18 · Nautical Maps

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Although, as I noted in the introductory chapter on South Asian cartography, there is a brief description of what appears to be a nautical map in a Sanskrit epic poem composed as early as the fifth century, that description does not give any clear idea of how the map might have looked or of how it was drawn.[1] In subsequent centuries, various writers left records that certain scholars have interpreted as suggesting that Indian navigators, among others sailing in the Indian Ocean region, may have produced some type of maritime charts before the advent of the Portuguese. But, in his review of the available literature, summarized above in "The Role of Charts in Islamic Navigation in the Indian Ocean" in part 1, Gerald Tibbetts concludes that there are no firm grounds for believing that Arabs, or by implication South Asians, made or possessed "practical" navigation charts before the sixteenth century.[2] Of one fact, however, we are certain: the earliest known nautical maps from South Asia date only from 1664. In what follows, we shall examine the few maps that have survived and consider textual evidence on others that are no longer extant. Whether we can project this evidence back before 1500 to postulate the earlier existence of such charts is still an open question and awaits solid evidence. But even without such evidence it will be in order to present some factors bearing on the likelihood that cartographic concepts, and possibly even maps themselves, were diffused before 1664, the date that can now be firmly established.

Based on conversations with informants residing in some of the port towns of Gujarat that are still visited by small commercial sailing craft (now usually with auxiliary motors), Varadarajan observes:

> Those navigating the high seas do possess maps and charts. These records do not fall into the category of log books, as skippers were not accountable in the European sense. The records which they maintained were for their own professional guidance rather than constituting a daily record of the voyage. Such books called *roz nama* were passed on from one *mullam* to another, each adding what was considered important for enlarging the compendium of knowledge rather than accumulating quotidian details.... Shri Dushyanta Pandya (resident of Jamnagar), and Dr. Manubhai Pandhi (resident of Kutch-Mandvi) have such *roz nama* in their possession. Details of successive voyages are entered, direction rather than speed is mentioned.... Some *roz nama* contain shoreline silhouettes, directional instructions presented in the form of riddles, and one, at least, has a coastal map of western India including Ceylon. Various calculations may also be found. The sun appears to be used for position-finding during the day.[3]

The Dushyanta Pandya that Varadaraja mentions had, in 1980, no fewer than seven *roz nāma* in his possession. The oldest, dated not later than A.D. 1664, written in Kutchi and comprising some thirty-five folios, was acquired by the National Museum in New Delhi in the early 1980s. The cartographic portion of that manual (also called *pothi*) has been the object of a detailed and exceedingly well informed study by B. Arunachalam.[4] I also inspected the original document in New Delhi in February 1984.[5] Photographs of all five maps contained in the manual are provided in figures 18.1, 18.2, and 18.3. Figure 18.4 indicates the area of coverage of each of these charts.

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1. See above, p. 321.

2. See pp. 256–62, esp. 262.

3. Lotika Varadarajan, "Traditions of Indigenous Navigation in Gujarat," *South Asia: Journal of South Asian Studies*, n.s., 3, no. 1 (June 1980): 28–35; quotation on 29.

4. Professor Arunachalam is head of the Department of Geography at the University of Bombay; see his "The Haven-Finding Art in Indian Navigational Traditions and Cartography," in *The Indian Ocean: Explorations in History, Commerce, and Politics*, ed. Satish Chandra (New Delhi: Sage Publications, 1987), 191–221. This essay was originally published under the title "The Haven Finding Art in Indian Navigational Traditions and Its Applications in Indian Navigational Cartography," *Annals of the National Association of Geographers, India* 5, no. 1 (1985): 1–23. I will cite the 1987 publication, which differs minimally from that of 1985, because of its presumed greater accessibility, the greater clarity of its illustrations, and its relative lack of typographical errors. The essay is based not merely on careful inspection of the surviving nautical charts and on archival research, but also on fieldwork at many localities along the Indian coast, among communities whose members include individuals who can recall navigational traditions that are now either moribund or dead.

5. I found the work in a serious state of decay. At least two and probably more folios of the original appear to have been lost. On many pages the ink from one side of the folio has bled through on either the

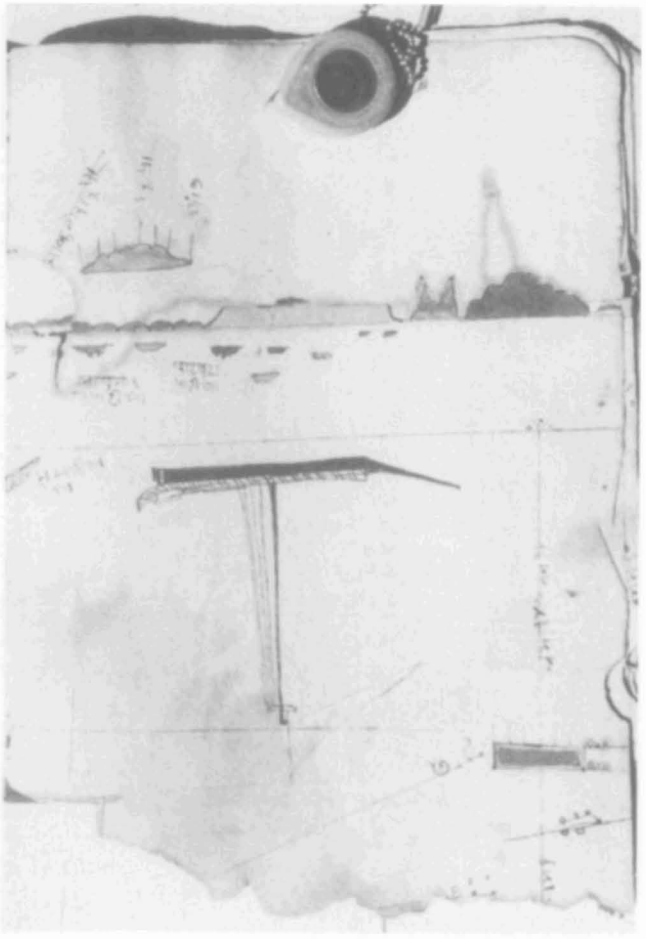


FIG. 18.1. FOLIO OF AN INDIAN *ROZ NĀMA* (NAUTICAL MANUAL). This Gujarati chart is watercolor and ink on paper, Kutchi language in Gujarati script, and dated V.S. 1710 (A.D. 1644). The short portion of the Indian coast depicted here is in the vicinity of the port of Coondapoor in Karnataka (area A on fig. 18.4).
Size of the original page: approx. 29 × 21 cm (untorn). By permission of the National Museum, New Delhi (MS. 82.263). Photograph by Joseph E. Schwartzberg.

