the uncritical people, and the third the mariner. The scientific map of Claudius Ptolemy and the utilitarian *portolan* chart have become, through a natural evolution, the land map and the sea chart in common use today. They survived and developed because the scientific production learned to go to the utilitarian for its subject matter, while the utilitarian borrowed from the scientific its learned system of construction. The ecclesiastical map underwent a certain degree of development in the embodiment of new geographical data, but, due to its function and purpose, it remained throughout its history unaffected by the superior construction of the other forms, and was without influence upon their evolution. It had its origin in the primitive geographical conceptions of the ancient Greek world, and it retained its archaic form throughout the three thousand years or so of its currency. In this opening chapter of our

discussion we shall be looking at Africa, the Indian Ocean, and eastern Asia successively through the eyes of Claudius Ptolemy, the churchmen who created the ecclesiastical maps, and the makers of the *portolan* charts.

The oldest world map ascribed to Ptolemy dates back to the year 1297. This manuscript map was produced and drawn by a team under the Byzantine monk Maximus Planudes (1260-1330) who worked in Constantinople at that time. The core question is now: what happened during around 1,150 years after Ptolemy? Was there a stand-still in the history of geography and cartography? In the article "Fuat Sezgin and the Re-writing of the History of Geography" by Detlev Quintern, he concludes that this appears highly improbable. Against this backdrop the history of cartography is confronted with several problems. Fuat Sezgin discovered many non-Ptolemaic elements in several of the surviving maps, among them the drawing of a second more southern latitude below the Equator. This is only one among many details analyzed by Fuat Sezgin and which make it seem plausible that the Ma'mun geographers and their followers had an important impact on the so-called Ptolemaic maps which circulated from early 14th century onwards in more than twenty manuscripts before book printing started.

Often histories of cartography qualify the Ptolemaic maps as scientific breakthrough towards modern world maps, compared to the mainly mythological *mappaemundi* in European medieval times which were more an eschatological guide than maps of the world (e.g. the *Hereford* and the *Ebstorf mappa mundi* dating both back to around 1300 #224 and #226).

Fuat Sezgin developed a convincing and comprehensive answer after more than thirty years of extensive and intensive research in the *Geschichte des Arabischen Schrifttums* (Vol. 10, 11., 12, 13).





Ptolemaic World Map by Maximus Planudes, 1297, Codex Seragliensis GI 57, Topkapı Museum, Istanbul

On the world map of Planudes, ascribed to Ptolemy, the Indian Ocean is depicted as an inland lake, surrounded by a landmass, corresponding to an old belief that was already questioned by Alexander the Great when he reached the Indian coast.

It is an open question why the Ptolemaic World Maps reproduced this obsolete and outdated cartographic depiction that was long before corrected by Arabic cartography. We still find the outdated over-extension of the length of the Mediterranean (63 degrees) and the “melon-shape” of the Caspian Sea.

The *Geography* of Claudius Ptolemy of Alexandria, while initially developed in the second century, was first given printed publication at Vicenza in 1475; its earliest edition with maps was that which appeared at Bologna in 1477, bearing the incorrect date, 1462. The world map in that book and the map of eastern Asia, entitled in later editions *Undecima Asiae tabula*, displayed no greater knowledge of the Far East than had been embodied in them when they were first constructed by the Alexandrian geographer about 150 A.D. It has been generally accepted that the maps in the existing manuscripts and early printed editions of the *Geography* go back to Ptolemy himself. From this general statement Father Joseph many historians excepts the all-important world map, which in their opinion was constructed by Agathodaemon, an Alexandrian geographer and an early editor of Ptolemy. Nordenskiöld, *Facsimile-Atlas*, discounts the part of Agathodaemon in the making of the sectional maps of the *Geography* but is not specific on the question of the world map. But whatever may be said it is clear that in its main features the world map is the graphic expression of Ptolemy's text, especially of Books I and VII. Because of this circumstance it seems proper to refer to the *mappemonde* in the *Geography* as the Ptolemaic world map.

In the Ptolemaic world map of 1477 as in those of all 15th century editions of the *Geography*, the far eastern extremity of Asia is shown throughout its length as unbroken land, bounded by a meridian running about fifteen degrees east of the Malay Peninsula. This was Ptolemy's 180° east longitude, the eastern limit of his *oikoumene* [the inhabited world of Europe, Asia, and northern Africa, so far as revealed to him and the men of his day]. Beyond that meridian lay unknown land. Ptolemy knew the world was round and that somewhere to the east of that unknown and very extensive area lay a great ocean. He must have believed, as Columbus believed later, that this was the ocean which washed the western coast of Europe, but as the whereabouts and shape of its eastern or Asiatic shore were unknown to him he eschewed guesswork and left out of his world picture the unknown land and unknown sea of eastern Asia, making his boundary the sharpest and most definite possible, that is, a meridian of longitude.

In another aspect of his eastern picture Ptolemy displays what may seem a perversion of truth rather than ignorance or excessive caution. Upon his world map, a landmass bearing the legend *Terra incognita* runs due east from Africa at 15° south latitude and joins a non-existent southward extension of eastern Asia, specifically of that section we call today Vietnam, Laos, and Cambodia, having at its southern extremity Cambodia and Malaysia. This concurrence of imaginary landmasses unites the continents of Africa and Asia and makes of the Indian Ocean a land-enclosed sea. Such a conception of the Indian Ocean was not, however, a new and radical theory advanced by the Alexandrian geographer. Its statement in his text and its portrayal upon his world map present a notable instance of the length to which a scholar will go in the application of an hypothesis. The Homeric conception of the world (#105) as a flat, circular disc of land surrounded by a continuous ocean stream remained a popular notion in the Greek world even after many philosophers and scientists had accepted the theory of the sphericity of the earth enunciated by the Pythagoreans and subjected to theoretical proof by Aristotle. That new theory raised the question of the comparative extent and weight of the land and water masses of the world and their distribution with respect to one another. One school of scientists maintained the continuous ocean theory of the older Greek world, asserting that on the sphere, as on the flat disc postulated by their forefathers, the landmass of the known world was encompassed by confluent oceans. In their conception the Atlantic Ocean, the Arctic, and the Indian Ocean merged to form a single body of water that surrounded the continents of Europe, Asia, and Africa. In the second century B.C., however, the continuous ocean theory was questioned by Hipparchus, who set forth in place of it the hypothesis of land-enclosed oceans, the great marine basins of the Atlantic and Indian Oceans, the Mediterranean, and the Caspian Seas. Hipparchus, astronomer and general scientist of the second century B.C., was not the inventor of the theory of land-enclosed oceans but merely its outstanding proponent, who put it into circulation and invested it with his authority. Before his time it had been mentioned as a not too unbelievable current theory by Aristode, who, however, in another work expressly made denial of its possibility. Much curious and rich learning has gone into the discussion of this subject.

Marinus of Tyre, the celebrated geographer of the first century A.D., accepted the Hipparchian hypothesis, and Ptolemy, obedient to these forerunners and masters of his thought, gave it the weight of his authority.

The incorrect southward extension of eastern Asia that we observe upon the world map of Ptolemy was a tradition of the Alexandrian school of geographers which he accepted without question. The extension of Africa eastward to a junction with the

false Asiatic projection seems also to have been a part of his heritage from the past. In the era of Hipparchus, three centuries before Ptolemy's time, the Egyptian Greeks, intermediaries in the commerce between Europe and Asia, knew the eastern coast of Africa chiefly from voyages made upon the Red Sea. Sailing the length of that body of water from ports near its head they had upon their right hand an African coast that turned sharply to the east beyond the Strait of Bab-el-Mandeb and ran in that direction until it reached the Indian Ocean at Cape Guardafui. But the voyages of these men of the second and third centuries B.C. did not carry them far beyond the Strait, certainly not often as far as Cape Guardafui. Their business was to meet at Moosa in Yemen on the Red Sea the Arab traders who brought to them at that place the wares of India and even of lands beyond the Ganges. It was the policy of the Arabs, firmly maintained for centuries, to discourage whatever inclination the Egyptians may have had towards the establishment of direct trade relations with the people of those distant countries. The southern shore of the Gulf of Aden was hardly known to them, therefore, from personal experience. They knew of its easterly direction beyond Bab-el-Mandeb, but until about 100 B.C. they did not know, nor were they told by the Arabs, that at Guardafui the African coast made a right-angle turn southward and thereafter ran for some thousands of miles in a general southwesterly direction. Towards the end of the second century B.C., about the year 115 of that era, Eudoxus, returning from India to Egypt, was blown out of his course along the Arabian coast and driven southward down the African coast below Cape Guardafui. It was probably because of his report of this event that Artemidorus, writing about 100 B.C. could know that the African coast turned around at the "Southern Horn," that is, Guardafui, though he stated that nothing was really known of the coast beyond that headland. Not knowing of its change of direction they must have conceived of it as continuing indefinitely its eastward trend. What the traders and mariners may have suspected we do not know, but it is plain that the geographers found it easy to let that coast run eastward in their imaginations until it met the equally false southern extension of the Asiatic coast which tradition had placed upon their maps. Such a solution was especially easy for the followers of Hipparchus, committed to the theory of land-enclosed oceans. This conception was accepted by Marinus of Tyre and from him was taken over by Ptolemy. But Marinus and Ptolemy expressed it with a difference, for by their time conditions had changed. The power of the Arabs had weakened, and the men of Egypt were customarily voyaging to Cape Guardafui, rounding its corner, and progressing south and southwest along the Indian Ocean coast of Africa as far as Rhapta at about 8° S latitude. They had knowledge, furthermore, of the promontory called *Prasum* five degrees further south. Ptolemy portrayed this new data upon his maps, but unfortunately for his reputation as a geographer he was not satisfied to record only what he knew to be fact, the knowledge acquired from the actual experience of the mariners and traders of the two centuries preceding his day. He had a tradition and an inherited theory to maintain. In his obdurate attachment to the tradition of an eastward extension of Africa and to the theory of land-enclosed oceans, he made a ninety-degree change of direction at *Prasum* and carried his African coast eastward across the Indian Ocean until it joined the imaginary southward extension of Asia at the place called *Cattigara*.



Cape Guardafui.

It has been suggested by all who have given thought to the subject that when Ptolemy compiled his book and maps in the middle of the second century A.D. there was current along the docks and in the warehouses of Egypt and Mediterranean Europe fuller information than he recorded about the Indian Ocean and its shores. It seems, indeed, that knowing so much he might have known more, that he might, indeed, have known as much as his predecessor, the anonymous Egyptian-Greek merchant who about 60 A.D. composed for the mariners and traders of his time the work we know as *The Periplus of the Erythraean Sea*. One of the routes detailed in that book of sailing directions leads us down the Red Sea, through the Gulf of Aden, around Cape Guardafui, and southward to Rhapta, situated, as already said, on the east coast of Africa at about 80 south latitude [present-day Tanzania]. Describing Rhapta and other neighboring markets along that coast, the author of the *Periplus* writes: “. . . beyond these places the unexplored ocean curves around toward the west, and running along by the regions to the south of Aethiopia and Libya and Africa, it mingles with the western sea.” Ptolemy could also have known the account given by Herodotus of the circumnavigation of Africa in the seventh century B.C. by Phoenicians sent forth by Necho, King of Egypt, and he might have learned from Strabo and Pliny of the attempt of Eudoxus to make that navigation from west to east, inspired by the rumor that the Phoenicians in Spain followed that route to Somali and Arabia in order to be free of the intermediation in their trade of the Ptolemaic rulers of Egypt. But these stories of a circumnavigation of Africa were tradition and hearsay and, in his consideration, of little weight against the belief of Hipparchus and Marinus of Tyre that the Indian Ocean was cut off from the Atlantic by an African barrier.

Alexander's conquest of India had disclosed an empire rich in possibilities of trade, and the rulers of the Greek state which he had set up in Egypt persisted in their efforts to establish a direct route to the Indus by way of the Red Sea and the Indian Ocean. Those efforts, as we have seen, were long frustrated by the insistence of the Arab upon his position as carrier and middleman. But by the second century B.C. we find the Ptolemies sending their ships beyond the Strait of Bab-el-Mandeb to trade along the Arabian coast and even, in B.C. 120 and 115, sending Eudoxus to India upon independent voyages. But in proportion as the Arab dominance began to weaken at this time so did the energy of the Ptolemies. They were kept out of the Persian Gulf by the Seleucids of Syria, the rival Greek rulers in Asia, and, when the Seleucid power had waned, by the Parthians. Decayed though it was, the Arab power remained sufficiently great to prevent their sailing to Guardafui. A change of great moment occurred, therefore, in the history of this commerce between East and West when in 30 B.C. Egypt came under the rule of Rome. Roman money and Roman enterprise gave it new life. The Egyptian fleets in the reign of Augustus went both to India and to Guardafui and beyond, and there was instituted at once a new era in world commerce which was to endure until the close of the second century A.D., when all things Roman suffered a decline.

Sometime in the course of this ceaseless effort by the Egyptians to reach India occurred an event, or a series of events, which immensely facilitated the navigation upon which their commerce rested. The Indian voyages of Eudoxus in 120 and 115 B.C. were coasting voyages of a tedious character. It was inevitable that sooner or later someone would strike out boldly on a direct course from Bab-el-Mandeb to the Indian peninsula, riding before the southwest monsoon that blew steadily from May to October. It is commonly said that this feat was accomplished by the Greek mariner Hippalus, who about 47 A.D. made the first voyage from the Arabian coast across the upper part of the Arabian Gulf direct to the mouth of the Indus, carried thither rapidly and with comfort by the monsoon. The historians who fix this date for the Hippalus voyage add that by 50 A.D. a succession of experimental voyages had resulted in even more direct courses across the Gulf, from Bab-el-Mandeb or from Guardafui, and in landfalls farther and farther south on the Indian coast until the port customarily attained was Muziris, now Cranganore, a town near the tip of the great peninsula. All this was before the time of Ptolemy the geographer. Because of it the shape of India was known to his contemporaries. Strangely, it seems to have been concealed from him. His portrayal of that land upon his maps seems to go little beyond the knowledge attained through the voyage of Nearchus from the mouth of the Indus to the head of the Persian Gulf, made four centuries earlier at the behest of Alexander the Great.

But Ptolemy's eastward extension of the African coast and his failure to portray India as a peninsula are not the only evidences we have that the world map of the Alexandrian was an unsatisfactory record of the geographical knowledge of his day. In the course of the enlarged commerce which followed the discovery by Hippalus of the direct course to India, a mariner named Alexander coasted the eastern shores of the Indian peninsula, rode the monsoon across the Bay of Bengal to Lower Burma, sailed thence southward along the Malay Peninsula, found, and passed through, the Strait of Malacca, and continued northward by way of the Gulf of Siam to Cambodia and Vietnam and probably beyond. The end of Alexander's voyage was the city of *Cattigara*, the exact location of which is uncertain. What is certain is that *Cattigara* did not lie where Ptolemy had placed it, that is, on the Indian Ocean at 10° S latitude, marking the spot, so

to speak, where his imaginary African and Asiatic extensions join. Ptolemy knew of this voyage to *Cattigara* made by Alexander the Mariner. In his *Geography* he discussed the account of it he had received from Marinus of Tyre, but neither that account nor his own acumen led him to realize that Alexander had found an outlet from the Indian Ocean to the seas beyond.

There must, indeed, have grown out of the trade which followed the voyages of Hippalus and Alexander a body of knowledge sufficiently full and exact to permit Ptolemy to free the Indian Ocean from the southern barrier he gave it upon his world map, and to open a way from it into the seas which washed the eastern coast of Asia. *The Periplus of the Erythraean Sea* offers other testimony that such knowledge existed in Ptolemy's day, or, certainly, that it had existed shortly before. The author of the *Periplus* seems to have believed not only that the Indian Ocean joined the Atlantic at the south of Africa, but that, sailing its eastern extremity, one might pass to "the sea outside ending in a land called This," whence were brought raw silk, silk yarn, and silk cloth." Ptolemy could have known the *Periplus* with its account of an unobstructed eastern coast of Africa, its record of the exploit of Hippalus, and its assumption of a passage from the Indian Ocean to the China Sea, but it is by no means certain that he did know a book which in his day, a full hundred years later, may have lost whatever degree of currency it once possessed. But one may go too far, may rest too heavily upon the vagaries and the sins of omission of the Alexandrian geographer. One need not, in truth, apologize either for the vagaries or for him. Whatever his sins, however rigid his theories, he remains the father of modern geography, the scientist who forced upon the world a cartographic system which takes into account the problems involved in projecting a sphere upon a plane and brought into common use the practice of locating places by reference to their latitude and longitude.

If there were reasons, as set forth in the foregoing section, for thinking of Ptolemy's portrayal of the Indian Ocean and its coasts as anachronistic even in the second century of the Christian era, how much more potent are those which apply to the editions of the great work printed without addition, gloss, or amendment in text or maps in the last quarter of the 15th century! This comment need not be interpreted as derogatory to the skill and intelligence of the 15th century editors of the book. It is a fair generalization to assert that the early recensions of ancient works in that and the preceding century were concerned chiefly with the presentation of the texts as received from the past. For those first scholars, warm with enthusiasm for the reborn knowledge, it was enough to collate and organize the records of the ancient culture every day being brought to light in the libraries of monasteries, princes, and savants. Criticism, emendation, and development would come in due course.

But even with so much said by way of extenuation, it sometimes seems that the fundamentalism, the reverence for the received text, displayed by the Renaissance scholar was carried to an extreme by the early editors of Ptolemy. Since the Alexandrian's day much had been added to the world's store of geographical knowledge when in the year 1410 Jacobus Angelus made the first translation of the *Geography* into the Latin. For one thing the Muslims in that period had become a great figure in the world. Stimulated by their new and militant religion, they began in the seventh century the dissemination of their faith and the enlargement of their political and economic life. Rome and Constantinople were no longer the mistresses of the world. The Muslims had pushed their conquests to the East and the West. Once more they were the merchant and carrier of the Indian Ocean, the freighter of merchandise between Asia

and Europe, and the agent and middleman in that difficult commerce. It would have been strange if those far-wandering traders, sailors, and men-at-arms, bridging the continents by their conquests, had not carried to their European kingdoms some notion, however vague, of the lands and seas and peoples which lay beyond their stations on the African coast and eastward of their empire in India. And yet it is a fact that little knowledge of the world is found upon the Islamic maps that have come down to us that had not been recorded centuries earlier by Ptolemy.

Nordenskiöld suggests in his *Periplus* that what was best in the Islamic maps was but Ptolemy in debased form. He has only mild praise even for the much lauded maps of Idrisi, the one engraved in circular form upon a silver plate for Roger II of Sicily in 1154, and the other a plane map of seventy sheets (#219) made about the same time to accompany the Arab scholar's own work, a detailed description of the known world. In our present interest, however, those maps deserve consideration, for they show an honest, if not always successful, effort to ascertain and record geographic truth, and furthermore they correct the errors of Ptolemy in one important particular. Idrisi retains on his plane map the southern land boundary of the Indian Ocean, but he has done away with the false southern extension of the coast of Asia and has opened the Indian Ocean to the eastern seas. His display of islands in the neighborhood of the Malay Peninsula shows plainly that an inquiring mind had been at work seeking information for a clear graphic record of that area. It has been pointed out that the place names upon this map are those employed in the tales of *Sinbad the Sailor*, hero of the *Arabian Nights*. There is a plausible literary theory that the Sinbad story was not wholly a creation of the artistic imagination, but that in the adventures of this fictional personage is found summarized the experience of many generations of Arab traders and mariners in the isles and seas of the eastern Indian Ocean.

Until recent years we might have brought forward at this point a map that would have demonstrated most satisfactorily the possession by the Renaissance world of full knowledge of the shape of Africa and the confluence south of it of the Indian and Atlantic Oceans. There was constructed in 1351 the *portolan* atlas which Nordenskiöld designates as the *Atlante Mediceo* (#233) and acclaims as a work of extraordinary significance. The map of Africa in this notable work shows that continent, more than a century before Bartholomeu Dias rounded the Cape of Good Hope, as a great southward-reaching peninsula thrust between the Atlantic and Indian Oceans. Since Nordenskiöld's time, however, close examination of this treasure of the Laurentian Library at Florence has shown that its portrayal of the southern portion of the continent is an addition of a later draughtsman. Just when this revision of the map was accomplished seems uncertain. In all probability the addition was made as the result of an increasing assurance on the part of the Portuguese of the early 15th century that Africa was in fact such a peninsula as we now know it to be. But whatever the explanation may be of this alteration in outlines, the map which suffered it may no longer be received as evidence that 14th century Europeans were aware of the peninsular form of that continent. More than a century elapsed after the construction of the *Atlante Mediceo* map before, in two maps of 1457 and 1459, Africa was so drawn as to leave little doubt that its peninsular character was understood by the cartographers responsible for the delineation. In the *Genoese* world map (#248) and the *Fra Mauro* map (#249), the Indian Ocean is shown as an open sea and Africa as a peninsula separating that ocean from the Atlantic. These maps were made some twenty years before the editors of Ptolemy, by implication certainly, contradicted the geographical facts affirmed in their delineations.

It is an historic fact that for more than half a century before the Ptolemaic map appeared in printed form explorers sent out by the Portuguese prince, Henry the Navigator, had been disregarding the picture of Africa set forth by the ancient geographer. Stage by stage, they and their successors had been pushing their way down the West African coast, intent upon rounding its extremity and making their way to the Christian Abyssinian kingdom of Prester John. The logic of this persistent exploration pointed clearly to a belief in an open Indian Ocean on the part of Prince Henry and the later Portuguese rulers and mariners whom he had inspired.

The final and the most effective criticism of the 15th century editors of the *Geography* is based upon their failure to embody in the Ptolemaic maps the greatly expanded knowledge of the world which through the narrative of Marco Polo's travels in the Far East had been current in Europe for nearly two hundred years before the period of their activities. His return from that voyage homeward from China to Venice in which Polo, passing through the strait of Malacca, had seen the waters of the South China Sea merge with those of the Indian Ocean, and at that time we shall speak of certain maps of the period before 1477 in which through the influence of Polo's story the land barriers of the Indian Ocean at south and east had been removed and Ptolemy's eastern bounds of Asia extended to the Pacific shores and beyond.

Claudius Ptolemy, whose second-century AD/CE *Geographia* achieved influence on contemporary as well as historical geography across Europe, particularly after its translation into Latin in 1406, disrupted the common late-medieval world view of the habitable world as a three-part *orbis terrarum* (circle of inhabited lands or *oikoumene*) surrounded and bordered by an ocean that becomes non-navigable and uninhabitable in the south because of the excessive heat of the so-called *torrid zone*. In its place, however, Ptolemy's *Geographia* set a detailed and, as it turned out, pervasive image of an Indian Ocean bordered by a *terra incognita* that linked Africa and the South East Asian promontory of *Cattigara*. In other words, the Indian Ocean after Ptolemy's re-introduction remained equally isolated, but in this case because it was land-locked. It should be noted that during ancient and medieval times all of the human activity (i.e., commerce, trade, etc.) took place only in the northern reaches of the Indian Ocean. Due to the plethora of languages and the state of marine technology, most interactions among the people of the Indian Ocean region, from Southeast Asia to Africa and the Middle East was subject to misinterpreting geographic information (distances, landmass descriptions, etc.), protectionism of trade routes ("secrets") and conflicting information.

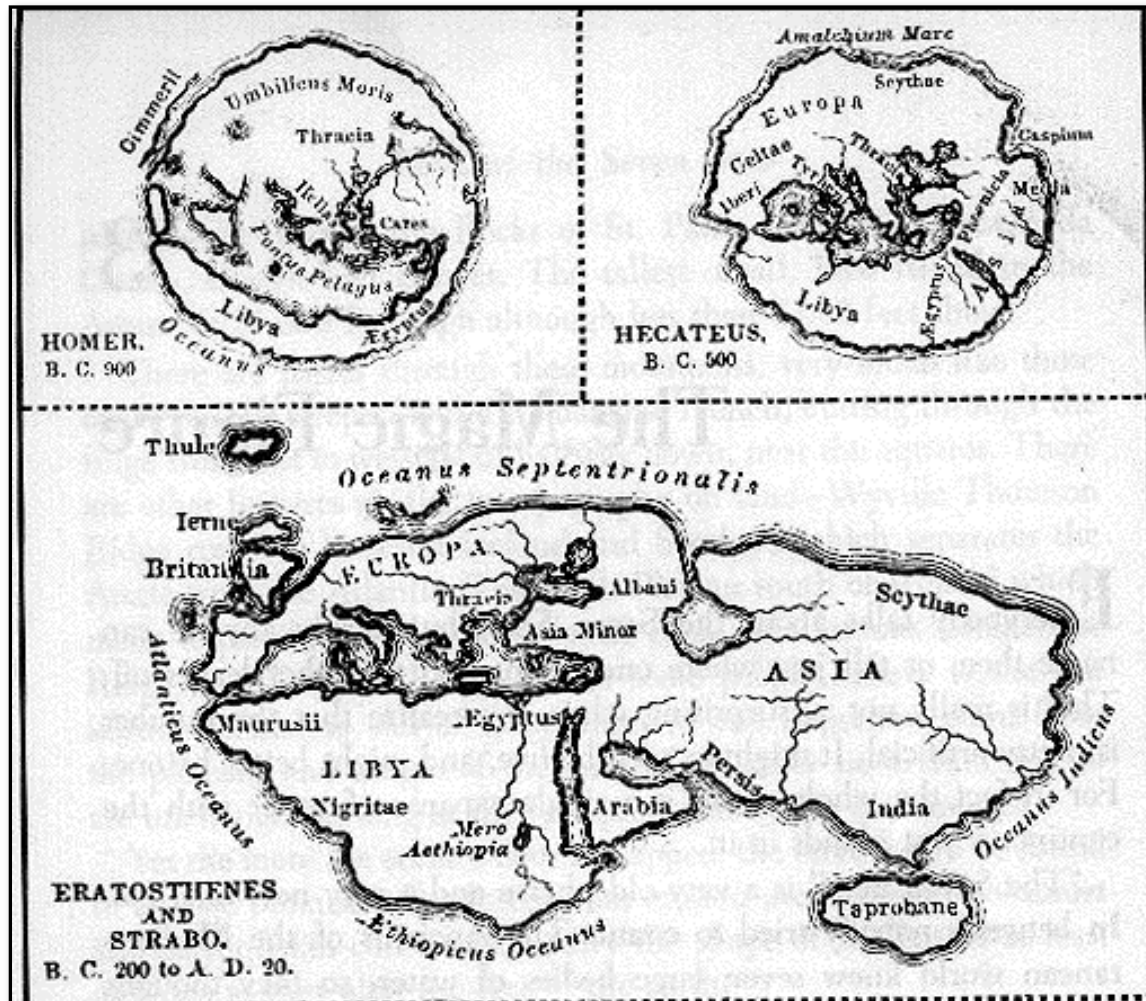
Ptolemy saw the world as a complete sphere, but the inhabited area as only a part of it, stretching south some 16 degrees beyond the Equator, north to about the Arctic Circle, east a little beyond Malaya, and bounded on the west by the Atlantic. Although his lists locate places by their geographical coordinates it is clear that these did not all come from immediate observation but were worked out from whatever information was available, such as accounts of journeys giving distances from one place to another; this means that their appearance of great accuracy is often spurious.

Ptolemy's text concludes with "A descriptive summary of the map of the inhabited earth" and the statement: "*That part of the earth which is inhabited by us is bounded on the east by the unknown land which borders on the eastern races of Greater Asia, namely the Sinae and the Seres, and on the south by the likewise unknown land which encloses the Indian sea and which encompasses Ethiopia south of Libya, the country called Agisymba, and on the west by the unknown land encircling the Ethiopian gulf of Libya and by the Western ocean bordering on the western-most parts of Africa and Europe. . . .*". This statement, if it is indeed

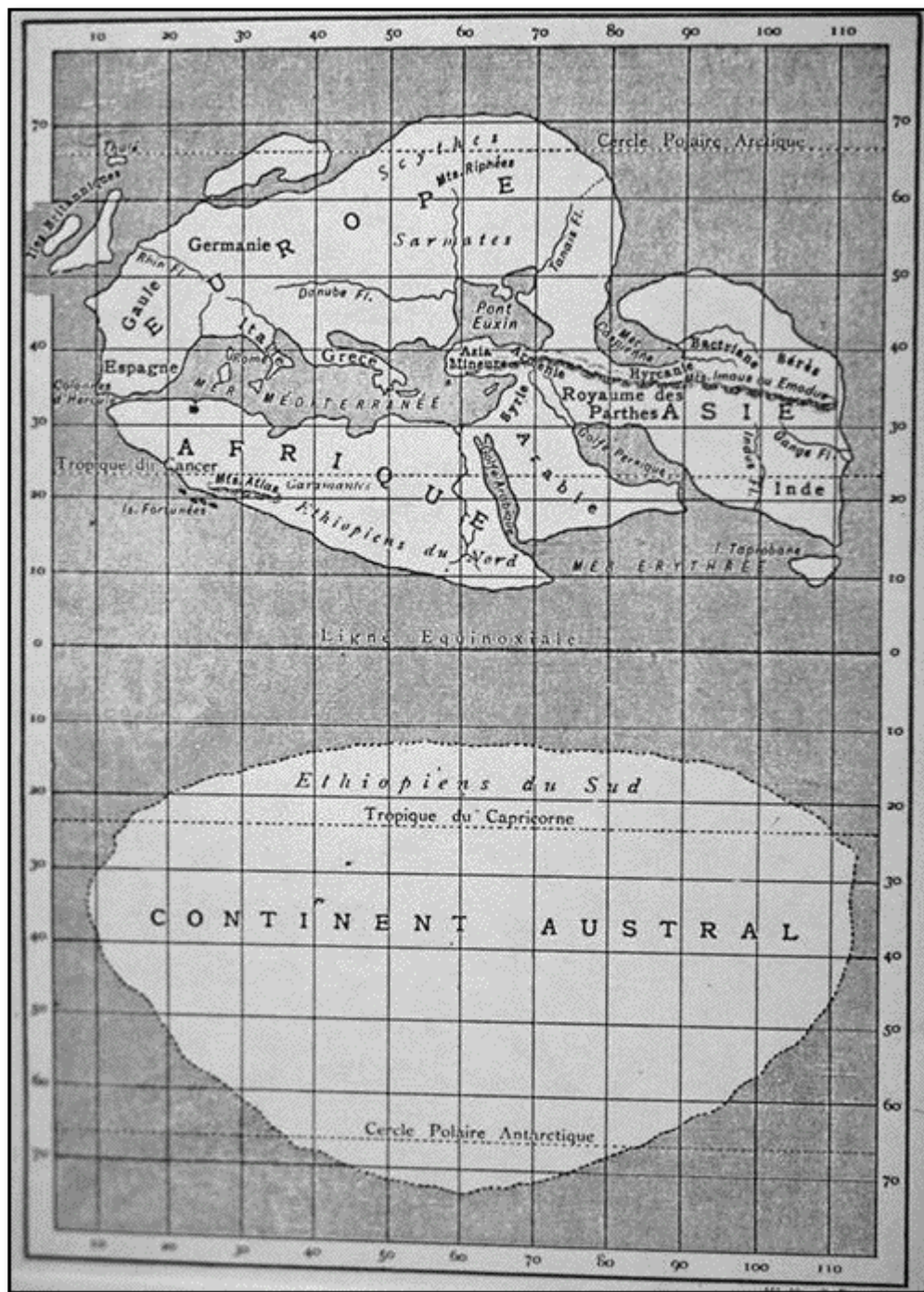
that of Ptolemy, states the belief that the Indian Ocean was enclosed by land stretching from southern Africa all the way to eastern Asia.

The oldest surviving manuscript of Ptolemy's Greek text was copied more than a thousand years after he wrote; it dates from the late 12th or early 13th century. Enough other copies survive from the 13th and 14th centuries to show that it was, perhaps had suddenly become, a popular work in the Byzantine Greek cultural world. Some, not all, of these medieval manuscripts include maps, and of these there are two versions. In both versions there is a world map, but one has 64 regional maps while the other, following Ptolemy's text more literally, has 26. These maps may or may not have been compiled by Ptolemy himself. His book gives instructions for making the maps but does not say in so many words that he has actually drawn them. They may have been constructed from the text and added to the book by a copyist at any date between Ptolemy's own time and the earliest known manuscripts. There is also some reason to suppose that the world map was constructed separately from the regional maps of either version (*see #119*).

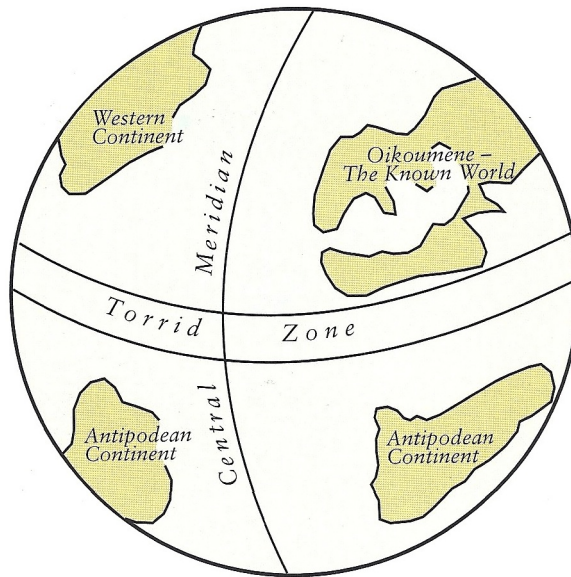
Prior to the writings of Ptolemy, the Greeks developed observations about the size and shape of the known world. Philosophers and historians such as Homer, Hecataeus, Eratosthenes, Strabo, Herodotus, and Crates wrote treatises describing their concepts of the physical world.



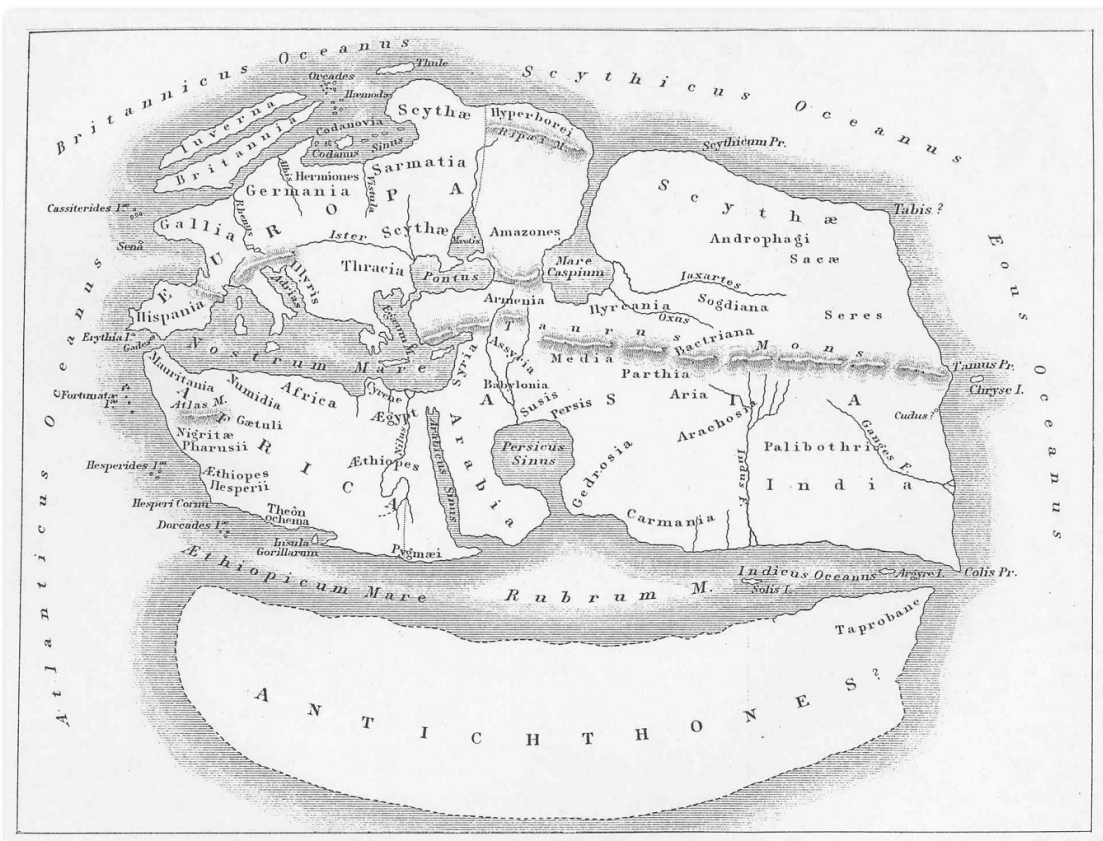
These Greek concepts included a round spherical earth with an all-encompassing world ocean; and some also included an austral continent south of the *oikoumene* which thought to provide “balance” and “symmetry” (#106).



A reconstruction of the Greek frame of the world (after Reinaud) #106



Crates concept of the world with four "balancing" landmasses (see #113)



Reconstruction of Pomponius Mela's world view, 37 C.E. (see #116)

As mentioned above, a tantalizingly brief story by the Greek historian Herodotus concerns a sea voyage that took place during the 26th Dynasty reign of Necho II. He relates the circumnavigation of Africa some 2,000 years before the Portuguese mariners of Vasco da Gama. We are not really given a reason for this expedition, though it would seem that such voyages were made for economic gain. Considering the control of the northern shores of the Mediterranean by the Greeks and of the southern coasts by the Phoenicians, the only region where Egypt, with its inferior fleet, might acquire some influence and wealth would have been Eastern Africa, where they had already established some trade. However, it has also been suggested that the voyage might have served a military purpose.

According to Herodotus, Necho II ordered a Phoenician-crewed fleet to leave Egypt from the east by way of the Gulf of Suez and to return via the Straits of Gibraltar at the Mediterranean's western mouth. Hence, he expected this expedition to navigate around Africa clockwise. This would be a long journey, in which the crew would help support themselves by establishing temporary settlements on land where they would cultivate crops during the voyage.

According to the story, after two full years the fleet eventually rounded the *Pillars of Hercules* (the Straits of Gibraltar), and returned to Egypt during the course of the third year. Herodotus finishes the story with a surprising conclusion:

The Phoenicians made a statement which I myself do not believe (though others may if they wish) to the effect that they sailed west around the southern end of Africa, they had the sun on their right.

This is exactly what they would have seen going west around the Cape of Good Hope at the southern tip of Africa, because the sun appears to the right when traveling westward in the southern hemisphere, but how could Herodotus have known this at such an early date if the journey did not take place. Outside of Herodotus' account, there is little or no evidence of such a voyage. However, most of his story appears to at least be plausible, and it should be noted that this voyage took place not so very distant from Herodotus' own time. His *Histories* were written in about 440 BC, while Necho II came to the Egyptian throne in about 610 BC.

The Egyptians would have known, for some time, a certain length of Africa's east coast, for they had from earlier times been making visits to the *Land of Punt*. Though *Punt's* exact location remains unknown, it was almost certainly on Africa's east coast somewhat south of Egypt. The Phoenicians had been in contact with the Atlantic since the trading port of *Gadir* (modern Cadiz) was founded in about 800 BC. They also possessed ships that were capable of sailing through the Straits of Gibraltar and along the North African coast, so technically a trip around Africa would have been possible. In fact, the winds and currents favor an east-west circumnavigation of Africa, and navigation would have been no problem if they kept the coast in sight. Furthermore, the Egyptians had for many years undertaken sea voyages to *Byblos*, on the Levantine coast, and to *Punt* by way of the Red Sea. Though the circumnavigation of Africa under Vasco da Gama, who sailed from Lisbon in Portugal to Calicut in India, took only ten months between 1497 and 1498, the two and a half year journey of the Phoenician ships also seems reasonable, especially considering their layover to replenish their supplies.

The tale is also consistent with the foreign policy of Necho II, who sought to benefit Egypt economically by improving access to sea routes. He is credited with probably starting the construction (or restoration) of a canal some 85 kilometers long

and wide enough for sea going ships, connecting the Nile Valley with the Red Sea. This canal, foreshadowing the modern Suez canal, later became an internationally important trade route.

However, while many readers of Herodotus have taken this story for granted, it does not in fact prove that Necho II's fleet did circumnavigate Africa. It must be remembered that Herodotus' *Histories* is an elaborate piece of rhetorical writing, and is not an objective history, but rather a highly literary, as well as partisan, analysis of the cultural clash between the Greek and Persian cultures.