Essential to the traditional way of navigation by the stars and to the making of the maps under discussion was the use of a compass card; an example, from the National Museum manuscript, appears as figure 18.5. A transliteration of the text of a comparable compass card, dated 1780, is provided by figure 18.6.[6] Such cards correspond closely to Arabic star compasses described by Prinsep and Tibbetts and probably are derived from Arabic prototypes that characteristically showed thirty-two rhumbs or sailing directions marked off at even intervals of 11¼°. Some Indian compass cards, however, were much simpler than the two I have illustrated. Chinese compass cards, while showing only twenty-four points, were in other respects similar to those of the Arabs.[7] The symbols at the periphery of the card represent the perceived appearance of specific constellations toward which ships were steered, together with the number of stars used to identify that constellation. In figure 18.6, east (Ṭā'ir = α Aquilae = Skt. Sravana *nakṣatra*) is at the top, and Jāh-Qutb represents the north-south axis. Each symbol appears twice on the card, at the directions of the rising and setting on the horizon of the constellation represented; hence the bilateral symmetry on either side of north. The cards were relatively accurate sailing guides for rhumbs close to north but increasingly inaccurate for sailing farther to the south.[8]

The compass card was used by providing a pair of symbols to be inscribed at either end of each of the numerous stellar rhumb lines drawn on the chart, so as to indicate sailing directions for specific legs of a voyage. Figure 18.7, adapted from Arunachalam (and corresponding to the area represented by the right portion of fig. 18.3 and also rectangle E on fig. 18.4) illustrates the system for sailing to the northeast of Kanniyakumari (Cape Comorin) at the southern tip of India and for sailing along any of the coasts of Sri Lanka.[9] The lowest rhumb line on the map shows a west-east bearing and has symbols signifying those two directions. Above the eastern terminus of that line is a rhumb, its symbols signifying a route from southwest to northeast. That it does not actually appear to go to the northeast (as it would on a European portolan chart or a Mercator projection) poses no difficulty, since it is the symbols rather than the apparent direction of the line that matter to the map user. The next rhumb indicates, according to the symbols, a north-south bearing; but the line actually appears to be veering slightly farther to the east. Again, the apparent map direction is without significance.

We may also note in the examples above that the linear distances along the stellar rhumb lines are not proportional to the actual distances represented on the earth's surface, which were not particularly well known. Since the coastal sailors had to rely on reaching visible landmarks that *were* depicted on the map (about which I shall say more below), the nautical distances traversed were

overleaf or the facing page. The folios were not individually numbered.

6. Arunachalam, "Haven-Finding Art," 201, fig. 2 (note 4); see also his figure 1 (p. 197) for various wind and star direction roses in use along different parts of the Indian coast.

7. James Prinsep, "Note on the Nautical Instruments of the Arabs," *Journal of the Asiatic Society of Bengal* 5 (1836): 784–94, esp. 788–92; Gerald R. Tibbetts, *Arab Navigation in the Indian Ocean before the Coming of the Portuguese* (London: Royal Asiatic Society of Great Britain and Ireland, 1971; reprinted 1981), esp. 290–95; and Arunachalam, "Haven-Finding Art," 200 (note 4); also *History of Cartography*, volume 2, book 2, forthcoming, and Mei-ling Hsu, "Chinese Marine Cartography: Sea Charts of Pre-modern China," *Imago Mundi* 40 (1988): 96–112, esp. 100, 102, and 103, fig. 4.