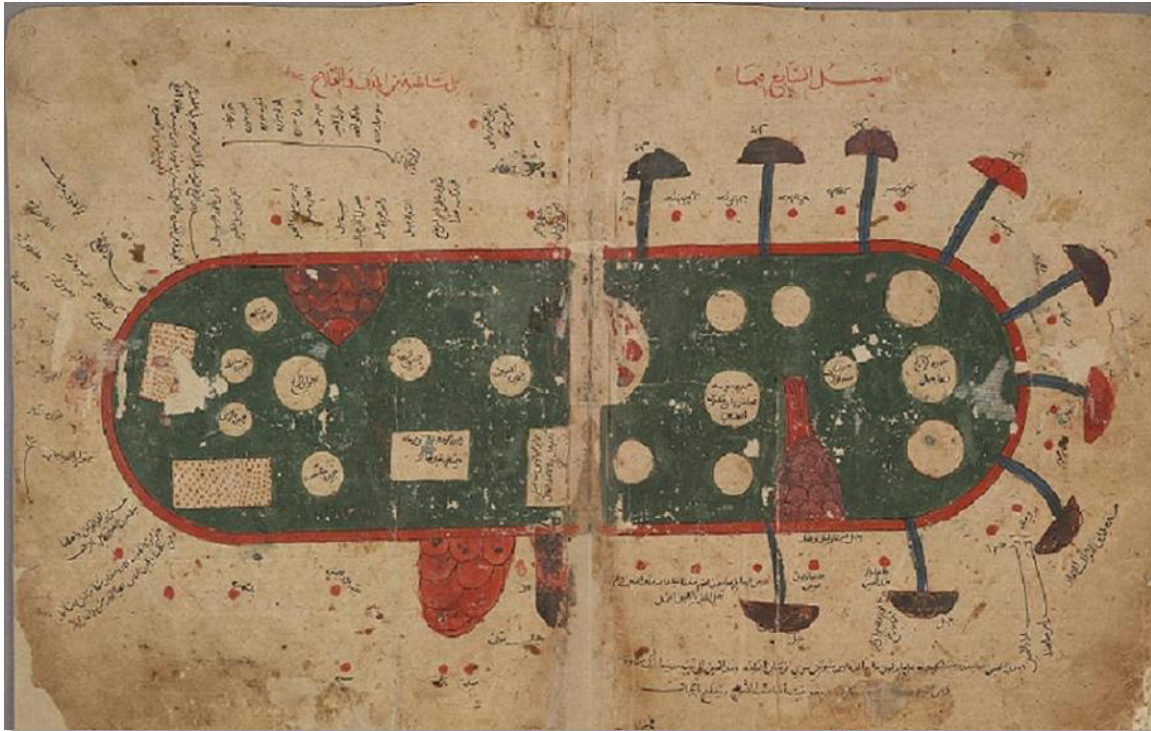
According to Philippe Foret and Andreas Kaplony in *The Journey of Maps and Images on the Silk Road*, although the depiction of the Indian Ocean as an enclosed sea may suggest a direct borrowing from Ptolemy, a more detailed observation suggests that this was not the case. As is well known, Ptolemy surmised that the Chinese coast extends southward and the African coast eastward, so that they eventually join up. Muslim geographers were heavily influenced by Ptolemy, and their world maps often envisage the coasts of Africa as running eastward parallel to the coasts of Southeast Asia and China. Other medieval Islamic geographers, including the two world maps found in the late 12th century *Kitāb Gharā'ib al-funūn wa-mulah al-'uyūn* itself, known as the *Book of Curiosities*, allow for a narrow opening at the eastern edge of the Indian Ocean. Moreover, it seems that the author, while depicting the Indian Ocean as an enclosed oval, still conceived of a passage between the Indian Ocean and the *All-Encompassing Ocean*. A long legend to the left of the protruding mountain of Cape Guardafui notes that: "The traveler here encounters the Land of the Zandj [East Africa] at the edge of the All-Encompassing Ocean [al-Bahr al-muhif]. Whoever wants to go there [i.e., to the All-Encompassing Ocean] is thrown back by the waves, but whoever seeks the Land of Zandj, the sea waves come from behind [and assist him]". In this passage, the author appears to suggest that the open sea beyond the Horn of Africa does lead to the *All-Encompassing Ocean*, but that the prevailing winds draw ships toward the shores of East Africa.

The depiction of the Indian Ocean here as an enclosed sea may be a result of stylistic considerations rather than geographical conception. The general shape of the Indian Ocean appears remarkably analogous to the *Book of Curiosities'* depiction of the Mediterranean Sea in a map that immediately follows. Both of these maps have no parallel in other geographical works, and both appear to be original to the author. The author of the *Book of Curiosities* was sufficiently acquainted with sailing on the eastern Mediterranean as to be able to list, in correct sequence, more than a hundred bays, and reproduce the names of about a hundred islands. He was not, however, well informed about the Asian coasts and islands and had recourse to the *Akhbar al-Sin wa-l-Hind*, Ibn Khurdadhbih, or other earlier sources. In June 2002, the Bodleian Library acquired an illustrated manuscript of this hitherto unknown Arabic cosmographical treatise, the *Kitāb Gharā'ib al-funūn wa-mulah al-'uyūn*, known as the *Book of Curiosities*. The manuscript is a copy, probably made in Egypt in the late 12th or early 13th century, of an anonymous work compiled in the first half of the 11th century in Egypt. The treatise is extraordinarily important for the history of science, especially for astronomy and cartography, and contains an unparalleled series of diagrams of the heavens and maps of the earth.



*The oldest extant rectangular world map, the late 12th or early 13th century
Book of Curiosities' Book 2, Chapter 2 (MS. Arab. c. 90, fols. 23b-24a). © The Bodleian Library.*





Map of the Indian Ocean: Book of Curiosities' Book 2, Chapter 7: "On the cities and forts along the shore [of the Indian Ocean]" (MS. Arab. c. 90, fols. 29b-30a). © Bodleian Library.

The assumption that Ptolemy actually believed in an enclosed Indian Ocean has been debated. Historian Wilcomb Washburn, in an article published in 1985, argued that Ptolemy and other geographers of his time and earlier did not believe in the closed Indian Ocean. Instead, according to Washburn, this idea emerged in the late Middle Ages in relation to arguments between those who believed that the unknown portions of the earth were primarily land versus those who believed that the unknown regions were predominantly seas. Washburn wrote that the "arbitrary character of the presumed southern border of the map and the southern border of the land on Ptolemy's maps" suggests errors of copyists. Though he had never made an actual count, Washburn thought that most of the printed editions of Ptolemy's *Geographia* showed the enclosed Indian Ocean while many of the manuscript world maps had an open Indian Ocean. The areas in question should have been left as blanks if the mapmakers were being honest, but because of "man's compulsion to fill them in" the land bridge was added.

One radical interpretation of the "enclosed sea" is worth noting. D.E. Ibarra Grasso, in 1970, proposed the thesis that Ptolemy's enclosed sea is the Pacific Ocean. In that case *Cattigara* is on the west coast of South America. This idea has not received much support, as it would be very difficult to prove, but it is a stimulating idea in any case, and one example of how different viewers may interpret maps in various ways.

As previously stated, it was a text with maps that was translated into Latin by Jacobus Angelus in about 1406 that first introduced Ptolemy's *Geographia* into Western Europe. Its impact is shown by the number of surviving 15th century manuscripts of the Latin version and by the succession of early printed editions. The first, at Vicenza in 1475, had no maps, but it was then published with maps at Bologna in 1477, Rome in 1478 (40) and 1490, Ulm in 1482 and 1486, and so on. It is shown too by the way that

other world maps published during this period quickly assimilated elements from Ptolemy's. Thus the map shown below that was copied by Pirrus de Noha in about 1414 to illustrate a quite different geographical text of the Roman period, the *Chorography* of the first century author Pomponius Mela (#116), takes from Ptolemy the following: its land-locked Indian Ocean, the shapes of Malaya and Sri Lanka (*Taprobana*), the Mediterranean Sea 20 degrees too long, the *Mons Lune* [Mountains of the Moon] as the source of the river Nile, no clear indication of the shape of central-southern Africa or the Far East, etc. This is an attempt to display only the *oikoumene* or known inhabited world, not an attempt to display those parts still unexplored.

Measuring 18 x 27 cm the de Noha parchment has been painted so that the oceans and seas are displayed in blue (the Red Sea is an exception and is shown in red), the mountains as symbolic sawtooths in brown on the natural colored parchment landmasses and the text is in red. There is the influence of the *portolan* [nautical] charts with regards to familiar coastlines, particularly the outlines of the Baltic and Caspian Seas, although Scandinavia is displayed as a massive peninsula with Greenland not yet joined to it, as it is in the later work of Clavius. Many of the geographical names in the countries of the interior recall Ptolemy and a total lack of adornment such as castellated towns, pictures or vignettes to occupy unknown areas.



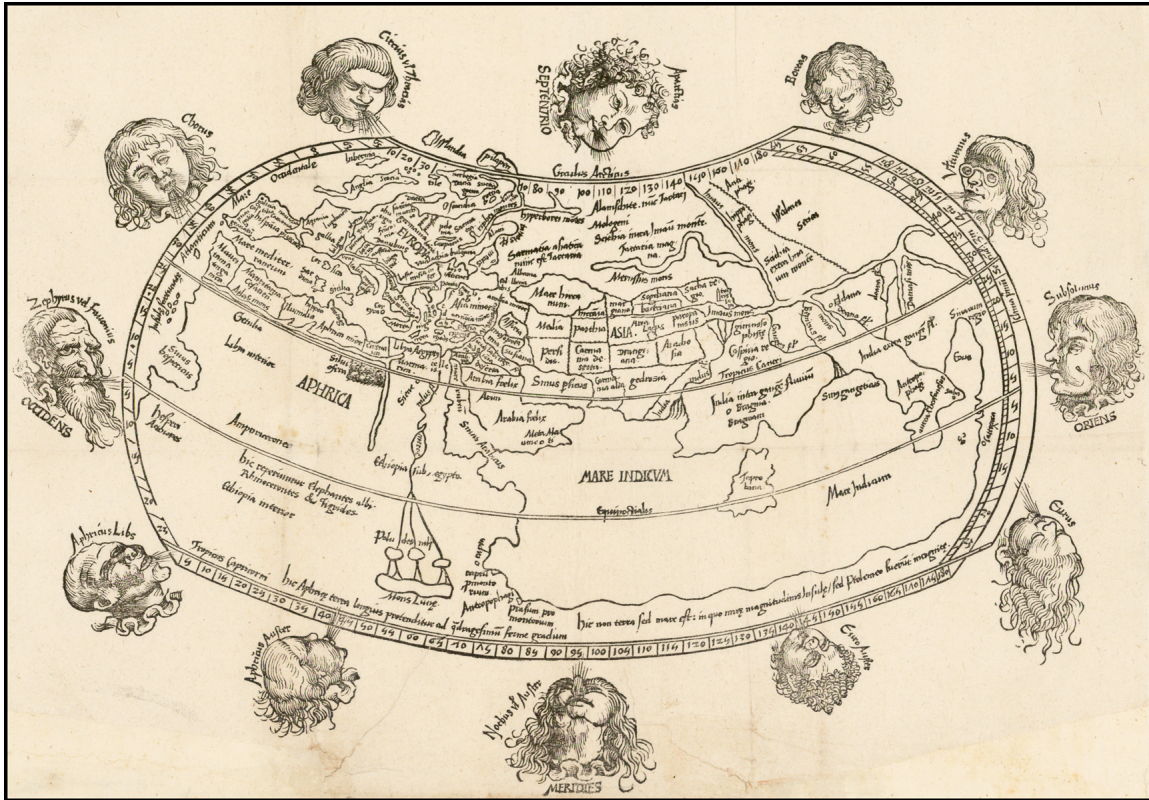
World map of Pirrus de Noha, 1414,
showing an enclosed Indian Ocean based upon Claudius Ptolemy (#239)

A rare Ptolemaic world map included by Gregor Reisch, the compiler of the *Margarita Philosophica* [Pearl of Wisdom], shown below, was first published in Basel in 1503; 10.6 x 15.9 inches, (27 x 40.5 cm). The world map shows the Indian Ocean enclosed by land. Reisch has added his observation on the supposed land connection between Africa and the East, as follows: “*Here is not land but sea, in which there are such islands not conceived of by Ptolemy*”. In this way Reisch shows awareness of the voyages of Vasco da Gama and possibly that of Christopher Columbus. Thus he refutes Ptolemaic geography, but with words, not by changing the map. It was a time when new information about geography came to scholars regularly. This information had to be incorporated, somehow, into the classical view of the earth that was represented in the maps of Claudius Ptolemy. The first edition of Gregor Reisch’s untitled map of the world is widely regarded as the first printed map to provide information concerning Columbus’ discoveries in the New World.

This is the first of four world maps by Reisch that appeared in his *Margarita Philosophica*, first published in Friburg in 1503. Though Ptolemaic in its geographic content, this map contains a legend that alludes to the discovery of the New World. The islands to which Reisch refers may be either Australasia, the Spice Islands, or most likely, the Caribbean, as Columbus had sailed west in search of a navigable trade route to Asia and was then actively promoting his strongly held belief that he had made landfall in the South China Sea, still unaware that he had in fact discovered a new western continent. Hence, the location of the note concerning the discovery of the New World in the land-bridge is consistent with Columbus’ belief that he had made contact with the islands off the coast of Asia.

In addition to the important reference to Columbus’ discoveries, the map is also widely recognized as the first map to incorporate a scale of measurements for longitude and latitude, a landmark scientific advance. The map is embellished twelve lively wind-heads, one of which includes what is believed to be the first printed depiction of eyeglasses. The stylized wind-heads are a significant departure from the traditional cherubic faces normally scene on 15th Century printed maps.

The *Margarita Philosophica* is an encyclopedia of knowledge, including commentaries on anatomy, astrology, astronomy, geometry, music, natural history, philosophy, and geography.



Ptolemaic world map by Gregor Reisch, 1503, showing an enclosed Indian Ocean even after the successful circumnavigation of Africa by the Portuguese in 1497-99. Below is a 1482 Ptolemaic world map from the *Cosmographia Germanus*, Ulm edition



Below is a typical *Macrobius* map (see #201) printed in 1483, where the sphere of the earth is divided into the five climatic zones. The map is oriented with north at the top, where the Northern, Frozen Zone lies. Below it lies the Northern Temperate Zone, which includes the whole of the inhabited world and most of the then known landmasses. A small part of Africa extends into the *Perusta* [Torrid] Zone, too hot for living creatures. Most of this zone is taken up by *Alueus oceani* [turbulent sea], whose circulating currents oppose each other, creating the tides.

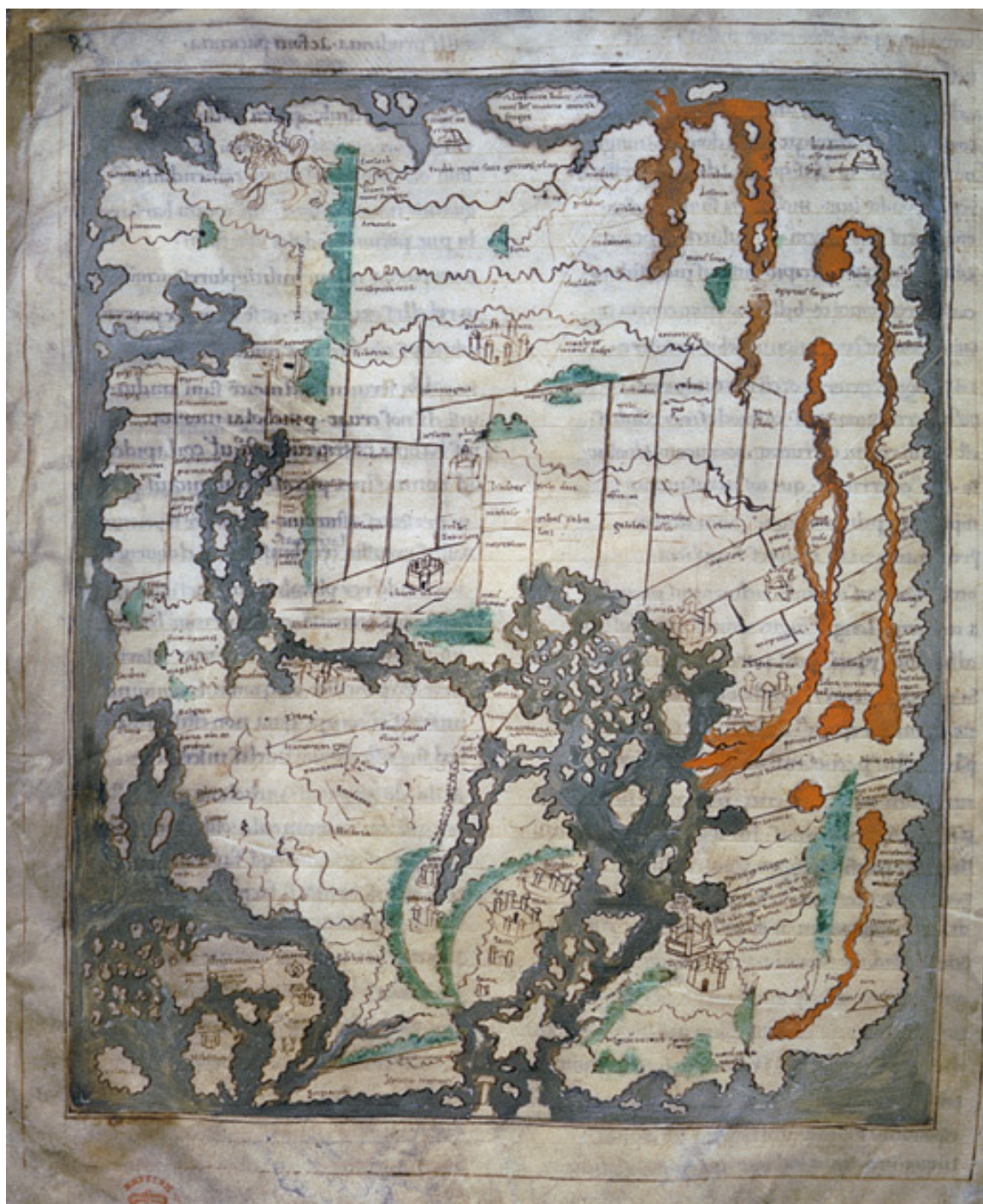
To the south of the central *Torrid* Zone lies the unknown *Southern Temperate* Zone, purportedly occupied by the *Antipodes*. This zone is called *Nobis Incognita* that is "unknown to us", implying that the creatures living in the zone are not descendants of Adam. It must be noted that Macrobius was considered as a pagan writer and his maps are bereft of any religious references.

In the *Northern Temperate* Zone the landmasses shown in this map are those of Asia, Africa and Europe, none of them named, while the countries of *Britania*, *Ispania*, *Aethiopia Perusta*, *Armenia* and *India* are named. From the seas *Mare Rubrum* [the Red Sea] is named.

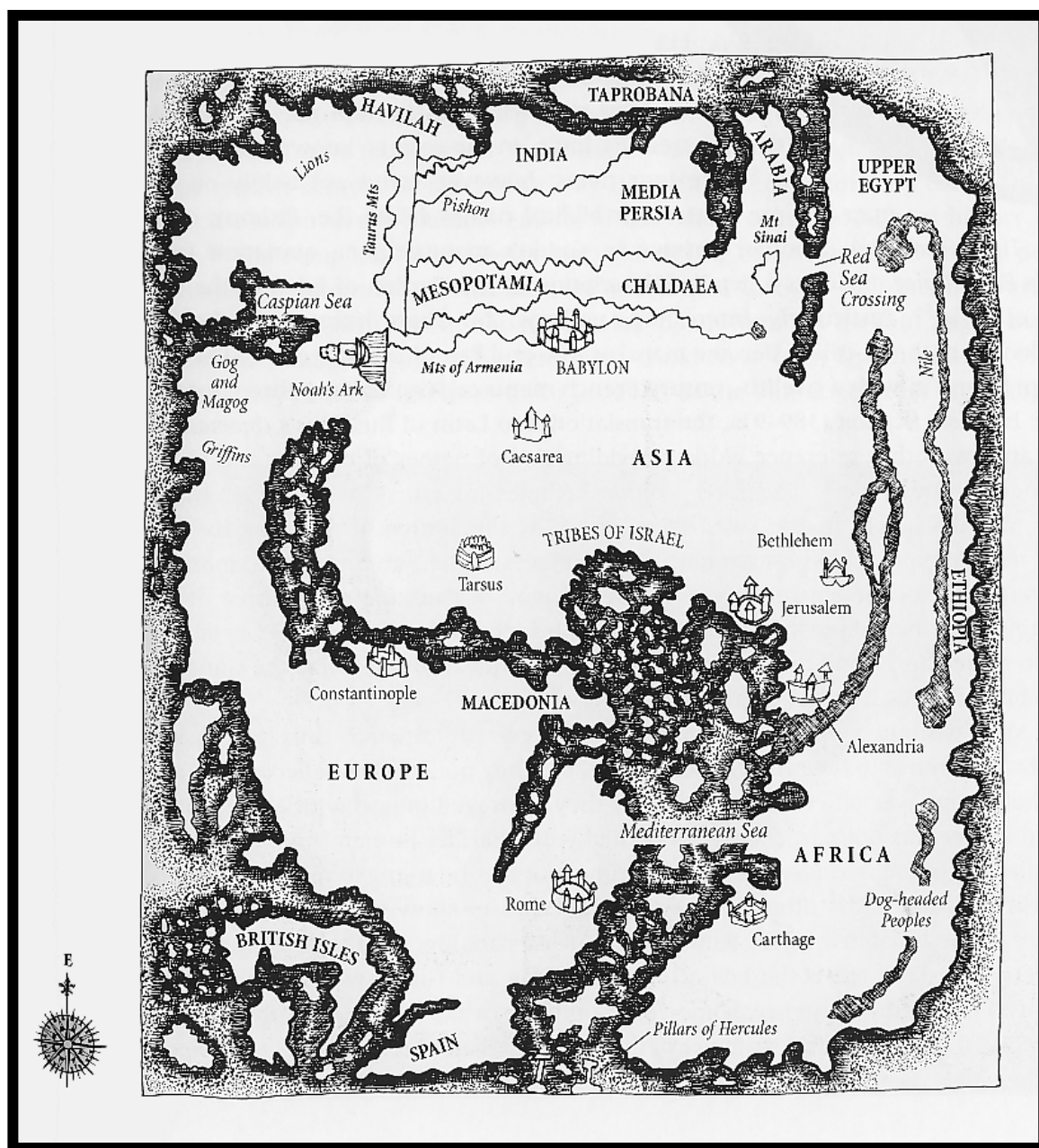
Below that is the 10th century *Cottoniana* or *Anglo Saxon* world map that displays an all encompassing world ocean, but no austral continent.