8. Arunachalam, "Haven-Finding Art," 200–201 (note 4).

9. Arunachalam, "Haven-Finding Art," 215–17 and fig. 8 (note 4).

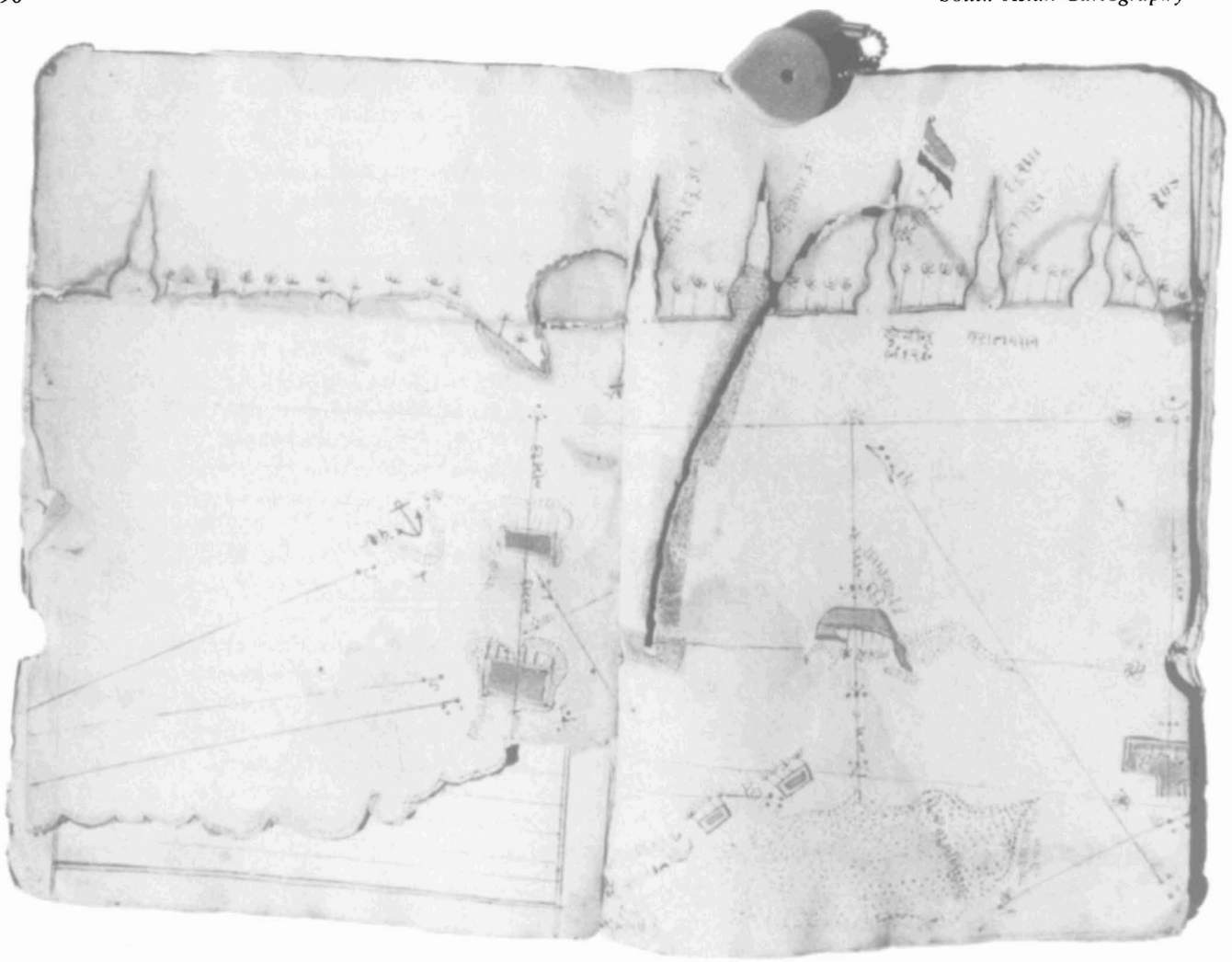


FIG. 18.2. TWO FOLIOS DEPICTING DISCONTINUOUS COASTLINE FROM AN INDIAN *ROZ NĀMA*. Physical details, provenance, date, language, and sources as in figure 18.1. The folio on the left portrays part of the Kerala coast between Cannanore and Kozhikhode (Calicut) and some of Lakshadweep (the Laccadive Islands) to the west (area B on fig. 18.4). The folio on the right shows part of the Kerala coast in the vicinity of Cochin (marked by the Dutch flag) and some of Lakshadweep as well (area C on fig. 18.4).
Size of each original page: approx. 29 × 21 cm (untorn). By permission of the National Museum, New Delhi (MS. 82.263). Photograph by Joseph E. Schwartzberg.

not especially relevant. Nevertheless, numerous distance notations did appear on some of the maps. The measure used was a *zam* (or *jam*), a unit of time-distance that corresponded to what, on average, could be covered during a single three-hour watch (watch being the original meaning of *zam*).[10] But the *zam* notations often referred to distances from the sailing route to specific mapped points along or near the shore or to specific offshore islands. Figure 18.8, also adapted from Arunachalam, shows some of the *zam* measures indicated in the chart that correspond to the right portion of figure 18.2 and also the area of rectangle C on figure 18.4. Since this chart extends from Lakshadweep (the Laccadive Islands) to the Malabar Coast, the distances it covers are such that pilots sailing the west-east rhumbs would be out of sight of land for much of the time and would then place greater reliance on time-distance measures than they would in coastal navigation.

A problem in using the type of chart under discussion is that it combines details about landmarks that would be visible mainly by day (lighthouses are an obvious exception) with stellar bearings, which would be maximally useful only between dusk and dawn, when the constellations designated would appear or disappear along the horizon. (On this point Arunachalam is silent.) One could set a course during these hours, but maintaining such a course throughout the night and into the next day, especially if there were a shift in wind direction, would not be easy. This problem, however, would be somewhat mitigated by the relative steadiness of the mon-

10. Arunachalam, "Haven-Finding Art," 205–6 (note 4).

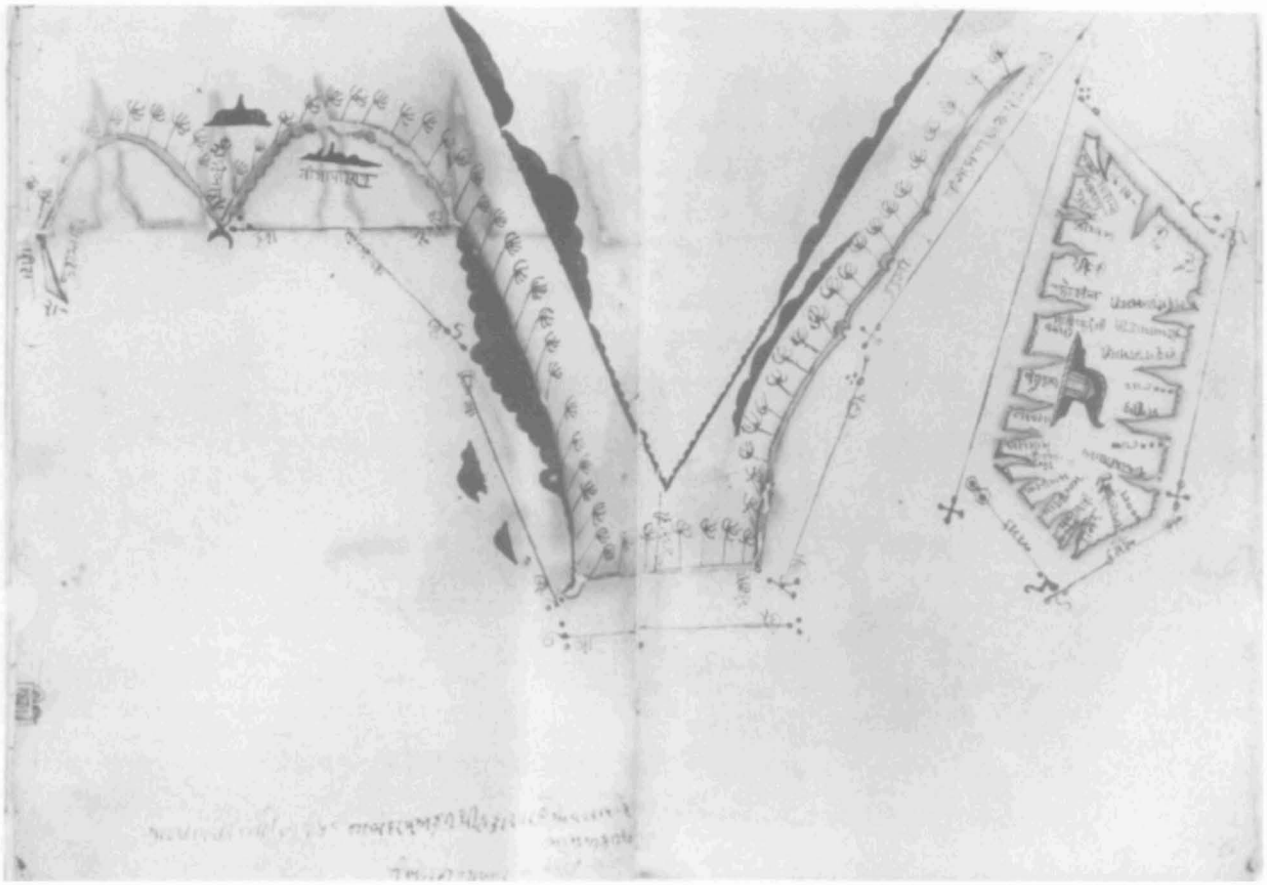


FIG. 18.3. TWO FOLIOS DEPICTING CONTINUOUS COASTLINE FROM AN INDIAN *ROZ NĀMA*. From the same manuscript as figures 18.1 and 18.2 above. The folio on the left portrays the coast from Kayankulam in Kerala to Kanniyakumari (Cape Comorin) at the southern tip of India (area D on fig. 18.4). The folio on the right shows the coast of Tamil Nadu from Kanniyakumari northeast to the old port of Kayal (near modern Kayalpattinam) and, at a greatly reduced scale, the whole of Sri Lanka (areas E_1 and E_2 on fig. 18.4). Size of each original page: approx. 29 × 21 cm. By permission of the National Museum, New Delhi (MS. 82.263).

soon winds in favored sailing seasons.

Another useful feature of the charts for navigators is their notation of Pole Star altitudes for many identified ports. These are written in numerical figures (integers and fractions) and preceded by the prefix *dhru*, signifying *Dhruva*, the North Star. Thus, if one were sailing at night and could ascertain from the altitude of the North Star that one had attained the latitude of a port one wished to sail toward on an east or west bearing, one could seek to continue along that parallel until the destination was in sight. The unit in which Pole Star altitudes were expressed was the *iṣba'*, taken as 1°36′. This was the distance one had to sail to raise (or lower) the measured altitude of the Pole Star by one integer in meridional sailing and was equivalent to eight *zams*, or roughly one day's sailing (which would yield an average distance for a *zam* of approximately 20 km).[11] Arunachalam has compared the Pole Star altitudes on Indian charts with those given in the maps and text of Tibbetts's work on Arab navigation and determined that the angles given do not accurately represent geographic latitudes. This results from the increased refraction caused by the earth's atmosphere as one approaches the equator; observed Pole Star altitudes nearer the equator are likely to be lower than if there were no atmospheric refraction.[12]

Apart from distance, direction, and Pole Star altitude notations, the surviving Indian nautical charts display substantial additional details of use to mariners.[13] These include numerous toponyms for coastal localities; skyline profiles featuring prominent hills and other landmarks; offshore islands, headlands, bays, lighthouses, anchorages, shoals, banks, and reefs, shown by special symbols (e.g., stippling) supplemented occasionally by explanatory notations (e.g., "troublesome shores"); the nature of

11. Arunachalam, "Haven-Finding Art," 208 (note 4).
12. Arunachalam, "Haven-Finding Art," 207–8 (note 4).
13. Arunachalam, "Haven-Finding Art," 209–17 (note 4).

FIG. 18.4. AREAS OF INDIA AND SRI LANKA COVERED BY SURVIVING NAUTICAL CHARTS. The areas covered are portrayed in figures 18.1 (area A), 18.2 (areas B and C), and 18.3 (areas D, E_1, and E_2).
After B. Arunachalam, "The Haven-Finding Art in Indian Navigational Traditions and Cartography," in *The Indian Ocean: Explorations in History, Commerce, and Politics*, ed. Satish Chandra (New Delhi: Sage Publications, 1987), 191–221, esp. 204 (fig. 3).

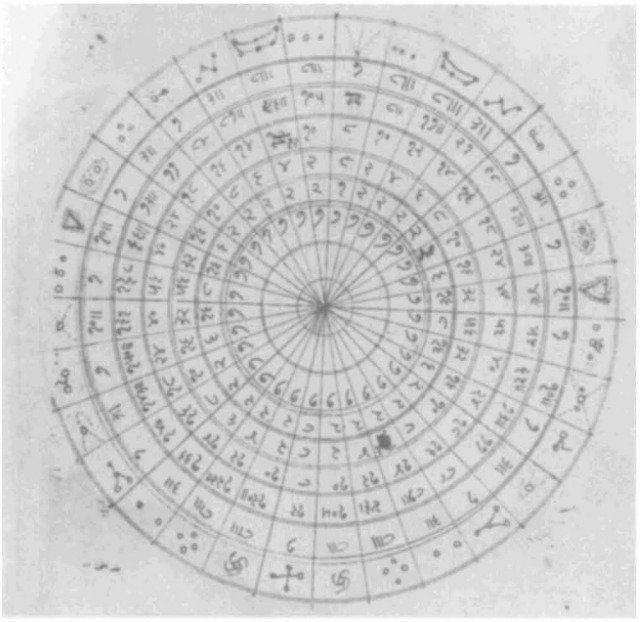


FIG. 18.5. COMPASS CARD FROM AN INDIAN *ROZ NĀMA*. Ink on paper, this chart is divided into thirty-two equal directional segments, each identified by a symbol standing for the azimuth on the horizon of the rising or setting of a particular constellation. Hence the bilateral symmetry of the symbols with respect to Dhruva, the Pole Star, the symbol for which appears at the top of the chart.
Size of the original page: approx. 29 × 21 cm. By permission of the National Museum, New Delhi (MS. 82.263).

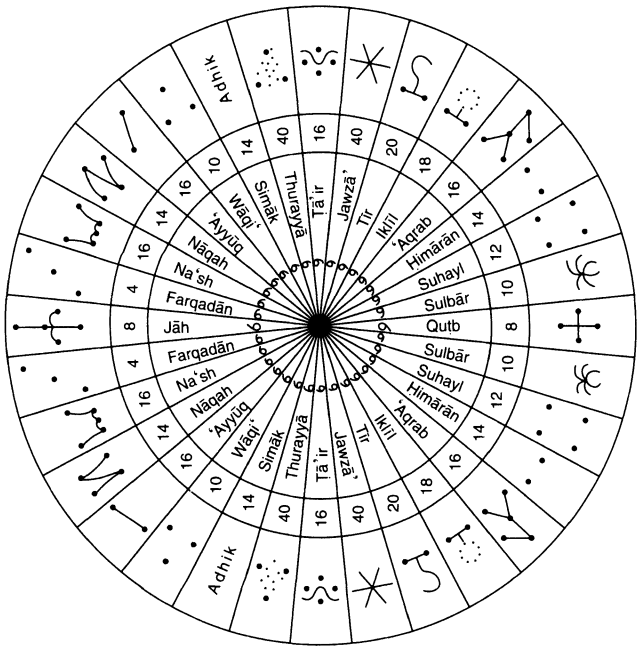
coastal vegetation (see the palm-fringed shores in figs. 18.2 and 18.3); ocean depths, measured in units called *wam* (roughly one fathom); and what seems to be a Dutch flag at Cochin and a written note to indicate the presence of Europeans (*firinghi*) in Sri Lanka.

The colors used for particular symbols appear to have significance. Noting, for example, one area in which the profiles to the rear of the coast are shown in red, in contrast to their usual black, Arunachalam wonders whether that is intended to "indicate the reddish appearance of the laterite caps of low plateaus behind the shores."[14] He also suggests that showing some islands in red and others in black might differentiate between those that are low and sandy and others that are rocky.[15] He offers no suggestion about long sections of the coast proper that are represented in yellow (bounded in brown ink), though obviously that might signify sandy strands.