Macrobian world map, 1483, 14.3 cm diameter (#201)
The Huntington Library, San Marino, California (HEH 91528)(#201A)



*The Cottoniana or Anglo-Saxon Map, c. 995, 21.2 x 17.6 cm, (#210)
British Library, Cotton MS Tiberius BV, f.56v, oriented with East at the top, a world map that
displays a circumfluent, all encompassing ocean*



A re-drawing of the Cottoniana/Anglo-Saxon world map

From a very early date, the Indian Ocean, like the Mediterranean Sea, was traversed by sailors, traders, religious men, and migrants moving in search of goods, new lands, or the great unknown. Their movements were shaped by numerous factors, both geographic and social in origin. Exchanges are not solely shaped by geographic and economic factors, but also by systems of ideas and by the balance of power. Over centuries, these exchanges transformed the Indian Ocean into a unified space. The cartographic representation of the Indian Ocean in the Middle Ages is a special case in the history of cartography, still puzzling the historians of geography. The present contribution offers some remarks on probabilities and patterns of knowledge transmission across time and massive diversity of societies of the region and to assess its place in the history of science and civilization. The source base is the corpus of medieval Arabic compositions having to do with geography, travel, and sailing on the Indian Ocean because it was these Arab traders and mariners who became the primary “links” between the Far East and Europe. Two vectors of knowledge transfer are explored: (1) between formal and informal geographical records and (2) between academic geography and the practical knowledge of the ocean and its coasts by Indian Ocean mariners.

The earliest extant Arab/Islamic sources dealing with the Indian Ocean date to the ninth century A.D. It has been long established that the founders of Islamic world geography relied significantly on Greek sources, in particular on the aforementioned *Geographia* of Claudius Ptolemy (c. 90 - 168 A.D.). The following discussion will first touch on a few early examples illustrating the transmission of antique geographical information about the Indian Ocean in very general terms. One of the early Arab interpreters of Ptolemy (both in astronomy and geography) was Muhammad ibn Musa al-Khorezmi, or Khuwarizmi (d. c. *Anno Hegirae* (A.H.) 232/846-847 A.D. In the description of African coastal locations of the First Climate and those south of the Equator, he transcribes a number of port cities with their geographical coordinates. There is, however, no narrative describing the ocean in the imperfectly preserved unique manuscript, although it probably existed because we can find a brief sketch in *Kitab al-Zij al-Sabi`* of al-Battani (c. A.H. 244-317/858-929), a later translator of Ptolemy's tables other than al-Khorezmi, who provides the ocean's dimensions. They had measured the Sea of India and say that its length, counting from the west to the east, from the limits of Ethiopia (*al-Habash*) to the borders of India (*al-Hind*) is 8,000 miles, while the width is 2,700 miles. It extends 1,900 miles south of the island of the Equinox. Near the land of Ethiopia the sea forms a gulf in the direction of the Barbara, called *al-Khalij al-Barbari* (that is, *Sinus Barbaricus*); its length is five hundred miles and the width of its seabed is one hundred miles.

Within a century from the first translation of Ptolemy, al-Battani's data were adopted and transmitted further. The same numbers are quoted a few decades later in *Kitab al-Unwan* [Book of Chapter Titles] by the Christian historian Agapius of Manbij (mid-to late 10th century A.D.), who omits the tables of geographical coordinates, but preserves narrative sections about the Earth and its regional divisions and includes the chapter “On the Seas, Gulfs, and Islands”.

The monsoon climate of the Indian Ocean was known to the Hellenistic Greeks as shown in the *Periplus of the Erythraean Sea* (c. 70 A.D.). This book ascribes its discovery to the Greek navigator Hippalus (1st century B.C.). The same source credits Arab seamen with plying the sea routes of the Indian Ocean, at least of its eastern part, as far as Ceylon/Sri Lanka, or the Greek *Taprobane*.

The earliest Arab reference to the regularity of Indian Ocean monsoons is to be found in the *Kitab al-Buldan* [Book of Countries] c. A.H. 289-290/902-903 A.D., by Ibn al-Faqih al-Hamadani, one of the founders of Islamic descriptive geography:

Know that the Seas of Persia (*Fars*) and India are in fact one sea because they join one another, except that they are unlike each other [for navigation]. . . As to the Sea of India, shortly before the Spring Equinox, when the Sun is the constellation of Pisces, it becomes dark and hard. Many waves appear, and nobody sails it because of the dark clouds and storms while the Sun is in the Gemini. When the Sun moves to the constellation of Virgo, the darkness of the sea dissolves and navigation becomes easy, until the Sun again reaches Pisces. The Sea of Persia is navigable in all seasons, but people refrain from sailing the Sea of India during its stormy period due to the darkness and difficulties. (Kubbel' and Matveev, 1960:72)

In the 10th century, to the formal and general descriptions of the known parts of the world are added travel accounts. Of these, *The Marvels of India* (*ʿAdjaʿib al-Hind*, c. 953 A.D.), are full of *mirabilia* stories and sailor adventures in ships, ports, and islands of the ocean. In the case of the historian al-Masʿudi (d. A.H. 345-346/965 A.D. see monograph #212), to his awareness of formal geographies of the world and the region is added his personal travel experience because of his first-hand knowledge of Arabia, India, Sri Lanka and China as well as the East African coast. Masʿudi is familiar with classical geographical place-names: he calls the western Indian Ocean the *Habashi Sea*, that is *Ethiopian*, in the tradition of Greek usage of “Ethiopia” for not strictly *Abyssinia* (the toponym derived from the Arab *Habasha* for Ethiopians, their neighbors across the Red Sea), but also for sub-Saharan Africa as a whole. On the other hand, Masʿudi also indicates a degree of familiarity with Islamic maps of the region. In his *Muruj adh-Dhahab* [Gold Meadows] he says: “The Sea of the *Zanj* and the *Ahabish* is to the right of the Sea of India, even though their waters adjoin”. The words “to the right” indicate that Masʿudi visualizes a cartographic representation of the ocean according to the dominant in Islamic cartography orientation to the South (some maps show orientation to the East). For map examples, see those above and in monographs #211, #212, #213 and #214).

Al-Masʿudi also knows of *al-Khalij al-Barbari*, or the Barbari Gulf of the Ethiopian Sea, originating in Ptolemy's *Geography*. The Arab ethnonym *Barbara*, in the context of northeast Africa (as opposed to *Barbar* in North Africa), refers to Kushitic populations of Somali and the Red Sea coast in its southern part on the African side. Thus, *Sinus Barbaricus* or the “Barbari Gulf” of the Indian Sea is the Red Sea, and especially its southern part; the western part of the Indian Sea is also called the *Habashi* (that is, *Abyssinian*, or *Ethiopian*) Sea in earlier Arab geographies. The northern part of the Red Sea is usually called *Bahr al-Qulzum*, so named after the port village of Clysma at the northern point of the Gulf of Suez; this name eventually drives out the use of the term *al-Khalij al-Barbari*, except in old-fashioned retellings of the globe's major geographical features. On Ptolemy's extant Latin maps, the Red Sea is named *Sinus Arabicus*, but a Greek manuscript map of Ptolemaic *Aithiopia below Egypt*, produced around 1400, shows the name *Barbarikios* off the eastern seaboard. It should be noted that the red coloring, used in European *mappaemundi* for the Red Sea, was never applied in Islamic maps. The 1482 print world map of Ptolemy shows the red tint applied not to the Red Sea itself, but to the part of the Arabian Sea that later became known as the Gulf of Aden.

Thus, beginning with late-Hellenistic and early-Roman period and reaching into the Islamic “Golden Age,” written evidence registers the Arab presence in the western

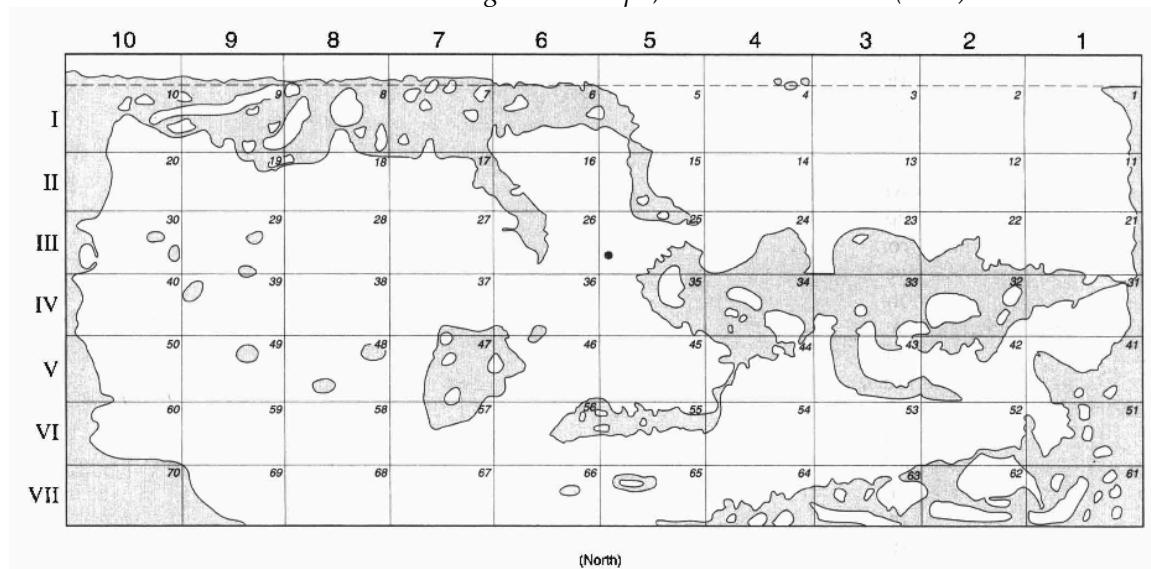
Indian Ocean; it confirms Arab knowledge of the sea and the use of Arabic as both a source of information and medium of international communication and transmission of knowledge. By the 10th century Arabic scholarship had produced a synthesis of received, preserved older and newly-developed knowledge. This body of classical Islamic geography combined or absorbed, in varying degrees, these three recognizable, if not independent, streams: (1) Greek *ecumenic* geography (largely, but not exclusively, Ptolemy), (2) Arab-Islamic travel narratives, and (3) Islamic cartography. It will be noticed that this list does not include Persian geography or a separate mention of Greek cartography. The former remains a lacuna, a question mark. Despite the evident, and recognized, impact of pre-Islamic Persian geography on Islamic regional geography and despite Persian participation in Indian-ocean trade and other maritime activities, well illustrated in the *Marvels of India*, since at least the Sassanid period, we lack tangible narrative evidence of specific and identifiable Persian elements in the mainstream representation of the Indian Ocean in early Islamic scholarship as a maritime entity beyond a simple enumeration of the traditional “Seven Seas” (in parallel with the *Seven Climates*, the Persian *kishvar-ha* regions, as distinct from the latitudinal Greek *κλίματα*).

For the best example of Greek influence on Islamic geography, and cartography, we first return to Ptolemy and then leap forward to the 12th century, when Muhammad al-Idrisi (A.H. 493-560/1100-1165 A.D. #219) produced a world geography and a related series of maps considered the pinnacle of Arab-Islamic geography. Idrisi worked at the Norman court of Sicily where, under patronage of Roger II (1098-1154), he had access to both Arab and European sources, some of which he names. Born in Morocco, Idrisi traveled at least as far east as Asia Minor, but much of his book is data compiled from earlier works. The projection of Idrisi maps is uniquely original and has not yet been explained. The undisputed and strongest systemic influence, however, came from Ptolemy. The narrative follows the maps, observing the Greek system of the *Seven Climates* that start from the Equator and rise to the Northern Polar Circle. Idrisi adds a section south of the Equator and instead of degrees of latitude and longitude he breaks the map up into ten sections per clime. In each section, major cities and geographical features (sea, lakes, rivers, mountains) are named and described, with added ethnographic and cultural information, sometimes contemporary and sometimes long since outdated.

As can be seen below, this rectangular map displays an open Indian Ocean that is heavily populated with large islands and is bordered on the South by a very eastwardly extended Africa. Idrisi’s Indian Ocean is open in the east, but in his sectional maps the eastern coast of Africa turns east above the Equator and forms the ocean’s south coast extending to Indonesia. Idrisi’s *Geography* (*Kitab Nuzhat al-Mushtaq*) in general had a strong impact on Islamic world cartography and descriptive geography, especially in the western Islamic lands. While Ptolemy was not yet lost to Idrisi, the latter’s overall influence in some ways reduced the felt need for ancient authorities. References to “Sharif al-Idrisi” made citing Ptolemy less necessary for later compilers, at least in geographical matters.



A modern copy of Al-Idrisi world map from the *Nuzhat al-mushtāq fi'khtirāq al-āfāq*, a.k.a *Tabula Rogeriana*, oriented with South at the top, 1154, *Bibliothèque nationale de France* (MSO Arabe 2221) as reconstructed by the German cartographer Konrad Miller in 1927 and published in Stuttgart in 1928; better known as "The large Idrisi map", size: 195 x 92 cm. (#219)



Index of the sectional maps in the *Nuzhat Al-Mushtaq*.

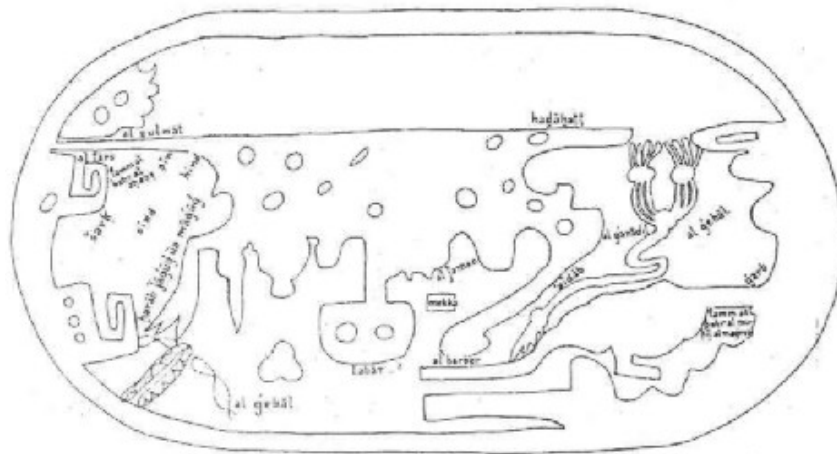
This line drawing is a simplification of Konrad Miller's composite map showing what the sectional maps (which are interspersed throughout the text in al-Idrisi's *Nuzbat al-mushtaq*) would look like if joined together. The climate numbers are given along the vertical axis, and the ten longitudinal divisions are given across the top. The consecutive numbers sometimes used to refer to the sectional maps are shown in the upper right corner of each section. Note that these delineations follow most closely the Paris (MS. Arabe 2221) and Oxford (MS. Pococke 372) manuscripts. The exact depictions of coastlines, islands, and so forth, differ in other manuscripts.

After Konrad Miller, *Mappae arabicae: Arabische Welt- und Landkarten des 9.-13. Jahrhunderts*, 6 vols. (Stuttgart, 1926-31), Band 1, Heft 2



Ibn Hawqal's world map (#213), Arabic, 980 A.D. oriented with South at the top, 35 x 43 cm, displaying a circumfluent ocean, Africa extended broadly to the East and the Indian Ocean almost completely enclosed. An interesting and speculative West African coastline, hinting at the Gulf of Guinea. The Nile River seems to be the only river system deemed worthy of illustration. Distortion of Europe is great with Italy laying east-west. Particularly of interest here is the inclusion of the Antipodes or Southern Continent seemingly part of Africa.

The earliest set of maps to survive from the corpus of Islamic cartography are those that accompany the text *Kitab surat al-ard* [Picture of the Earth] of Abu al-Qasim Muhammad ibn Hawqal [Haukal] in the manuscript dated 1086, found in the Topkapi Sarayi Müzesi Kütüphanesi in Istanbul.





*Ibn Said al Maghribi (1250) Kitab Djoughrafiya fi l' aqalim al Sab
[Book of maps of the seven climes] This map is of the Indian Ocean. The original manuscript of
Ibn Said had no maps. The one was added in later centuries in copies of his work. They originated
in Ibn Hawqal's work (#221, #213)*



*World map of al-'Umari (16th century), oriented with South at the top,
20 cm diameter, Topkapi Museum of Istanbul, #226.1
shows an almost totally enclosed Indian Ocean*

It was crucial for the rapid and far reaching cartographic survey of the earth in the Islamic culture area that the notion of the various oceanic basins being enclosed by land, as inherited from the predecessors Marinus and Ptolemy, was abandoned in favor of the concept of an insular configuration of the *oikoumene* [known inhabited world].

This world map, created by Arab Islamic geographers upon commission of the Calif al-Ma'mun, already represents the *oikoumene* in an insular configuration. The oceans are laid-out in a peculiar manner: the entire landmass of the *oikoumene* is surrounded by an ocean of restricted navigability (*al-bahr al-muhit*) which in turn is enclosed by a second 'obscure' ocean that was considered unnavigable due to its darkness. This concept alone would have discouraged potential adventurers from any attempt to reach Asia via the western route across the Atlantic as long as it held sway. It

took in fact quite a long time until the theory of an unnavigable, dark ocean was dismissed for good. Abu Abdallah al-Zuhri, who revised the Ma'mun *Geography* in the 6th/12th century, raised objections against the 'dark zone'. At any rate, according to his account the offshore distance known to be navigable had by this time been expanded to 800 *parasangs* [ca. 2,400 Arabic miles or 4,800 km]. In this context an important yet still little known concept by al-Biruni (died 440/1048, #214.3) should be remembered. It states that the *oikoumene* was enclosed by an all-embracing ocean that separates its western and eastern (outermost) shores and possibly isolates also another continent or inhabited island in between.

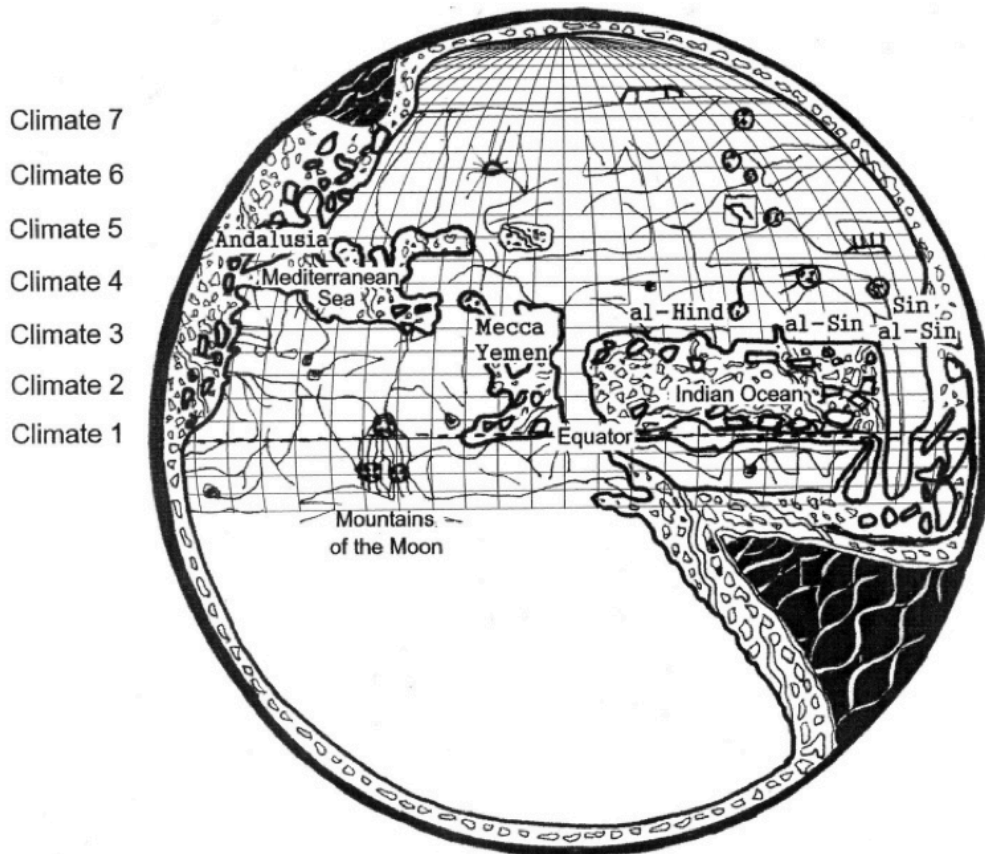
The geographic work *Masalik al-aNar fi mainalik al-amsar* [Ways of Perception Concerning the Most Populous [Civilized] Provinces] was written by Ahmad ibn Yahya Ibn Fadlallah al-'Umari (died 1349), a distinguished administrator and author who was active in Cairo and Damascus under Mamluk rule. He claims that this map is a copy of the world map made by al-Mas'udi (#212) for Caliph al-Ma'mun (reigned 813-833). The world map shown above is reproduced in this manuscript of the work of al-'Umari. The same manuscript also has maps of the first three climates. Although the climates are not divided into sections, the general impression is that the maps are derived from those of al-Idrisi (#219). However, from its appearance it seems to have been compiled from the text of the *Kitab bast al-ard fi tuliha wa-al-'ard* [Exposition of the earth in length and breadth] by Ibn Sa'id (#221). Al-'Umari's text does mention a map and gives a few examples of longitude and latitude, but on the whole they do not correspond with positions given on the map.

As mentioned above, the map's landmass contours, including the plausible, though inaccurate, longitudinal and latitudinal lines, roughly resemble reconstructions of al-Khwarizmi's geographic table, which was directly influenced by Ptolemy's geographic treatise. Thus, it is possible that the map in *Ways of Perception* descended from maps made by the scholarly community under Caliph al-Ma'mun's patronage, which included al-Khwarizmi. The map for Caliph al-Ma'mun was most likely drawn based on al-Khwarizmi's geographic treatise because al-Khwarizmi was one of the major scholars in Caliph al-Ma'mun's academic institute, "The House of Wisdom." Fuat Sezgin argues that the map is an exact copy of the world map of Caliph al-Ma'mun in the ninth century. With regard to the map's contents, however, the name *Sin al-Sin* [China of China] on the northern hemisphere's eastern edge of Ibn Fadlallah al-Umari's map does not appear in al-Khwarizmi's geographic table that merely documents *al-Sin*. The presentation of both *al-Sin* and *Sin al-Sin* (*Chin* and *Machin* in Persian) suggests that al-Umari updated al-Khwarizmi's geography using available contemporary information, in the same way that al-Khwarizmi updated Ptolemy's treatise in order to write his own.



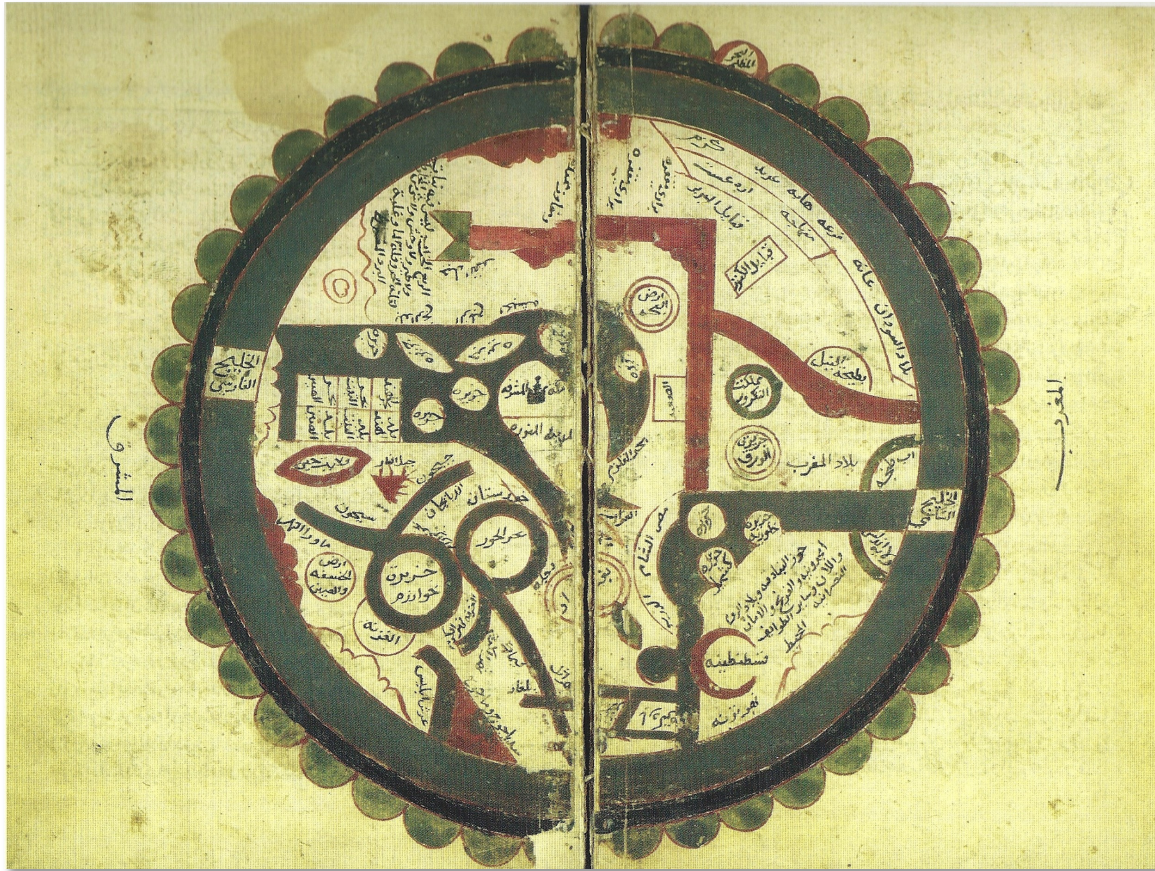
The world map of Caliph al-Ma'mun from Ibn Fadlallah al-Umari's (1301-1349) *Masalik al-absar fi mamalik al-amsar* [Ways of Perception Concerning the Most Populous[Civilized] Provinces], 26.5 cm diameter, oriented with South at the top. Topkapi Museum, Istanbul A.2797, fols. 292v-293r.

The longitude and latitudinal graticule, which is most uncharacteristic for manuscripts from the 14th or even 15th century, appears to have been modified by a copyist at the time the map was drafted, perhaps in the 16th century. This map is sort of a "compromise" by showing a navigable path around Africa, but also a nearly land-locked Indian Ocean



The world map of Caliph al-Ma'mun from Ibn Fadl Allah al-'Umari's "Ways of Perception Concerning the Most Populous [Civilized] Provinces" (Masalik ai-absar fi mamalik al-amsar), re-oriented with North at the top.

Translated, from Fuat Sezgin's "Science and Technology in Islam"



Al-Wardi, oriented with South at the top (#214.1)

World map in a 1481 Turkish manuscript of al-Wardi's "Enumeration of Wonders"

Oriented with the South at the top, it shows the known world as a sphere surrounded by the Encircling Sea, which is enclosed by mountains. Mecca, shown unusually in graphic form, the focal point of all spatial references, is near the center of the Arabian Peninsula, which is embraced by the Persian Gulf and the Red Sea in the shape of a crescent moon to signify the unity of the celestial and terrestrial worlds, a unity of conjoined sacredness. Turkish Constantinople is a red crescent "wall" or barrier against the "people of the cross". At the top, Africa is extended the length of the Indian Ocean, but unlike most of the contemporary Islamic world maps, here the continent does not entirely enclose the Indian Ocean; although most of the maps attributed to al-Wardi display a very open-ended Indian Ocean. The Nile, drawn in red, takes a right-angle turn, possibly reflecting the river's great bend. Library of Congress.



A 1415 al-Wardi world map (oriented with South at the top) displaying a very open Indian Ocean. The Museum of Islamic Art, Qatar, Ms 228.1998 (#214.1)

In medieval European maps based upon the writings of Ptolemy the Indian Ocean is enclosed. However, as have been seen above, it is not enclosed on most Islamic maps. As mentioned above, an aberrant and as yet unexplained exception is the schematic map of the Indian Ocean in the recently discovered *Book of Curiosities*, thought to be produced in the late 11th century it therefore predates al-Idrisi. Islamic world geographies consider the Indian Ocean an offshoot of the *Surrounding Ocean* [*al-Bahr al-Muhit*]. The encyclopedist al-Biruni (c. A.H. 362-440/973-1048 A.D. #214.3) explained this in *Kitab al-Ta'fihim* [Book of Instruction in the Elements of the Art of Astrology]:

From the Eastern side, beyond the farthest limits of the land of China, the Surrounding Sea is likewise impassable. From it branches out a gulf that forms a sea that is named in each location by the name of the country it washes, so that at first it is the Sea of China, then the Sea of India. From the sea, in turn, branch our great gulfs that are separately named seas, such as the Sea of Persia and Basra... (Matveev and Kubbel, 1965: 113)

Biruni is the only Islamic author who specifically articulates the undividsibility of the world's oceans. In his other book, *al-Qanun al-Mas'udi* [Mas'ud's Canon for Astronomy and Stars] he wrote about the Indian Ocean past southeast Africa:

Regardless of such (great difficulties) there is no absolute obstacle for reaching the Ocean Sea (*Bahr Uqiyanus*) through these narrows or from the south behind these mountains. I have found indications that the two (seas) join together even though I have not seen this with my own eyes. (Matveev and Kubbel, 1965: 125)

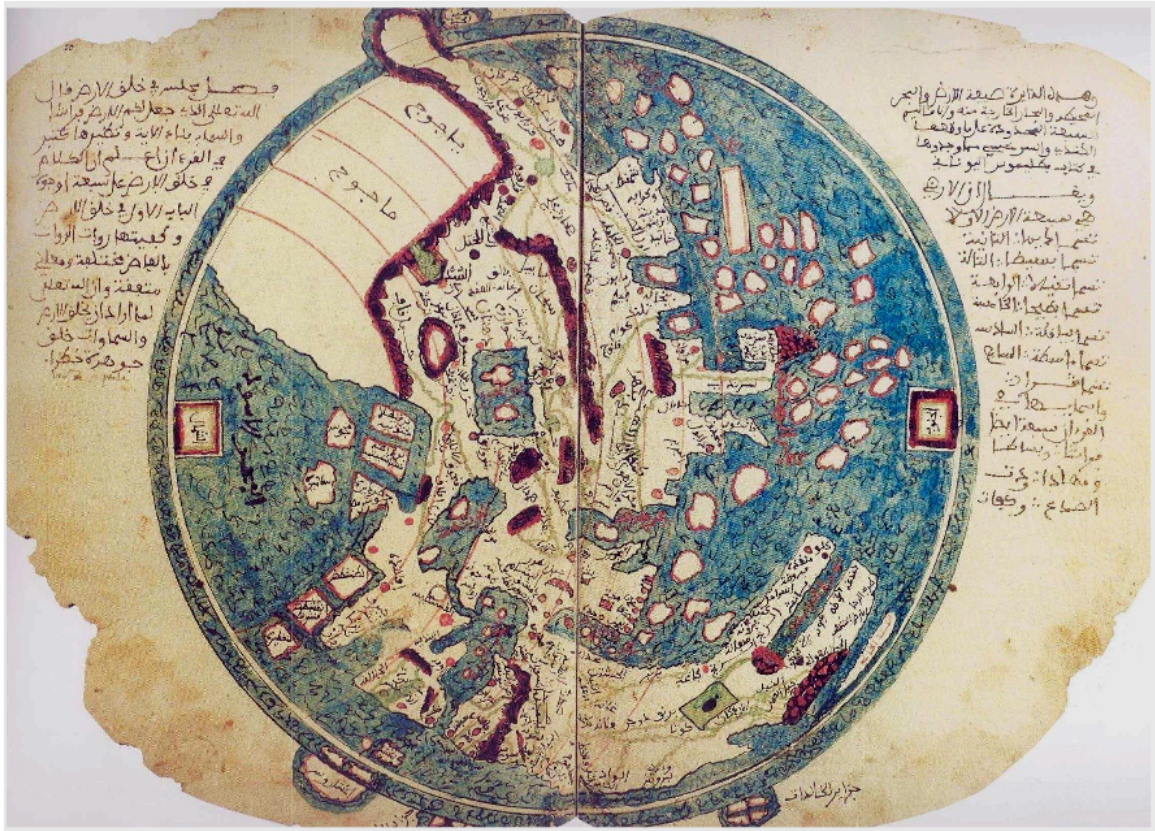


Another al-Idrisi's world map, oriented with South at the top, 21 x 30 cm (23 cm diameter), 1154, Bodleian Library, MS Pococke 375, dated 1553/960 H (#219)

By contrast with sectional maps, the so-called round world map of Idrisi shown above, lacking many if not most sectional details, became quite popular, and a version of it appears in manuscripts of Ibn Khaldun's *Muqaddima*. Thus, with al-Idrisi, a comprehensive picture of an open Indian Ocean is created, from Africa to China, but certain lines of knowledge transmission wither away or become dormant.

Idrisi's superiority in both descriptive geography and cartography is unarguable, yet on the subsequent situation is somewhat paradoxical. Many later authors drew on al-Idrisi, but, considering the expansion of travel and production of new astronomical data that might reasonably be expected to lead to growth of geography as a discipline, there appears to be a lack of systemic originality and loss of precision in world geography and cosmographical genre. The Idrisi sectional map system shown earlier on

page 27 was not used at all, nor further developed by later authors, although it was not lost. In terms of geographical data, the closest Idrisi follower is Ibn Sa'id al-Maghribi (c. A.H. 610-685/1214-1286 A.D. #221). His *Geography of the Seven Climates* follows the Idrisi narrative according to the map sections, repeating much of his information, but for locations Ibn Sa'id adds the coordinates. The round world map ascribed to Ibn Sa'id al-Maghribi opens the Indian ocean wider toward the south than any Islamic world map previously. He fills the ocean space with islands and, unable to accommodate all the place-names provided by Idrisi on the East African coast, divides the southern African continent by a deep gulf, with double the coastline looking east.



*Ibn Sa'id's world map from the Kitab al-bad' wa-al-ta'rikh, 13th century
(oriented with East at the top)
28.5 cm diameter (#221)*

Expansion of Islam continued along the coasts of the Indian Ocean, whether in Eastern Africa or Indonesia, as it did on the Indian subcontinent. New Islamic states arose and maritime commerce prospered. The famous 14th century traveler Ibn Battuta (1304-1369) performed several voyages on the Indian Ocean and left a record of them in the *Rihla*, [Book of Travels]. His experience in southeast Asia and somewhat hazy report of reaching China provide, at the very least, a personal confirmation, if not a case study of the widely reaching shipping and trade networks emanating from or converging on certain vital points of destination – Red Sea ports for the annual Muslim pilgrimage, Kilwa for the gold trade of the interior, Sri Lanka as the crossroads of the oceanic routes and a waiting-haven for the change of monsoon. While in India, he aspired to reach China and discovered that the voyage could be made only on Chinese ships. Indeed, in

the early 15th century China was to make the exploration by Zheng He of the Indian Ocean an imperial project, though Arabic sources are silent about this.



Al-Qazwini world map (#222) oriented with South at the top, from his Monuments of Places, copy dated 1580, Walters Art Gallery, Baltimore, USA, Ref. W 593, ff. 52v-53r, 30.5 cm diameter. Shows a nearly enclosed Indian Ocean with the usual easterly extension of Africa.

The map shown above indicates the extent of Islamic cartographers' knowledge regarding the solar day cycles at extreme latitudes, though there is the possibility that these legends may have been added to the 13th century original map by latter-date copiers. Most of the map is occupied by Africa and the unknown southern lands, while Europe and Asia occupy most of the lower half at the map. The seven inscriptions in the left specify the zones and give their dimensions. The sea to the left of the map (east) is the Pacific Ocean and the one in the top middle is the Indian Ocean with the Arabian

Sea. The peninsula surrounded by six islands is China, and to its right is the Indian Sea [Gulf of Bengal]. The other gulf further to the right, with three rivers pouring in, is the Persian Gulf. Next is Arabia shown as a circular bulge protruding into the Indian Ocean/Arabian Sea, with *Bahr-i-Kulzum* [the Red Sea] at its west (right). The River Nile is shown with eight tributaries, which join together to flow into another lake and thence to the Mediterranean, which is the unevenly shaped sea connected at the right to the surrounding ocean and named *Bahr-i-Misr* [Sea of Egypt]. The Black Sea branches from the middle of the Mediterranean and extends northwards to join the ocean at the north of the landmass. The rivers *Dejle* [Tigris] and *Forat* [Euphrates] are shown connecting the Mediterranean Sea to the Persian Gulf. Parts of the Caspian Sea are obscured by the close binding in the centerfold of the map. The rivers *Arax* and *Kura* we also depicted joining and flowing into the Caspian, the former being connected to the River Tigris and the latter to the Black Sea. Between the Tigris and *Arax* rivers the inscription *Arminiya* [Armenia] can faintly be made out. Armenia is flanked by the cities of Tabriz and Erzurum. The small rectangular lake at the left (east) of the fold is the Sea of Aral, with the rivers *Jeihun* [Oxus, or Amu-Darya] and *Seihun* [Jaxartes or Sir-Darya] rising from Central Asia and flowing into it.

No other Arab traveler left as comprehensive a record of personal voyages on the Indian Ocean, but a 13th century traveler in South Arabia related an extraordinary story about the far and early reaches of the monsoon sailing routes. Writing about A.H. 624-627/1226-1230 A.D., Ibn al-Mujawir describes maritime contacts between Madagascar, East African coast, Aden, and eventually *Siraf* (the Persian Gulf port destroyed by an earthquake about 970):

The building of Aden. When the dynasty of the pharaohs came to an end, the place fell into ruins as their dynasty disappeared. A group of fishermen settled the island, fishing there. They remained a long time thus, provided with God's sustenance and a livelihood, until some Madagascans [*Ahl al-Qumr*] arrived in ships with lots of people and took control of the island after chasing out the fishermen by force. They settled the Summit of al-Jabal al-Ahmar, Huqqat and Jabal a-Manzar, a mountain overlooking the boatyards. Traces of them still exist and their building remains in Stone and gypsum, brought from these wadis and mountains.

This passage is quite rare in Arabic travel literature in providing a glimpse of oceanic migration history that connects Malay and East African immigrants to South Arabia and makes clear the northward direction of the movement, as distinct from the relatively frequent mentions of southern Arabians (especially Omanis) sailing to East Africa. Continuing the story of Aden, the author also describes the migrants' vessels and the sailing regime: The year *Anno Hegirae* (A.H.) 626 began 30 November 1228.