Apart from the five pages with maps and the one showing the compass card, four other pages among the thirty-five surviving folios of the manual (at least two pages of maps appear to have disappeared) also contain illustrations. Arunachalam discusses none of these. One shows an enigmatic ten-spoked wheel with the Gujarati numbers one through ten in the segments between the successive spokes and a personal name inscribed in the hub. Two almost surely are essentially astrological diagrams, each with considerable text. One of these diagrams contains a central three-by-three rectangular matrix comprising an empty middle rectangle and eight peripheral rectangles, each with a constellation symbol from the compass card indicating a cardinal or secondary direction, with east at the top. The final illustration shows the same symbols, though with north at the top, several inscriptions, and a drawing of two snakes. The rear halves of the snakes, in the lower left quarter of the diagram, are intertwined, while the front halves diverge toward the upper right. Conceivably this represents the seasonal fluctuation in the position of some visible portion of the heavens, either a particular constellation or a group of constellations. The rest of the manual consists of text that has yet to be translated. Taken as a whole, the manual seems to deal not merely with navigation using the heavens and nautical charts, but also with the astrological influences that would have a bearing on when and when not to sail or engage in other nautical activities. Other information of potential use to mariners may also be incorporated in the work.

Another nautical chart of Gujarati provenance was

14. Arunachalam, "Haven-Finding Art," 210 (note 4).
15. Arunachalam, "Haven-Finding Art," 210 (note 4).



On this chart, in pairs:

Jāh = al-Juday, the Pole Star
Qutb = Pole, not only the point about which the heavens revolve, but also denotes here the north point on the horizon

Farqadān = nearest of the rhumbs to the poles, Bγ*Ursa minoris*
Sulbār = Θ*Eridani*

Na'sh = the Plough αβγδ*Ursa majoris*
Suhayl = Canopus α*Carinae*

Nāqah = the first star of the group called Sanām that forms the hump of the camel seen by Bedouins in the constellation Cassiopeia – no modern identification
Himārān = the two asses, could be γδ*Cancri*, but here probably αβ*Centauri*

'Ayyūq = α*Aurigae*, Capella
'Aqrab = Shawlah, the raised tail of the scorpion, λυ*Scorpii*

Wāqi' = "falling," from the expression *nasr wāqi'* (the falling eagle), here referring to the star Vega, α*Lyrae*
Iklīl = the crown, βδπ*Scorpii*

Simāk = Arcturus, α*Boötis*
Tīr = Sirius, α*Canis majoris*

Thurayyā = the Pleiades
Jawzā' = here probably only in the sense of the constellation Orion or the Bedouin large giant seen in the area of Orion and Gemini; it is not likely to be Gemini in this context, though the name has been applied to all three at one time or another

Tā'ir = from the expression *nasr ṭā'ir* (the flying eagle), α*Aquilae* or three stars in Aquila

FIG. 18.6. TRANSLITERATION OF A COMPASS CARD FROM AN INDIAN *ROZ NĀMA*. On this diagram east is at the top, but the bilateral symmetry about north noted on figure 18.5 still holds. Symbols here are similar but not identical to those of figure 18.5. This is a redrawing of an adaptation by B. Arunachalam of an illustration in an eighty-page leather-bound volume dated V.S. 1836 (A.D. 1780) and found in the National Museum, New Delhi.

After B. Arunachalam, "The Haven-Finding Art in Indian Navigational Traditions and Cartography," in *The Indian Ocean: Explorations in History, Commerce, and Politics*, ed. Satish Chandra (New Delhi: Sage Publications, 1987), 191–221, esp. 201. Additional information provided by Emilie Savage-Smith.

obtained from a local pilot by Sir Alexander Burnes in June 1835 and was subsequently presented to the Royal Geographical Society, London (fig. 18.9 and plate 40). Its age was not recorded, but Burnes wrote in a corner of the chart that it showed "the Coast of Arabia and the Red Sea [and was] drawn by an inhabitant of Cutch and used by pilots at the present time in that navigation." This may suggest that the chart was compiled not long before its acquisition. Kammerer assigned the work to the end of the eighteenth century, presumably on the strength of comments made on it by Edgar Blochet, who transliterated the Gujarati text into French for the Bibliothèque Nationale, Paris, which possesses a facsimile of the map.[16] The original copy in London also includes a large number of transliterated place-names, possibly adapted from Blochet.

Even though at least a century separates the Red Sea chart from the charts of southern India and Sri Lanka discussed above, the stylistic similarities between them are striking. In particular, they appear to employ identical means of using stellar rhumb lines with constellation symbols at each end to indicate sailing directions. Pole Star altitudes are similarly recorded, both at regular intervals along the African shore of the Red Sea and at selected localities elsewhere. As with the southern India charts, the apparent direction and length of the rhumb lines is of no great importance, for not only is their compass card direction conveyed by symbols, but their distances, in *zam* of sailing time, are also noted. Accordingly, the right-angle bend in the Arabian coastline at the Bab el Mandeb Strait between the Red Sea and the Gulf of Aden is totally ignored, doing no disservice to the informed map user. Arunachalam had little difficulty in transforming the chart into a form comprehensible to a contemporary non-Indian student of geography, using methods identical to those he applied to the charts previously discussed.[17]

Compared with the southern India charts, which include a richer array of detail for onshore features, the Red Sea chart puts greater stress on features at sea:

16. Albert Kammerer, *La Mer Rouge: L'Abyssinie et l'Arabie aux XVIe et XVIIe siècles et la cartographie des portulans du monde oriental: Etude d'histoire et de géographie historique*, 3 vols., Mémoires de la Société Royale de Géographie d'Egypte, vol. 17 (Cairo: Institut Français d'Archéologie Orientale pour la Société Royale de Géographie d'Egypte, 1947–52), vol. 1, pls. LXXII–LXXIII, presents a large facsimile of the map, and p. 132 gives a description of it.

17. Arunachalam, "Haven-Finding Art," 219–20, fig. 11 (note 4).

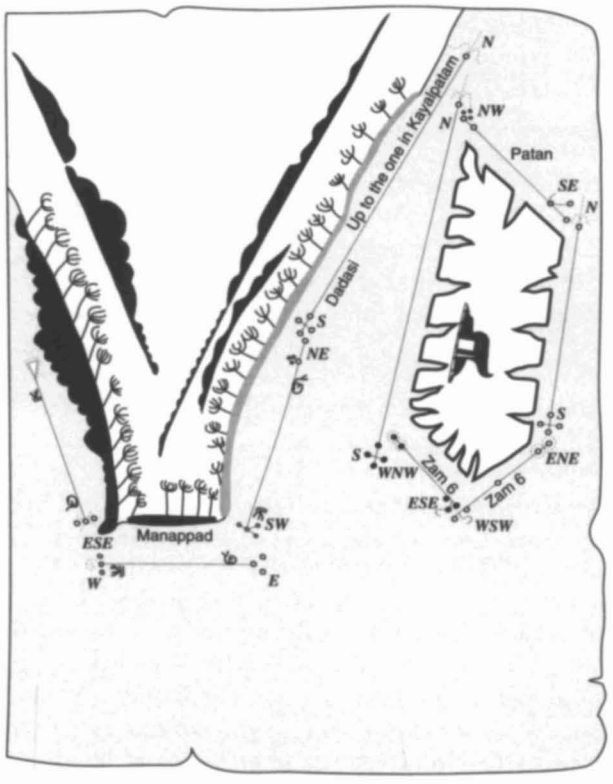


FIG. 18.7. DRAWING OF A SHORT STRETCH OF THE SOUTHERN COAST OF INDIA AND THE WHOLE OF SRI LANKA. The thin straight lines paralleling the coast represent stellar rhumbs or sailing courses. The symbols at both ends of each such line are taken from the compass card illustrated in figure 18.5 (abbreviations for the directions signified have been provided). The designations "Zam 6" along each of the two rhumbs adjacent to southern Sri Lanka signify the number of three-hour watches normally required to sail that course. The numerous ports named on the original have been omitted and also several figures (e.g., "008 1/4") indicating Pole Star altitudes above the horizon, expressed in *iṣba'*s (units of 1°36′). The nature of the Indian coastal region is shown by the fringe of palms and the profiles of the horizons to their rear. The peculiarly shaped feature in Sri Lanka is presumably Śrīpada (Adam's Peak). The scale at which Sri Lanka is shown is several times smaller than that used for the mainland.
After B. Arunachalam, "The Haven-Finding Art in Indian Navigational Traditions and Cartography," in *The Indian Ocean: Explorations in History, Commerce, and Politics*, ed. Satish Chandra (New Delhi: Sage Publications, 1987), 191–221, esp. 216, 218.

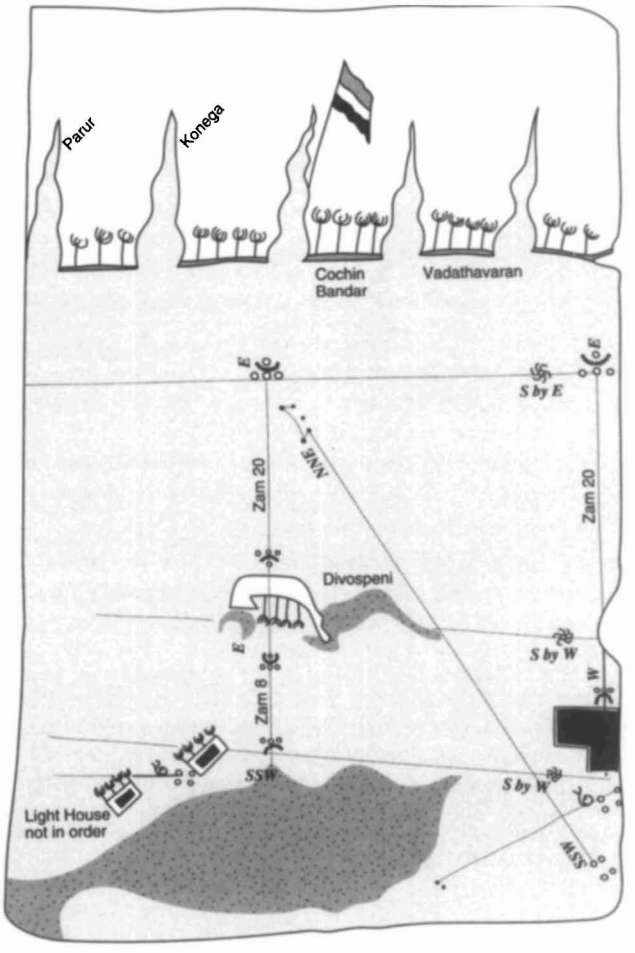


FIG. 18.8. DRAWING OF A SHORT STRETCH OF THE MALABAR COAST AND THE LACCADIVE ISLANDS OF INDIA. In this figure, note the great contraction of the east-west extent across the open reaches of the Arabian Sea. The conventions on this diagram are by and large the same as for figure 18.7. The most important feature of this map, however, is its emphasis on depicting sailing times in *zam* between Lakshadweep (the Laccadive Islands) and the Malabar Coast.
After B. Arunachalam, "The Haven-Finding Art in Indian Navigational Traditions and Cartography," in *The Indian Ocean: Explorations in History, Commerce, and Politics*, ed. Satish Chandra (New Delhi: Sage Publications, 1987), 191–221, esp. 213.

islands, shoals, reefs, shallows, and the like. A part of the difference presumably relates to the different scales employed and to the differences in the sizes of the ships the maps were intended for. The larger-scale southern India charts were probably used mainly by small vessels carrying on coastal trade in short stages, whereas the small-scale Red Sea chart would have served craft capable of crossing the open waters of the Arabian Sea and linking the ports of Gujarat with those of Arabia and the horn of Africa. The effective northern limit of the Red Sea map was Jiddah, the port for Mecca, which suggests that carrying pilgrims on the hajj was among the functions those ships performed. Yet despite its scale, the chart did find room for profiles of selected stretches of coastline, for symbols designating forested shorelines (which would have been rare, even in the relatively humid Yemeni portion of Arabia), for major mosques and other coastal monuments, and for the flags of the potentates whose domains included the coastal regions depicted.

A study of the documents relating to the Red Sea chart

notes that "Burnes was also shown the Kutchi copies of English charts which had been brought 'a hundred years before' from Holland by Ram Singh, and he found no similarity between them and this 'native' chart."[18] That Gujarati pilots, even after seeing and copying European charts, continued to rely on charts of their own device suggests their ongoing faith in the reliability of the latter as an aid to navigation. It does not, of course, imply that one type of chart was inherently superior to the other, since there is normally a cultural predisposition in favor of what is familiar; but it does allow one to believe that Gujarati navigators saw no great advantage in converting to charts of Western origin.

Burnes's note in regard to the Red Sea charts is so matter-of-fact that we may surmise he saw nothing especially unusual about it, though just how common such maps might have been we cannot say. Kammerer has a rather deprecatory paragraph on the Red Sea map that makes it clear that he did not really understand how it was used. Nevertheless he seems to have recognized, although with no statement as to the source of his knowledge, that the map was one of a type habitually employed by Indian pilots in the service of Gujarati *banias* (merchants) during the eighteenth and nineteenth centuries, but that had since become very rare.[19]

Gujaratis were not the only South Asians known to have made original nautical charts or to have copied or adapted European charts. Clarence Maloney states:

> In the 1830s, Captain Moresby saw Maldivians make and repair astrolabes, quadrants and wooden sextants, and they copied the English nautical tables. He noted schools for navigation on some islands. But there were indigenous charts too, for James Tennent wrote in 1860 that he had seen Maldivian sailors with "charts, evidently copied from very ancient originals" perhaps derived from those developed by the Arabs, which did show the Maldive Islands.[20]

When the Maldivians first began to make charts is not suggested, nor do we know when they gave up the practice.