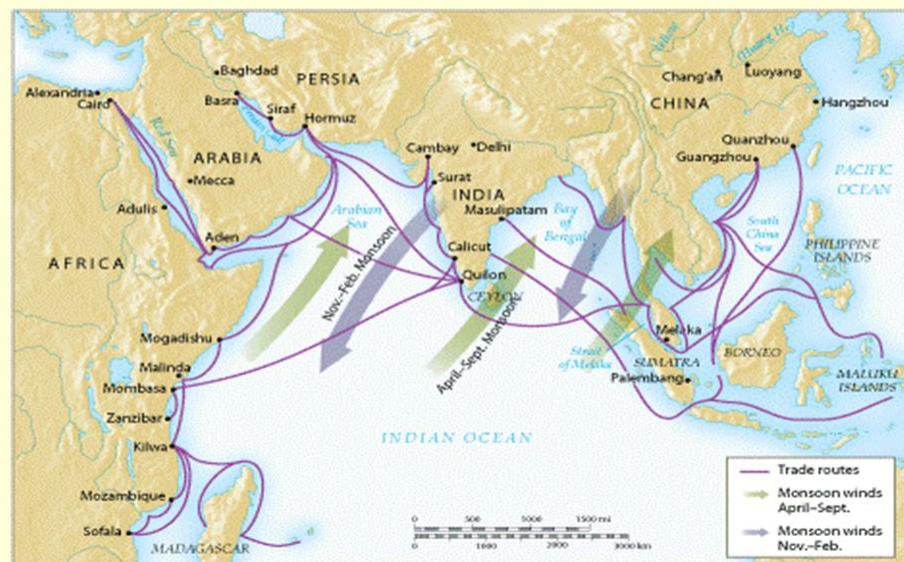
They used to come up from Madagascar, taking in Aden in one go in one monsoon [...] From Aden to Mogadishu is one monsoon, from Mogadishu to Kilwah a second and from Kilwah to Madagascar a third. But [some] people would turn the three monsoons into one: in 626 a ship sailed from Madagascar to Aden in this way, setting sail from Madagascar, making for Kilwah, but dropping anchor in Aden. Their ships have outriggers on account of the narrowness, rockiness and shallowness of their seas. When these people became weak and the East Africans got the better of them, they forced them out and took over their land and settled the wadi, a place which is now inhabited [by people] in reed huts. They were the first to build reed huts in Aden. When they had gone,

the place fell into ruin and remained thus until the inhabitants of Siraf moved out [and settled there].

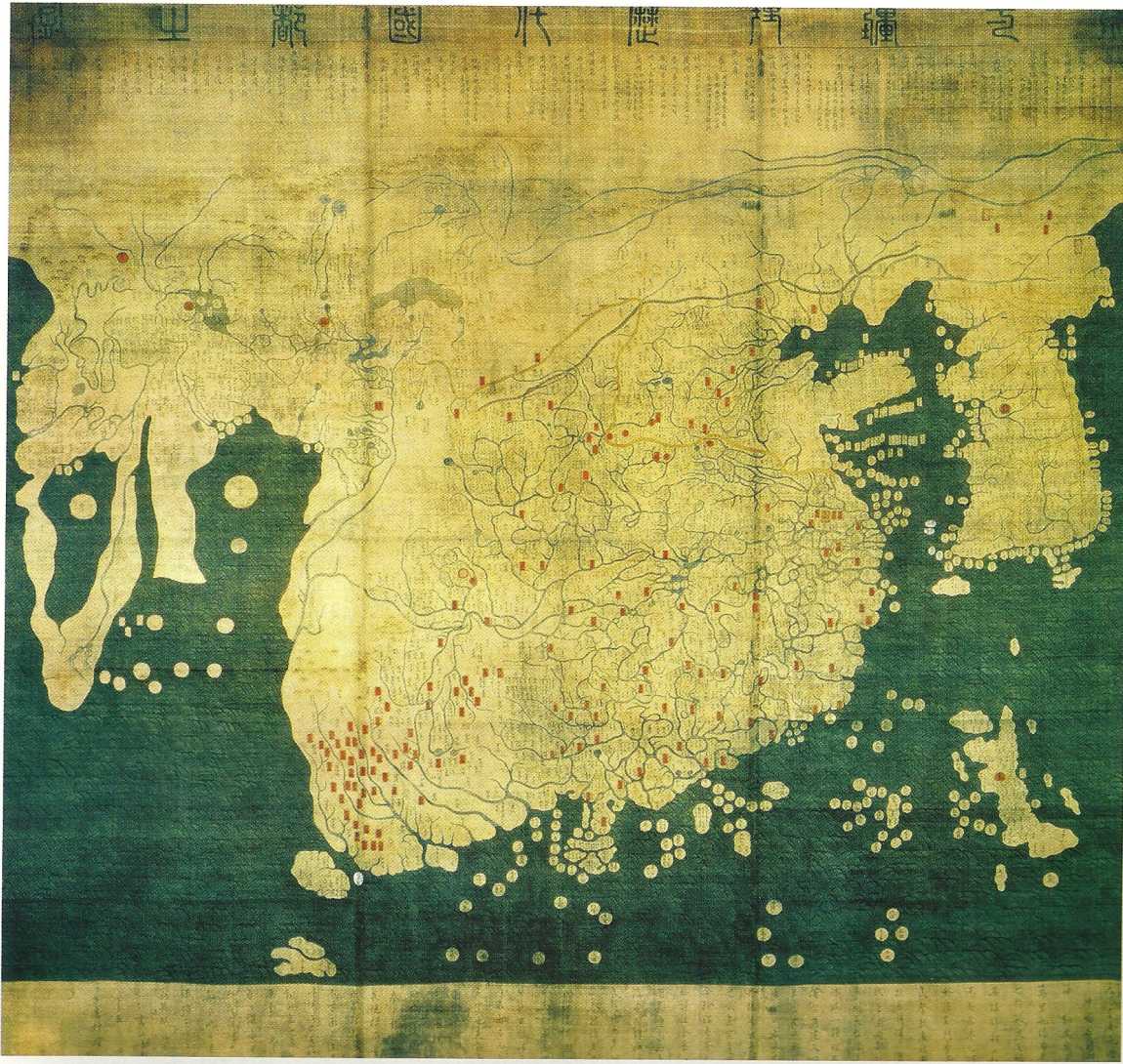
In the 13th century Marco Polo claimed that Arab pilots had good nautical maps and used the Pole Star for guidance. Furthermore, in the early Portuguese records there are indications that Arab (or Muslim) navigators on the Indian Ocean, in addition to the traditional compass and instruments for astronomical observations, also used nautical charts or written sailing directions, but none have been found. It is as though academic cartography, too, remained irrelevant to mariners' practical activity. Sea voyages were very different in execution from land travel, and on the eve of the Portuguese era on the Indian Ocean, Arabic seafaring expertise was being recorded and shaped into formal encyclopedias and manuals. Naturally and necessarily, more than Arabs took part in the seafaring enterprise. Tradition and experience took centuries to produce an effective, though diffuse body of knowledge, but in the 16th century the new global reality dramatically changed the dynamics of oceanic activity and signaled an end to the Arab chapter in the Indian Ocean story.

It must be noted that all of the writings from ancient and medieval times about the Indian Ocean primarily centered on only the northern portion. This is where all of the commercial trading took place between and among the various ports from China, Malaysia, Sri Lanka, India, East Africa, the Middle East and, ultimately via Middle East intermediaries, to Europe. The southern extents of the Indian Ocean, then, and even today, were quite irrelevant. Whether a "southern continent", or a land-bridge between Africa and Asia, or a tightly strung series of islands existed in the southern reaches of the Indian Ocean really did not have meaning to this on-going extensive trading activity. It was only when the Europeans decided to try to eliminate the "middle-men" traders from the Middle East and try to develop trade directly with the Far East that the geography of the southern and eastern Indian Ocean became a subject of interest.

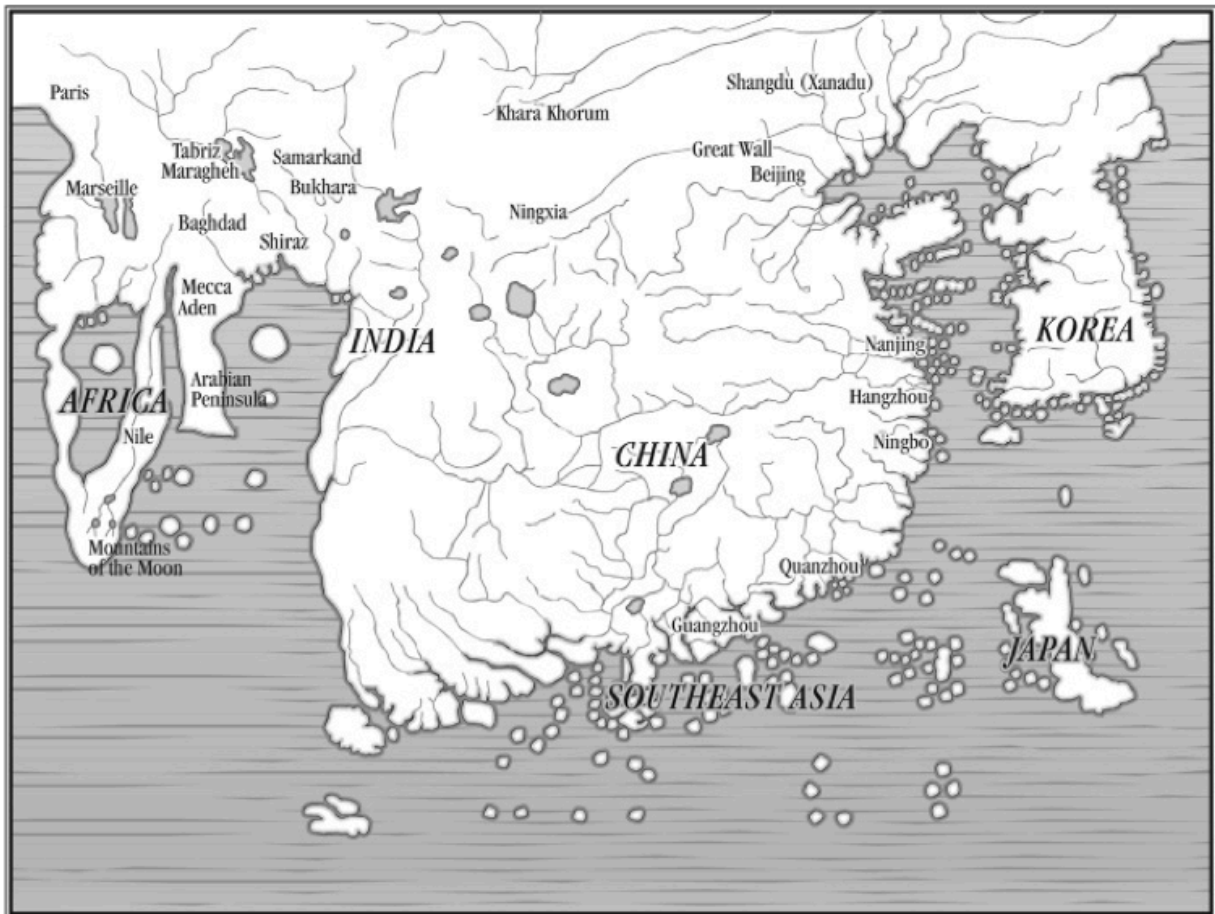
The trading world of the Indian Ocean basin, 600-1600 AD



A major exception to the medieval perception that Africa and/or Asia extend in such a way as to form a land-bridge connecting the two continents is the 1402 Korean *Kangnido* map, shown below (#236). Here is a map that displays a surprisingly realistic shape of the African continent 90+ years before the first Europeans circumnavigated Africa. Also no “Tiger Leg”, or extension of Asia south and westward is shown.



The Ryukoku Kangnido: Honil kangni yoktae kukyo chi to 混一疆理歷代國都之圖
 [Map of Integrated Lands and Regions of Historical Countries and Capitals] Painted on silk,
 164 x 171.8 cm, 1402 Information Center, Kyoto, Japan (#236)
 Dominated by an exaggerated China, India and Korea, Africa is shown much more realistically
 than any European map of the period and, of course, the Indian Ocean is shown completely open.



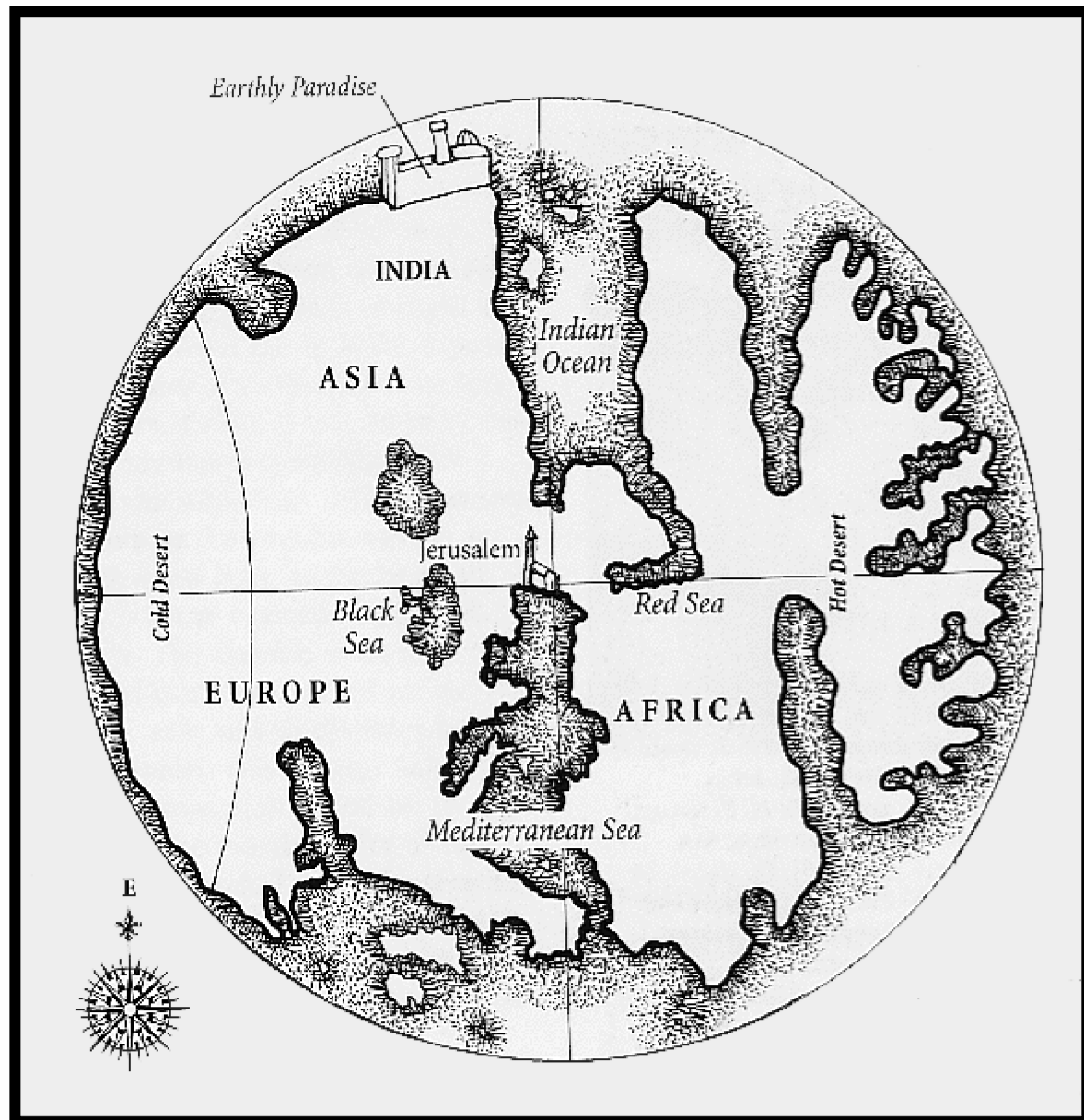
Another exception during this period is the de Virga *mappamundi* shown below (#240). The delineation of Africa is unusual given that most European medieval world maps show southern Africa as extending strongly eastward (see #242, #245, #246), or, as with those based upon Ptolemy, showing an enclosed Indian Ocean (#239). The outline of de Virga's Africa is quite intriguing given that the Portugal's Bartolomeu Dias was still over 70 years away from rounding the Cape of Good Hope.



This map by the Venetian cartographer, Albertin de Virga, shows Marco Polo's "Southern Continent" southeast of Asia. The island-continent is called "Ca-paru or Great India." The map was made between 1410 and 1414. (#240)



Mapa Mundi Figura Mundi, 1442 world map by Giovanni Leardo (#242), 34.7 x 31.2 cm, Biblioteca Comunale Library, Verona, Italy, showing Africa extended eastward (oriented with East at the top)





*Pietro Vesconte World Map, ca. 1321**



*Andrea Bianco World Map, 1436**



*Giovanni Leardo World Map, 1452-53**



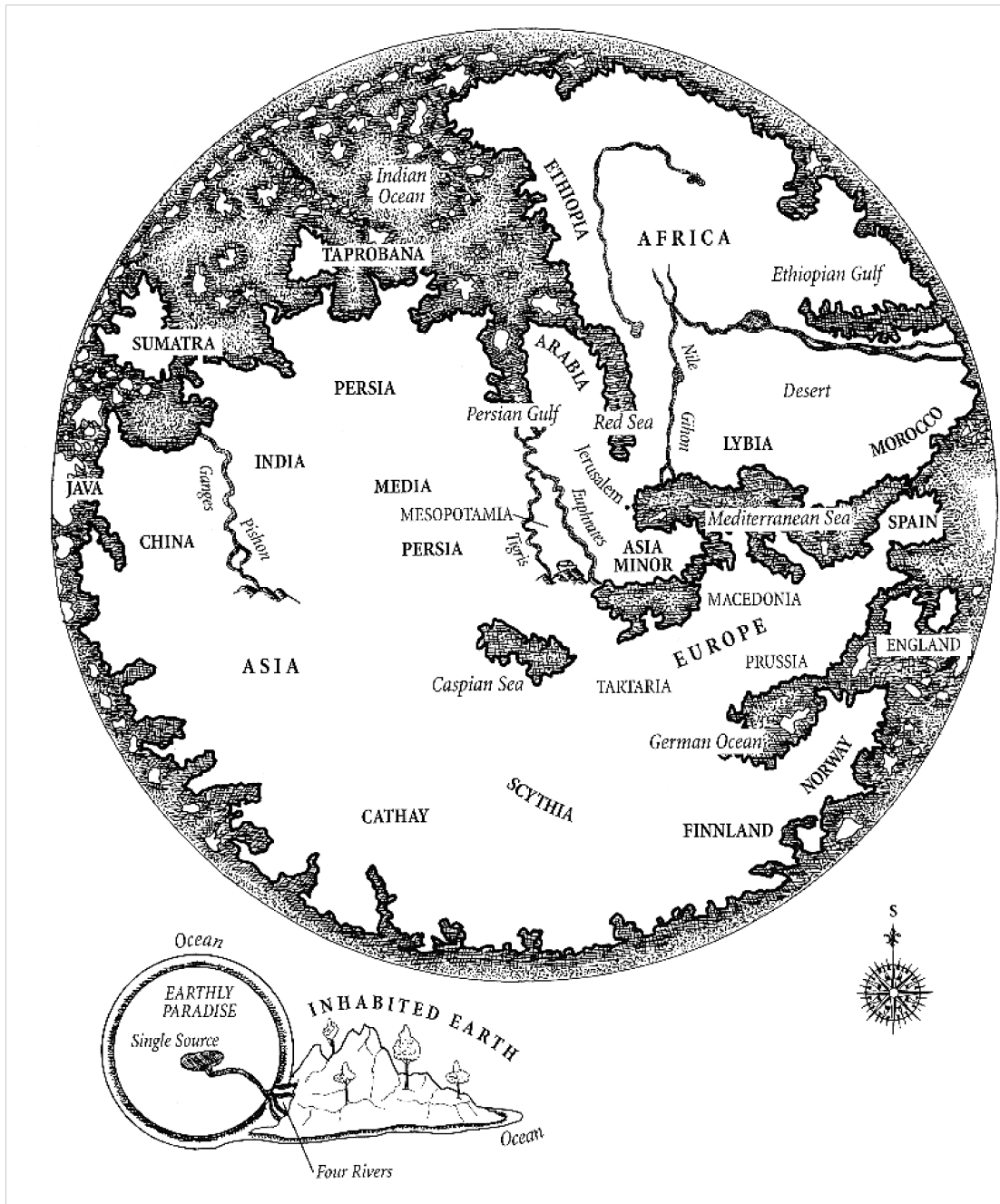
The Catalan-Estense Map, ca. 1450



*Fra Mauro's World Map,
1459***



*Fra Mauro's Mappamundi, 1459 (#249)
(oriented with South at the top)
190.5 cm diameter*



The following is an excerpt from Marianne O'Doherty's article "Fra Mauro's World Map (c. 1448-1449): Mapping, Mediation and the Indian Ocean World". Begun around 1448 and completed some time before 1459, Fra Mauro's world map, illustrated in the figure accompanying this article, is a beautiful object. Its designer, Fra Mauro, was a fixture at the Camaldulian monastery of San Michele on Murano, and worked on the map over a period of some years with the assistance of a workshop including fellow-monks and the Venetian galley captain and cartographer, Andrea Bianco. Around four meters square and mounted on boards that enable it to be hung on a wall, the map was clearly intended for display. The map as a whole is fascinating, and has been an object both of wonder and of scholarship for historians of cartography, exploration and culture for hundreds of years. Its representation of the Indian Ocean world has attracted particular

scholarly attention (Cattaneo, 2004; Falchetta 2004). Fra Mauro's delineation of the Indian Ocean region is unusually detailed; even a brief glance at the map shows the Ocean between Africa and China (the map is oriented, like many Arab maps of the period, with the South at the top) dominating a large swathe of the map and dwarfing the Mediterranean towards which it reaches out. In his representation of the region, Fra Mauro clearly capitalized on Venice's position as a hub in the exchange both of goods and knowledge between East and West. A network of linked legends spread out across the ocean's surface traces the routes of spices, luxury goods, and people between Indonesia and China, between China and Africa, between Arabia and South Asia, between the Indian Ocean world and the Black Sea and, through the Black Sea, to Europe. However, the map does not merely reflect Western European conceptions of the Indian Ocean world and of its own relationship with that world at the moment of the map's production. Like all maps, this map aims not simply to represent space, but to intervene in and manipulate its political and socio-spatial world. Certainly, the world projected in this map, and the activities it stimulated are, potentially, particularly significant: in 1459, records show that a copy of it – now lost – was made and sent to Alphonso V of Portugal, at the time sponsoring the series of voyages down the western coast of Africa that would eventually take Bartolomeu Dias and Vasco da Gama into the Indian Ocean. An understanding of this map is therefore crucial to the wider project of understanding the historical development of relationships between Western Europe the Indian Ocean world.