In a historical review by Brohier devoted primarily to land surveys in Ceylon, to which the Maldives were formerly administratively attached, a catalog of historical maps gives details on two allegedly Maldivian nautical charts and provides a facsimile illustration of one.[21] The look of the map, said to measure 90 by 60 centimeters, and the relevant title and text, however, are rather discordant and confusing. The illustration is titled "Chart of Southern Asia and East Africa (Used by Early Arabian Navigators, circa 13th Century)," but the map, which extends all the way to the Malay Archipelago, appears very much like a seventeenth-century European portolan chart, bears the Western style of Arabic numerals, and seems in no obvious way an indigenous Maldivian production. To confound matters further, Brohier's text indicates that the map was drawn on paper with an 1801 watermark, while a catalog box preceding the text reads: "MAP No. 50 17th Century." The second allegedly Maldivian chart is not illustrated, but the text says it is "almost identical with Map No. 50 save that the total area mapped is not so extensive" and notes an 1815 watermark.[22] On the former map is a note, presumably relating to the pair, that reads, "Charts upon which the Maldivians navigate and which were given to Sir Alexander Johnston (Chief Justice) by the chief man whose business it was to navigate the vessels of the Sultan of Male which brought the annual presents from the Sultan to the King of England in the year 1817."[23]

Although the foregoing paragraph throws no clear light on the alleged "ancient" style of chart that Tennent wrote about, it does suggest that Maldivian sailors, who presumably felt as much at home in their neighboring seas as any maritime group in the Indian Ocean basin, might have made use of charts and might have felt a need to adapt them to their own purposes. In passing, let me note that, along with the charts, Johnston was also given "a book in the Maldive language on astrology to which the Maldive navigators referred for directions as to the days of sailings and other circumstances which might occur during the different voyages which they made."[24] In this they resembled their Gujarati counterparts.

A related note of similar date bearing on the links between navigation, charts, and astrology is provided by H. H. Wilson in his 1828 catalog of the vast collection of manuscripts of the deceased surveyor general of India, Lieutenant Colonel Colin Mackenzie. In the section on Tamil books, a palm-leaf manuscript is described as follows:

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18. Susan Gole, *Indian Maps and Plans: From Earliest Times to the Advent of European Surveys* (New Delhi: Manohar Publications, 1989), 156. "The titles of the English charts that Burnes gives," says Gole, "suggest that they were early 18th century English charts by John and Samuel Thornton."

19. Kammerer, *La Mer Rouge*, 1:132 (note 16).

20. Clarence Maloney, *People of the Maldive Islands* (Bombay: Orient Longman, 1980), 156. For Tennent's comments, see James Emerson Tennent, *Ceylon: An Account of the Island Physical, Historical, and Topographical, with Notices of Its Natural History, Antiquities and Productions*, 5th ed., thoroughly rev., 2 vols. (London: Longman, Green, Longman, and Roberts, 1860), 1:636, n. 2. Robert Moresby's work, "Nautical Directions for Maldive Islands" (1839), was not published.

21. R. L. Brohier, *Land, Maps and Surveys*, 2 vols. (Colombo: Ceylon Government Press, 1950–51); vol. 2, R. L. Brohier and J. H. O. Paulusz, *Descriptive Catalogue of Historical Maps in the Surveyor General's Office, Colombo*, 2:158–59 and pl. LI.

22. Brohier, *Land, Maps and Surveys*, 2:159 (note 21).

23. Brohier, *Land, Maps and Surveys*, 2:158 (note 21).

24. Brohier, *Land, Maps and Surveys*, 2:158 (note 21).

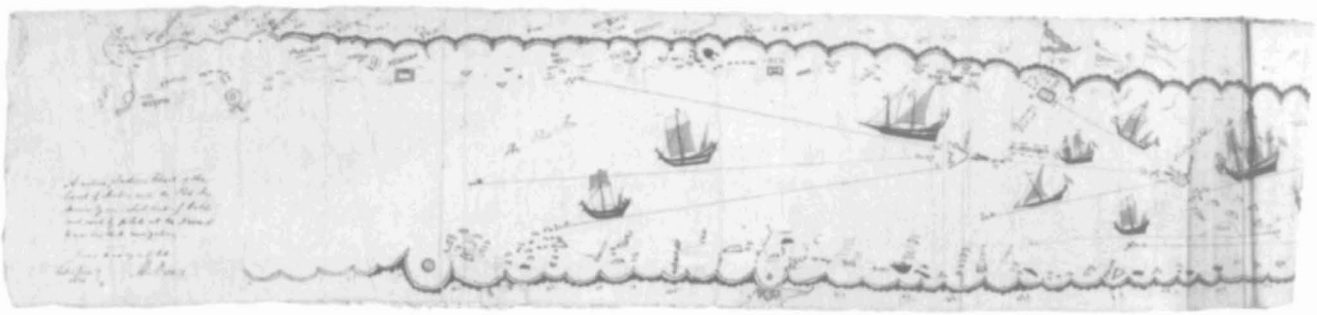


FIG. 18.9. NAUTICAL CHART OF THE RED SEA AND THE GULF OF ADEN. This nautical chart has text in Kutchi, Gujarati script, with English transliterations and a handwritten note by Sir Alexander Burnes added. Dating from the late eighteenth or early nineteenth century, it was given to Burnes by a Kutchi pilot in 1835. A noteworthy feature of the map is the prolongation, in a straight line, of the axis of the Red Sea beyond Bab el Mandeb and into the Gulf of Aden, the axis of which is actually at roughly a 90° angle to that of the Red Sea. Given the conventions incorporated within this map, however, this posed no difficulty to the pilots who used it. Seemingly the map was not used for travel farther north on the Red Sea than Jiddah, the port for Mecca, since there are no rhumbs depicted north of that city. Left and right photographs respectively show the northern and southern portions of the map. Watercolor and ink on paper, with heavier paper backing.
Size of the original: 24.5 × 195 cm. By permission of the Royal Geographical Society, London (Asia S.4).