But the significance of this cultural artifact does not begin and end with its position in a historical process of transition from what Chaudhuri has identified as a period of regional segmentation of trade between the Western Indian Ocean and the South China Sea to a period of European dominance in the Indian Ocean world (Chaudhuri, pp. 102-03). The map is a deeply complex artifact that is positioned intentionally by its cartographer in the role of mediator between Western Europe and the Indian Ocean world; between oral and written systems of knowledge; between reality and representation, and, temporally, between 'then' and 'now'. Fra Mauro's world map is the first surviving European map to represent the Indian Ocean world in detail. However, as cartographic historian Angelo Cattaneo has pointed out, the map's major cartographic innovation is not so much in the detail of its representation as in its assertion of the navigability and habitability of the oceanic space between east Africa and Southern China (Cattaneo, 2004, p. 210). One might, however, go further than this; on the map, the Indian Ocean world comes across as positively crowded; populous and well-traversed, it is a functioning cog in the economic machinery of the world. Indeed, in places, the crowdedness of the region outstrips the representative capacity of the map. *'In this sea'* he says of the Indian Ocean, *'there are many islands that cannot be specially noted because of lack of space, but all are inhabited and very fertile in various precious spices and many other new things'*. Images of islands, rigged ships, and legends crowd the region, as do the witnesses that clamor to support Fra Mauro's assertions about it: *'[E]veryone'* – the implication being that there are too many to name – *who sails in the Sea of India says that one loses sight of the Pole Star at Cape Chomari*.

Legends on the Fra Mauro map trace the routes of goods – notably spices – through the three major trade circuits of the pre-modern Indian Ocean (more or less corresponding with, in modern terms, the Arabian Sea, the Bay of Bengal, and the South China Sea). In one such legend, Indonesia, identified rather confusingly on the map as two islands called *Greater* and *Lesser Java*, is identified as housing a regional *entrepôt*

crucial in trade between Eastern Indian Ocean and the South China Sea. Goods are taken from *'the eight islands, in which grow fine spices'* around Lesser Java to Greater Java – possibly an amalgamation of Java and Sumatra – from which *'one part [is sent] to Ceylon and Cathay, another to Hormuz, Cide [Jidda] and Mecca, by the Sea of India, and the third is sent northwards across the Sea of Cathay'*. Another inscription, this time at Hormuz, on the Persian Gulf, follows the same chain of people and goods to the Black Sea, the doorstep of the Mediterranean world. The ocean represented here is not just navigable: it is overlaid with a network of intersecting trade routes, routes that bear its influence deep into continental Asia and Western Europe.

The map represents the Indian Ocean, moreover, as not just internally navigable, but as interconnecting with the Atlantic (and the yet unknown Pacific) Ocean. Subsequent historical events and developments in cartography have led us, of course, to take the interconnectedness between Indian and Atlantic oceans for granted, a position that makes it easy to underestimate the immense rhetorical effort that Fra Mauro puts into persuading the map's readers of this connection. The possibility of navigation between Europe and Asia tended to be dismissed by late-medieval geographers and cartographers for a range of not always consistent reasons. As mentioned above, Claudius Ptolemy, whose first-century *Geographia* achieved influence on contemporary as well as historical geography across Europe, particularly after its translation into Latin in 1406, disrupted the common late-medieval world view of the habitable world as a three-part *orbis terrarum* (circle of lands or *oikoumene*) surrounded and bordered by an ocean that becomes non-navigable and uninhabitable in the south because of the excessive heat of the so-called torrid zone. In its place, however, Ptolemy's *Geographia* set a detailed and, as it turned out, pervasive image of an Indian Ocean bordered by a *terra Incognita* that linked Africa and the South East Asian promontory of *Cattigara*. In other words, the Indian Ocean after Ptolemy's re-introduction remained equally isolated, but in this case because landlocked.

Against these two conceptions of an Indian Ocean isolated by geography, hydrography, or climate, Fra Mauro delineates one reached in the past and reachable again in the future:

Some authors write that the Sea of India is enclosed like a pond and does not communicate with the ocean. However, Solinus claims that it is itself part of the ocean and that it is navigable in the southern and southwestern parts. And I myself say that some ships have sailed it along that route. This is confirmed by Pliny when he says that in his day two ships loaded with spices coming from the Sea of Arabia sailed around these regions to Spain and unloaded their cargo at Gibraltar [...]. Fazio [Degli Uberti] says the same; and those who have taken this route, men of great prudence, agree with these writers.

A clear sense emerges here of the passage between Indian and Atlantic oceans as not just navigable in theory but navigated in fact. Indeed, in a later legend, Fra Mauro exploits his privileged access to both European and Indian navigational knowledge, adducing the authority on the one hand of *'all those who were sent by his Majesty, King of Portugal'* who had sailed south-southeast along the west coast of Africa, and on the other of *'a person worthy of trust, who says that he sailed in an Indian ship caught in the fury of a tempest for 40 days out in the Sea of India, beyond the Cape of Soffala and the Green Islands [unidentified] towards west-southwest'*. Here, Fra Mauro exploits his position as mediator between geographers and witnesses, past and present, east and west, in order to assert that *'without any doubt that this southern and south-western part is navigable, and that the Sea*

of India is an ocean and not an inland sea. This is what is said by all those who sail this sea and live in those islands'.

To present his Indian Ocean as reachable from the Atlantic, Fra Mauro's map must work precisely in this way. Scattered references to the circumnavigability of Africa from geographers' and sailors' reports thousands of years apart in time are compressed into a single cartographic assertion; the past is plundered to serve a desired future. Yet the act of mapping that desired future is, of course, an intervention that helps to bring that particular future about.

In his representation of the navigability and accessibility of the Indian Ocean, Historian Marianne O'Doherty sees Fra Mauro exploit his position as adjudicating mediator between geography and eyewitness, between past texts and present map, in order to shape real contacts, relations and actions between the Mediterranean and Indian Ocean worlds. Yet this is not the only way in which Fra Mauro strategically manipulates his intermediary role. The world map is a translation in the literal sense of the word; it carries knowledge over, across both space and time and between cultures. Translating in the most literal sense of the word, the map carries over to its Venetian readers a myriad of toponyms and terms of Chinese, Indian, Arabic, Javanese, Malay or other Indian Ocean world origins. Arabic toponyms feature, for instance, along 'the entire outline of the eastern coast of Africa to the south of the Horn of Africa' according to the map's editor. Locally-current names appear attached to many of the ports around the Bay of Bengal and eastern Indian Ocean, from *Paliechat* [Pulicat] and *Orica* [Orissa] on the east coast of India to *Melacha* [Malacca, Malaysia] in modern-day Indonesia. The map uses the name *Mihen*, of Chinese derivation, for the region of Myanmar and of *Cimpangu* (from China via Marco Polo) for Japan; represents Chinese *Jih-pên kuo*: *Rashid-al-Din*. Such translations bring with them, of course, traces of the power-relations that produced them; the map's preponderance of toponyms of Arabic origin reflects centuries of Arab dominance in the navigation of the western Indian Ocean, whilst it is through reports of the Mongol Kubilai Khan's late-13th century designs on Japan, culminating in two attacks in 1274 and 1281, that news of that island filters through to Europe.

In his depiction of the Indian Ocean, Fra Mauro places the local place names into a distinct relationship with a conspicuously Latinate, largely Ptolemaic, European framework of knowledge about the region. Larger geographical and hydrographic areas and features are marked out on the map by Latinate, often Ptolemaic names, printed in decorated, sometimes gold, capitals. On the land encircling the Indian Ocean we find *Africa*, *Ethiopia*, *Garamantia*, *Arabia Felix*, *Arabia Deserta*, *Arabia*, *Persia*, *Mesopotamia*, *India Prima* (in the northern region of India) and *India Secunda* (Indo-Chinese regions and parts of south west China), names whose Latinity stands out when set against the etymologically-diverse port and town names all around them, seen through the prism of Fra Mauro's own vernacular Venetian dialect. In the sea, we find the *Sinus Ethiopicus* [Gulf of Ethiopia], *Sinus Arabicus* [Arabian Gulf], *Mare Arabicum* [Arabian Sea]. Against these, the probably Arabic *Colfo de lasiavo* [Gubbat Asiya] stands out as unusual. *Mare Indicum* is inscribed in gold-leaf capitals to the south of the Indian Ocean, between *Chancibar* [Zanzibar] to the west and *Diuomoal* (one of the Maldives, from the Arabic *Dhibat-al-Mahal*, according to Falchetta) to the east. The principle of selection that underlies this balance between familiar Latinate and unfamiliar, etymologically diverse place names is nowhere clearly articulated but occasionally hinted at. '*This Abasia was called Agisimba by the cosmographers*' notes a legend close to the regional descriptor

Abassia, signaling that Fra Mauro has updated a place name (in this instance Ptolemaic) with one of Arabic derivation that he views as up-to-date.

It would be a mistake, however, to assume that Fra Mauro's temporal translations are uniformly directed to translating the geography of the past into contemporary terms, to create a geography for his future. In fact, there are occasions when the map's concern seems to be to map the Indian Ocean world of recent report onto an Indian Ocean world of timeless myth and legend. To the south of a peninsula that corresponds with the Malay Peninsula on modern maps, the map locates the island of *Taprobana*. An island located, according to the classical and late-antique geographies of Pliny the Elder, Ptolemy, and Solinus, close to India but so far to the south that it was 'formerly considered another world' (Solinus, 53.1) *Taprobana* is normally thought by historical geographers to refer to Sri Lanka. However, a note adjacent to this island on Fra Mauro's map translates as '*The Island of Siamotra, or Taprobana*', indicating that the cartographer identified modern Sumatra, of which Fra Mauro probably read or heard from the early-15th century Venetian traveler Niccolo Conti, as the *Taprobane* of the ancient world. Particularly significant and surprising here is the balance the map arrives at between ancient and modern; the 15th century toponym *Siamotra* appears just once on the map, whereas *Taprobana(e)* appears in six separate legends. With *Taprobane*, the map appears to translate the geography of the present into the terminology of 'the cosmographers' he often associates with the past, rather than the reverse. Another act of translation that we might also classify as working from present to past is to be found in the mapmaker's depiction of Africa. Like many maps of the later Middle Ages and Early Modern period, Fra Mauro's *mappamundi* gives a physical location to one of medieval Europe's most enduring legends: the priest-king Prester John.

Clearly, part of the mapmaker's role, in Fra Mauro's view, is to mediate between the geographical frameworks of 'the cosmographers', Christian tradition, and the knowledge of populations, navigators, and travelers about topographical, navigational and political detail. The map's mediations are, moreover, not just geographical but also temporal. It positions the map's Indian Ocean world strategically in relation to a past sometimes distanced from and sometimes brought close to its present. However, it is not just the Indian Ocean world that is shaped by this process, but the image, role and status of the cartographer himself. Fra Mauro deploys both his locally-sourced Indian Ocean world place names and cosmographic framework in such a way as to cement his own status as a knowledgeable cosmographer and his map's status as up-to-date cosmography, the benchmark against which the outdated should be judged. The particular focus of the cartographer's efforts here is the recently-translated and influential work of Claudius Ptolemy, with which Fra Mauro's map is constantly in tension.

Fra Mauro's problem is that whilst he wishes to define himself and his work against the amorphous group he calls 'the cosmographers', he nevertheless needs the framework for understanding the physical layout of the world that their efforts supply. In the Indian Ocean region, this tension and its results are particularly clear in Fra Mauro's treatment of Ptolemy's work. The map silently carries over Ptolemy's geographical framework and toponyms in too many places to cite, but borrowings relate to settlements (e.g., *Stabana*, Malaysia), regions and provinces (*Arabia Dextera*), mountains (*Sardonis* mountains, India), rivers (the *Indus* and its mouths), peninsulas and promontories (*Satoris*, on the Red Sea), gulfs and maritime regions (*Gulf of Sabara*; *Sinus Gangeticus*), peoples (*troglodites* in East Africa; the *Sale in Sailam*). These borrowings

commonly appear unsigned on the map. However, when Fra Mauro disagrees with Ptolemy – as with Ptolemy’s depiction of the Indian Ocean as an enclosed basin – he sharply foregrounds the completeness and newness of his own depiction and information against Ptolemy’s perceived limitations. ‘*As I have said elsewhere*’, he writes tersely of Persia, ‘*this province of Persia is divided into eight kingdoms, and extends far beyond the limited borders that Ptolemy gives it*’. In a gulf at the furthest eastern edge of China, the map highlights yet again its divergence from Ptolemy’s vision of an enclosed Indian Ocean: ‘*Southwards from this province of Serica [China], Ptolemy labels as terra ignota*. Fra Mauro identifies the *Taprobana* of classical geography with Sumatra of his contemporaries. Rather unfairly singling out Ptolemy for criticism here, Fra Mauro’s note reads that ‘*Ptolemy, when wanting to describe Taprobana, simply described Saylam [Sri Lanka]*’.

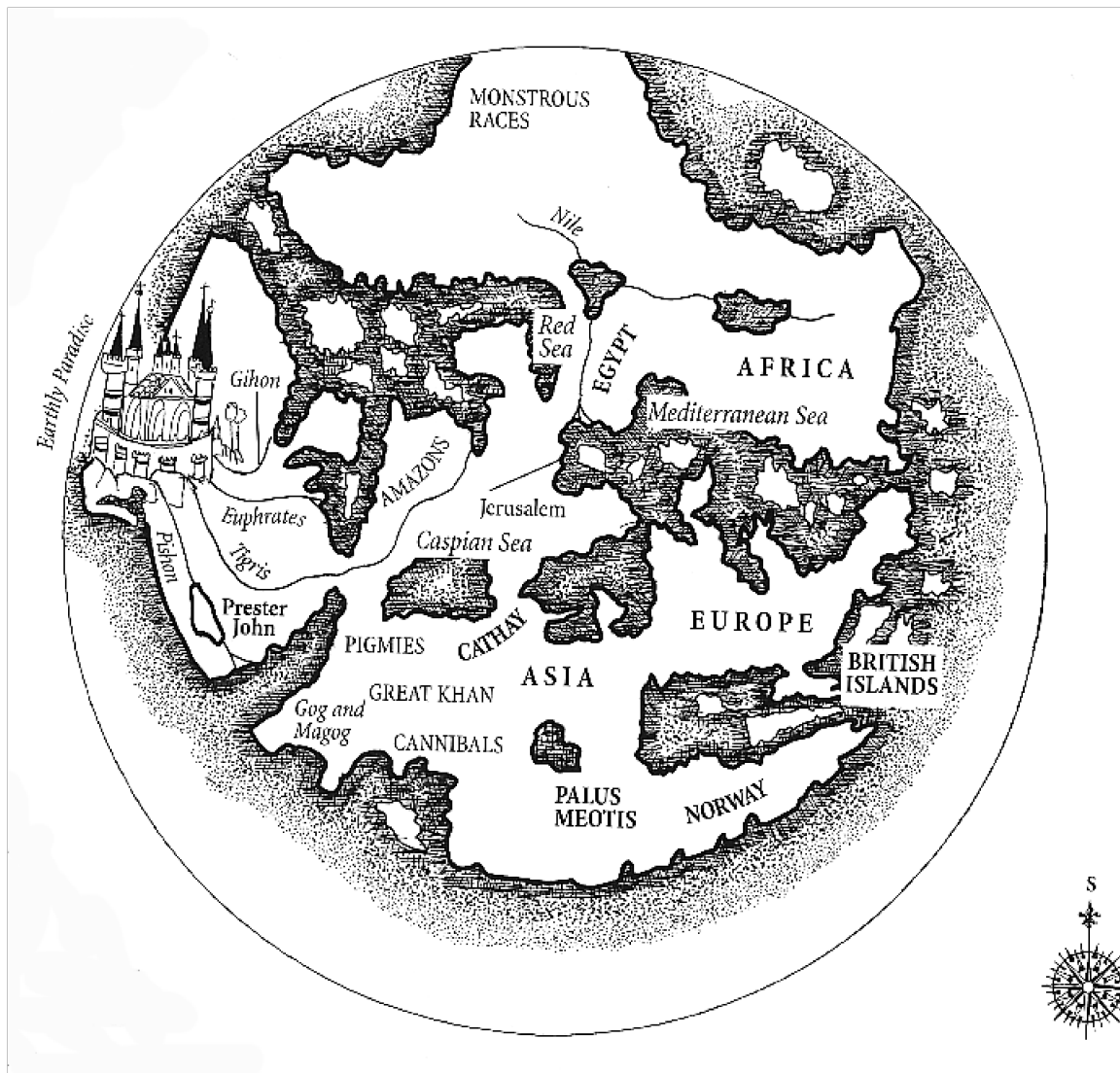
A whirlpool to the east of the Bay of Bengal is, the map comments, ‘*very dangerous for sailors*’. A chain of uninhabited islands that encompasses the Ocean to the south represents, according to an adjacent note, the southernmost limits of navigational practice:

Note that when navigators see the birds of these islands, they think that they have come too close to them and they pull away – because beyond these islands are the Shadows, which are so dense that if a ship ventured into them it would not be able to go either backwards or forwards.

This legend does not attempt to plot the *tenebre* or *scurita*, the shadows or regions of darkness that, according to the Ibn Majid’s late-15th century navigational manual, circumscribed the Indian Ocean to the south and west. Rather, it attempts to plot the practice of navigators, who used the habits of birds to locate themselves and set courses. Here, the map mediates between practically-acquired, orally-transmitted knowledge and the theoretical knowledge of the world transmitted through geography and cartography.



Andreas Walsperger's world map, 1448 (#245), Biblioteca Apostolica Vaticana, Rome, Pal. Lat. 1362b (oriented with South at the top), 57.5 cm diameter, showing a nearly enclosed Indian Ocean



In the 1485 Wieder-Woldan map (#255) shown below the Indian Ocean is shown totally enclosed. An obvious and retrograde feature of the map, when compared to earlier maps, is that no consideration is given to the discoveries made in East Asia by medieval Italian explorers. In the representation of Africa the author was evidently guided by two leading principles: on the one hand, adherence to Ptolemy's viewpoint as regards the land connection of South Africa and East Asia, and on the other hand, consideration of the recent discoveries made by the Portuguese on the west coast of Africa, which, however, in no way contradicts Ptolemy's conception. The effort to compare separate bays and points of the West African coast on the map with the actual ones in order to find out how much of the Portuguese discoveries were known to our author would be in vain. The general impression can be gathered, however, that the navigation round the Bay of Biafra (Cabo de Catarina 22° S latitude was reached by Ruy Sequeira in 1475) was the last achievement in the exploration of the west coast of Africa recorded by the map. Later discoveries, made by Diogo Cão (1482-85) as far as Cape Cross (about 22° S) were certainly unknown to the author of the map. Regarding the sources of the Nile, the

author tries to connect Ptolemy's point of view with the medieval one based on a certain interpretation of the Bible (the four rivers of *Paradise*: the *Pison* [*Fison* = Ganges] the *Gihon* [Amu Darya/Blue Nile], the *Hiddeke* [Tigris] and the Euphrates), and shows one of them, flowing from the *Lake of Paradise*, running through the whole length of Africa and uniting the other sources coming from the mountains only in the middle of the continent. The author did not share the view of some of the medieval cartographers, as known to us, that Africa was separated from Asia by a more or less wide and open ocean, because he probably regarded Ptolemy as more trustworthy than Herodotus or Idrisi; for the rest, the difference between his representation of Africa and that of Idrisi and his adherents, regarding the southern extremity of Africa protruding far out to the east and the chain of islands adjacent to it stretching out in the direction of southeastern Asia, is not so great.

As mentioned above, until the end of the 15th century, Ptolemy's depiction of the world was widely accepted as authoritative. A particularly noteworthy feature of his map of the world, beyond the Arabian, Indian and Malay peninsulas, is a long, thin, southward extension of Asia named *SINARVM SITVS* [place of the Chinese], which is joined to Africa by way of a southern land mass, thus turning the Indian Ocean into a vast landlocked lake. Ptolemy's representation was proved false when Bartolomeu Dias rounded the Cape of Good Hope in 1487– 1488. So two or three years later, when Henricus Martellus drew his four world maps, he opened up Ptolemy's Indian Ocean south of Africa, removed the southern land mass and turned his southward extension of Asia into a long peninsula to which the name *Dragon's Tail* has sometimes been applied. Martellus copied the western coastline from Ptolemy, together with three place-names: those of two rivers, *ambastus flu[uius]* and *s[a]lenus flu[uius]*, and of the port city of *Catigara*. The other inscriptions on this peninsula, and on the land immediately north of it, were derived from Marco Polo.

Three of Martellus' maps are small. The contents of all three are broadly similar, although there are a few minor differences in the portrayal of northern Europe and southern Africa. The fourth map, in the Beinecke Library at Yale University (#256), is not only much larger, measuring 79 × 48 inches (201 × 122 cm), but also has some significant differences. It is the only one to include indications of latitude and longitude and a representation of Madagascar. To the east of the *Dragon's Tail* peninsula, the sea, which is unnamed on the small maps but is here called *OCEANVS INDICVS ORIENTALIS*, is much more extensive and contains a number of large named islands. Regrettably, most of the inscriptions are illegible, but from the works of those contemporary cartographers such as Martin Behaim on his globe of 1492 (#258) and Martin Waldseemüller on his world map of 1507 (#310), who copied its relevant parts, we can with some confidence suggest that these islands are hypothetical representations of Asian islands mentioned by Marco Polo.



Wieder-Woldan Map map, 1485, 17.5 cm diameter showing the infamous land-bridge between Africa and Asia with the four Biblical rivers (the Pison [Fison = Ganges] the Gihon [Amu Darya/Blue Nile], the Hiddeke [Tigris] and the Euphrates), emanating from the Lake of Paradise on the right (East)

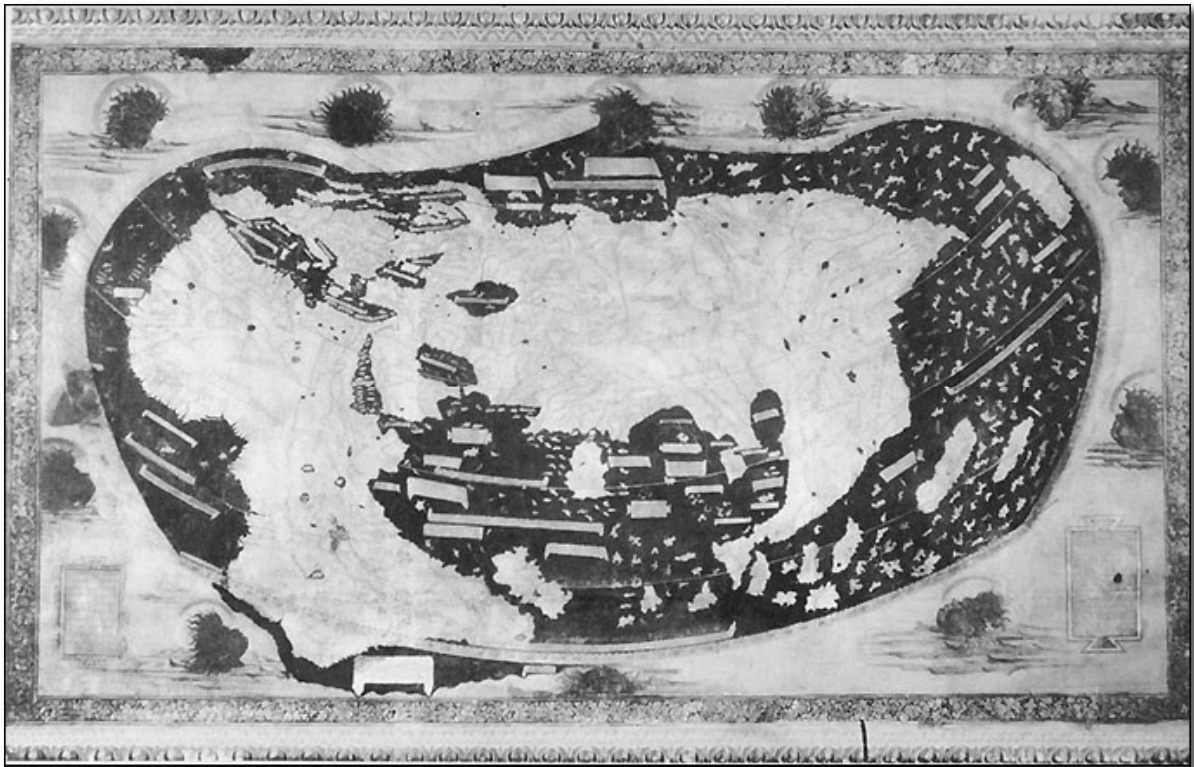


Martellus world map, 1489, from his *Insularium illustratum* (#256)
 British Library, Add MS. 15760, fols. 68~69r, London, England; 46.5 x 30 cm/18.3"x11.8"

The two maps by Henricus Martellus shown here display the widely held belief in the eastern extension of Africa (even after the discovery of the Cape of Good Hope) and in the southwesterly extension of Asia, known as the *Tiger Leg* or *Dragon's Tail*. On the world map in his *Insularium* at the British Library, Martellus shows the results of Bartholomew Dias' rounding of the Cape of Good Hope in 1488, listing the names of the various ports and landmarks along the way. "Here is the true modern form of Africa between the Mediterranean Sea and the southern Ocean, according to the Portuguese description," says an inscription. Modern Africa is so long, however, that it breaks through the frame at the lower edge of the map. The Indian Ocean is open to the south, but Martellus retains its eastern coast, which Ptolemy had called *Sinae*, home of the fish-eating Ethiopians. This was the edge of Ptolemy's map - he did not show the full extent of Asia, noting that "unknown lands" lay beyond. On the *Martellus* map there is a long peninsula to the east of the *Golden Chersonese* (Indochina), featuring the mysterious port of *Cattigara*. Unlike Ptolemy's Asia, Martellus' version has an eastern coast with the island-bedecked ocean beyond and additional names taken from Marco Polo. As mentioned above, the peninsula of *Cattigara*, i.e., the *Dragon's Tail/Tiger-leg*, was copied on most of the world maps of the first half of the 16th century, as the shape and extent of Asia was being sorted out. The coasts charted by Diaz have been fitted into the circular outline of the world of the *Fra Mauro* planisphere (#249), representing such a marked trend to the southeast that the Cape of Good Hope seems to be due south of the Persian Gulf, whereas it is due south of the Adriatic. The Indian Ocean is a little less open to the south

on the Martellus maps, compared to the *Fra Mauro* planisphere. Due south of the Malay peninsula, at 28° S, there appears an enormous peninsula which widens and turns north to join China again with the largely circular concept of the *Fra Mauro* map. This peninsula does not exist in fact, and seems to be a repeat of the *Donus Nicolaus* map of the world in the *Ulm Ptolemy*, cut away by the circular outline of *Fra Mauro*.

With the *Tiger Leg* or the *Dragon's Tail*, there has been a controversial attempt to identify it as an early map of South America, turning Ptolemy's *Sinus Magnus* into the Pacific Ocean. The corresponding coasts on the British Library *Martellus* uses a Portuguese map for them. Nevertheless, the Cape of Good Hope is at 45° S on the Yale *Martellus* map, the *Tiger Leg* extends to 33° S, and Africa breaks through the frame of the map in both. One map has been copied from the other, at one-quarter the scale. The *Dragon's Tail/Tiger-leg* must have formed part of the map and the proposals that Columbus made to King John of Portugal in 1485, for it was embodied in Portuguese cartography thereafter for half a century. It was in the prototype drawn by Bartholomew, copied by Martellus in 1489. The *Behaim* globe (#258) has placed it 30° S. The *Laon* globe (#259), made in France about 1493 (probably by Bartholomew Columbus when he served Anne, Regent of France) has the *Tiger Leg* at 40° S. It is shown to be more than 25° S in the *Cantino* map of 1502 (#306), *Canerio* map of 1504 (#307), the *Waldseemüller* maps of 1507 and 1513 (#310) and many others. If purposeful, was one of the boldest and cleverest concepts of the Admiral.



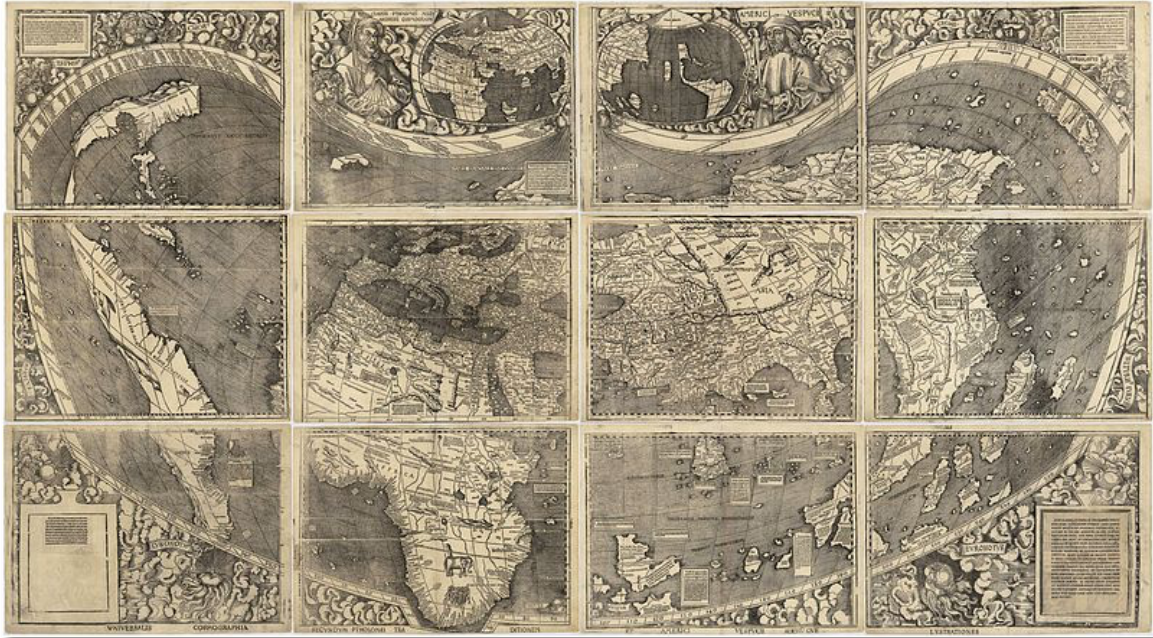
Martellus world map, 1490, 79 x 48 inches/201 x 122 cm, (#256)
Yale University Beinecke Library, New Haven, Connecticut



A comparison of Henricus Martellus Germanus' map of 1490 (outline drawing above) and Waldseemüller's map of 1507 (below)



The famous "birth certificate" of America, the 1507 Martin Waldseemüller world map (the first to include the word "America" on a map) copies the Martellus' "Tiger Leg" but provides a much more accurate contour of the African continent.



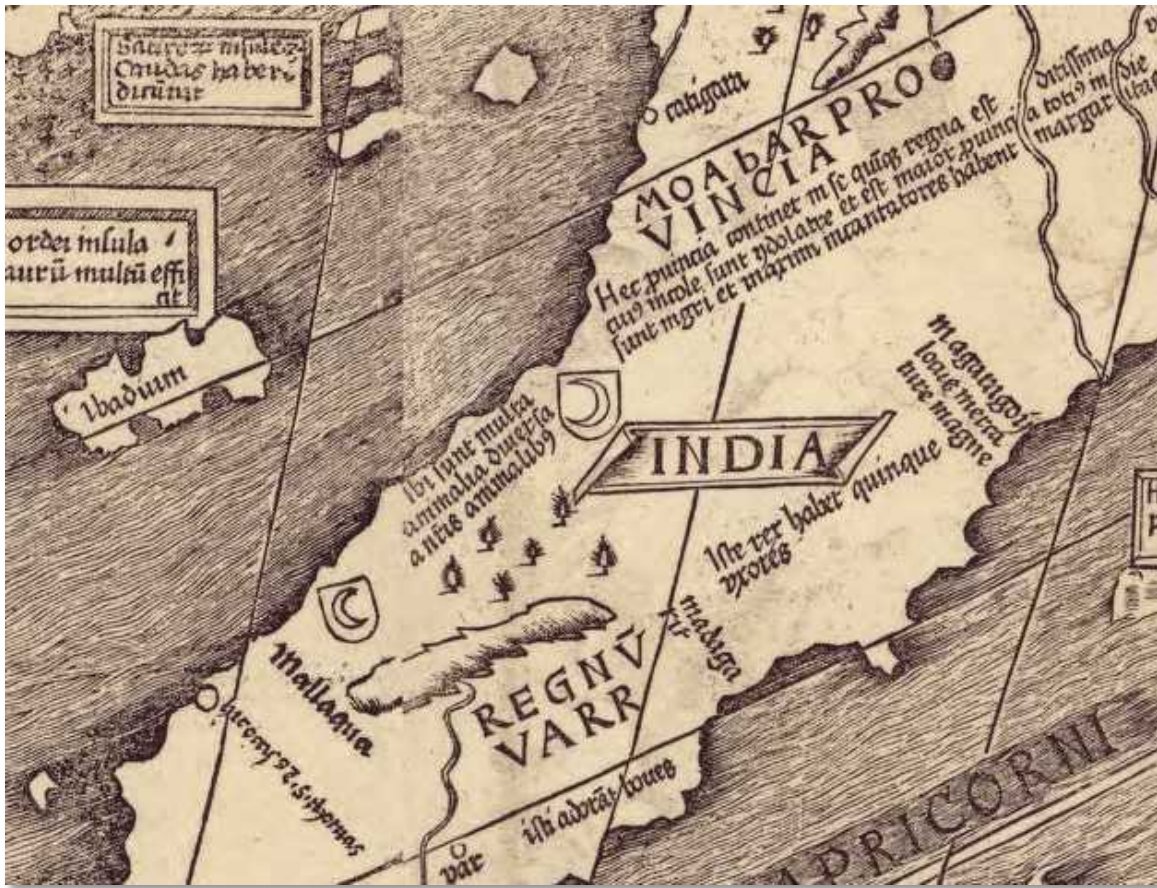
*The 1507 world map by Martin Waldseemüller: (#310)
53 x 94 inches (132 x 236 cm), woodcut on paper, 12 sheets designed to be joined.*



The Indian Ocean on the Waldseemüller map of 1507, the "Tiger Leg" on the right

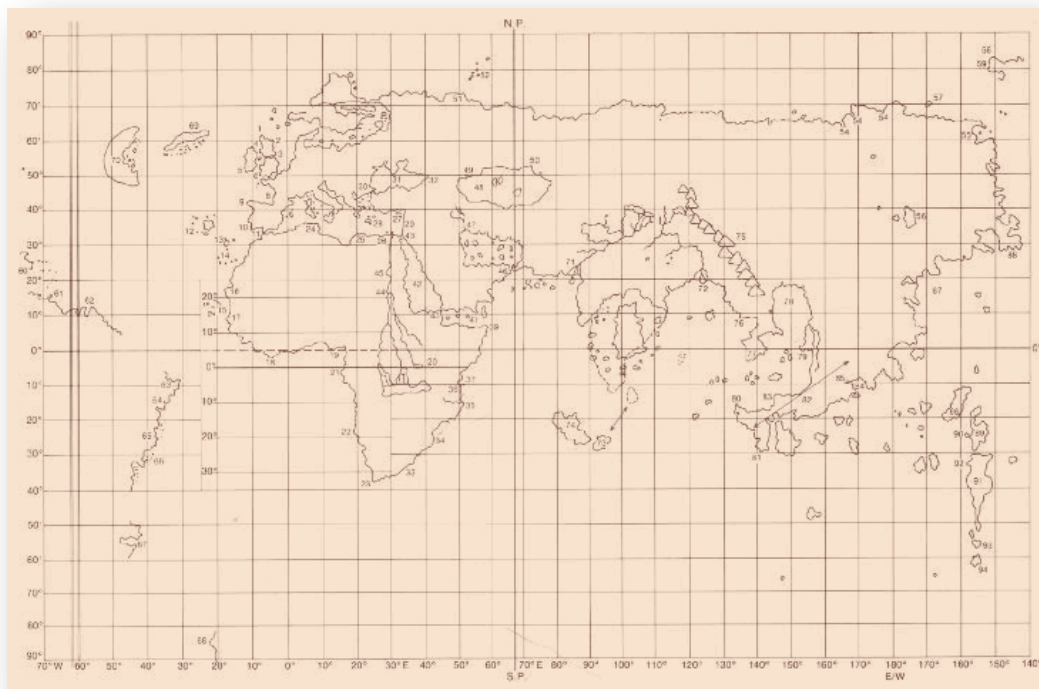
The Indian Ocean area is very representative of the Ptolemaic character, albeit re-interpreted by Waldseemüller, showing a typically enlarged *Taprobana Insula* (the location of which represents a juxtaposition of this island with *Seylam* [Sri Lanka] as found on Fra Mauro's map, a reduced Indian subcontinent, an exaggerated Madagascar and Zanzibar and a string of numerous islands (possibly representing confusion in the reports of the Maldives Islands and the Malay Archipelago) that seem to form a series of stepping stones leading to a mysteriously elongated southeast Asian peninsula labeled

India, located south and east of the *Aureus Chersonesus* [Malay Peninsula] - this extension of Indochina to 25° S, unlike the Martellus map which extends to 33° S, is a remnant of the Ptolemaic land-link between Africa and Asia that had formerly enclosed the Indian Ocean.





King-Hamy world map of 1502 (#307.1)





The *King-Hamý Chart* of 1502 is based partly on Ptolemaic and partly on *portolano* traditions, with recently discovered lands added by an early explorer, thought to be Amerigo Vespucci. The European section seemed to be based on the most accurate of the *portolano* [nautical] charts. This world map provides evidence of numerous and extensive geographical and geological changes since the first prototypes of its original local maps were drawn. It was interesting to note that in placing the center of the *portolano* chart in the Indian Ocean, the cartographer made it possible to construct a world map embracing all of Europe, Asia, Africa and the Americas as well.

One of the greatest puzzles of the *King-Hamý* map is India. As shown in detail above, India is depicted as a truncated peninsula, with a large landmass lying as an island to the south. In an obviously controversial theory, Charles Hapgood and his students considered the possibility good that this was not a result of bad cartography, but rather the influence of an ancient time when the plains of India were flooded and the southern part of the peninsula, ancient *Draoidia*, was an island. Because the mouths of the Ganges River, across the whole extent of India, was correctly placed, and that the map represents latitude and longitude fairly well, they proposed that *Dravidia* was perhaps the center of a great maritime civilization, and an advanced culture that was very old when Egypt was young. Also, there is geological evidence for the flooding of the northern plains of India, presented by A. K. Dey of the Geological Survey of India. In a paper entitled "The Shores of India", he followed elevated beaches into the interior as far north as the estuaries of the Indus. There is also literary evidence, traditions of ancient Indian literature, the *Vedas*, which tells of a time when *Dravidia* was an island.

There are additional suggestions of geological changes on the *King-Hamý* map. There is a vast extension southward of the Asian landmass, which interestingly, was also

postulated by Alfred R. Wallace, co-discoverer of the theory of evolution. He studied the distribution of species in the islands of Indonesia and concluded there was much evidence for a very recent connection between Java, Sumatra, Borneo and the mainland of Australia. He also reported native traditions that placed this connection in the very recent past, only a few thousand years ago.

So it was that because of the exchanges and interactions of people and goods within this Indian Ocean region had primarily been relegated to the northern portion of the ocean, the geography of that portion was fairly well known from ancient times, at least to local mariners. The trade and commerce included many intermediaries that exchanged goods and services back and forth from Southeast Asia, India, Eastern Africa and the Middle East. Considering all of the different cultures, languages and motivations, the cartography of this region was always subject to these influences and conflicting interests. Whether the Indian Ocean was a land-locked sea or an open ocean that intermingled with the “world ocean” was not very relevant until the Europeans needed to find a way to trade directly with the sources for spices and precious gems found in the various ports of the Indian Ocean.

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