> A work professedly on navigation, but in fact an astrological account of the destinies of Ships, and those who sail in them, according to certain marks and planetary aspects. The substance of it is thus described at starting; "Sitting opposite to the sun, a figure of a Ship is to be delineated, with three masts, of three yards each, and three decks, amongst these the twenty eight asterisms are to be distributed, nine amongst the rigging, six in the interior of the hull, one at the bottom, and twelve on the outside. In calculating them the person is to begin with the star in the main top mast yard, and then count those on the right side, and according to the distance between it and the asterisms, in which the sun happens to be, will be foretold future events, the good or evil fortunes of the Vessel and its commander. By *Terukuta nambe*."[25]

This entry is immediately followed by another relating to a work written on paper entitled *Kāpilaśāstra*, which in its entirety reads, "A work of a similar character as the last, attributed to the *Muni Kapila*."[26]

Although the evidence we have examined to this point relates to the use of navigation charts by South Asians in the western portion of the Indian Ocean basin after contact with Europeans, there is at least one notice, apart from Wilson's puzzling observations about the two Tamil manuscripts, that indicates Indian familiarity with charts in Java. Referring to the first Dutch voyage to Java (in 1596), Meilink-Roelofsz notes that "the high Bantemese functionaries with whom the Dutch came into contact (both of whom . . . came from India) were very well acquainted with nautical charts, and they immediately asked to be allowed to inspect those of the newcomers so that they might know from which country their strange visitors had come."[27]

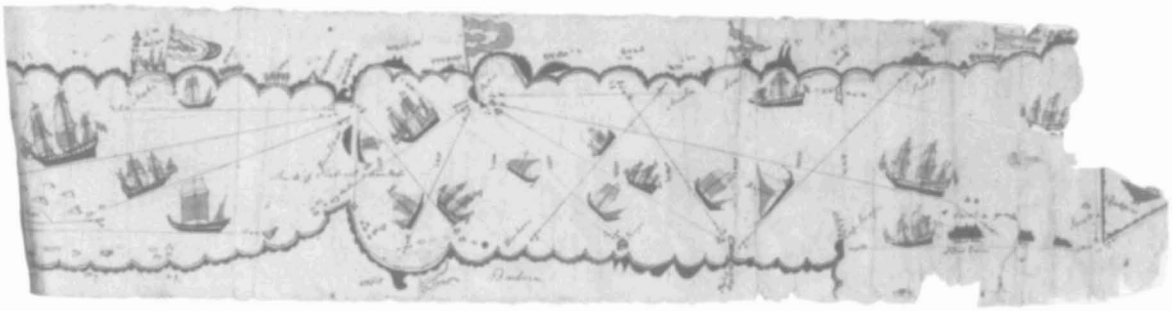
However suggestive these notes may be with regard to early South Asian use of nautical maps, the lack of surviving tangible evidence of maps from before 1664 leaves one uncertain when such maps were first used. That the examples we have described are fairly sophisticated, as well as fairly reliable, makes it reasonable to suppose they were not the earliest prototypes of their genre. But how much time would have been required for charts such as those to evolve is an open question—as is the question of where they evolved. That the surviving examples all come from Gujarat, yet relate to areas as distant from that region as Sri Lanka, southern India, and the Red Sea, suggests further that there probably existed—at least by the seventeenth century, if not earlier—many other charts of intervening areas, not to mention Gujarat itself. About 1500, Gujaratis, even more than the Arabs, were the dominant traders on most of the routes of the Indian Ocean from East Africa to Indonesia and beyond, all the way to China.[28] If any mercantile community in Asia then had a need for maps, it would have been that of Gujarat. The inspiration for Gujarati mapping, whenever it did originate, may well have come from the Arabs; but it also seems plausible that at least in part the inspiration could have come from China.

25. Horace Hayman Wilson, *Mackenzie Collection: A Descriptive Catalogue of the Oriental Manuscripts, and Other Articles Illustrative of the Literature, History, Statistics and Antiquities of the South of India; Collected by the Late Lieut.-Col. Colin Mackenzie, Surveyor General of India*, 2 vols. (Calcutta: Asiatic Press, 1828), 1:261–62.

26. Wilson, *Mackenzie Collection*, 1:262 (note 25).

27. M. A. P. Meilink-Roelofsz, *Asian Trade and European Influence in the Indonesian Archipelago between 1500 and about 1630* (The Hague: Martinus Nijhoff, 1962), 354, n. 123.

28. Michael N. Pearson, *Merchants and Rulers in Gujarat: The Response to the Portuguese in the Sixteenth Century* (Berkeley: University of California Press, 1976), 10.



In her discussion of Chinese cartography in *Imago Mundi*, Mei-ling Hsu states that the literature on maritime activities has shown that Chinese nautical cartography originated at least as far back as the thirteenth century. Of the various types of nautical maps known to have been produced in China, the most remarkable was the one that appeared in the *Wubei zhi* (Treatise on military preparations), a work that, among other things, documents the seven great maritime expeditions into the Indian Ocean region that were led by the Ming admiral Zheng He between 1405 and 1433.[29] I will not attempt to summarize here what will be discussed in volume 2, book 2 of the *History of Cartography*, but let me simply observe that the *Wubei zhi* chart (in forty sheets), though strikingly different in appearance from those emanating from Gujarat, did in certain respects resemble them functionally.

In his chapter in part 1, Tibbetts drew attention to the wide knowledge of the Indian Ocean contained in both Chinese and Arabic geographical literature and suggested that certain methods of navigation were common to all of its littoral peoples, and he noted that the Arabic texts on the subject were more or less indicative of the nature of all Indian Ocean sailing.[30] Similar ideas about the commonality of certain cultural traits within the region have been expressed by numerous other authors. Neville Chittick, for example, has stated that until about 1500 the Indian Ocean was "arguably the largest cultural continuum in the world" and that in its western region "the coasts had a greater community of culture with each other and with the islands than they had with the land masses of which they formed the littorals."[31] A characteristic of Asia's great port cities was the heterogeneity of their populations. Because the seasonal nature of the monsoons enforced long layovers when sailing in particular directions—or sailing at all—was impractical, representatives of all the major seafaring communities from the Arab world to China (and later also from Europe) would necessarily live close together for long periods in small coastal communities. In such circumstances, exchange of information relative to sailing—which was potentially a matter of life or death to all concerned—was inevitable. Whereas shipowners might have put a premium on secrecy and enjoined it on those in their employ, the interests of sailors were diametrically opposite.[32]

In light of the maritime interaction over many centuries among India, China, the Malay Archipelago, and the Middle East, and taking into consideration the views expressed by numerous writers about the remarkable cultural convergence within the Indian Ocean basin, it seems reasonable to suppose that cartographic innovations could have diffused from any one of its littoral regions to any or all of the others. From 1498 onward, the Portuguese and other European powers could also have played an important role in spreading new ideas about nautical maps. Yet despite many broad cultural similarities within the overarching region, local differences obviously persisted. It therefore seems likely that diffusion processes within that region—to whatever extent they did occur—would have been accompanied by some adaptation of innovations to the indigenous cultures of the peoples they spread to, thereby masking in varying degree the identity of the source area. In conclusion, then, one may plausibly suggest that the spread of new ideas that affected cartographic thinking and practice among Asian mariners was an interactive process in which many peoples and areas, including those of the West, may have played significant roles.

29. Hsu, "Chinese Marine Cartography," passim (note 7).

30. Tibbetts, "Role of Charts," esp. 257 (note 2).

31. Neville Chittick, "East Africa and the Orient: Ports and Trade before the Arrival of the Portuguese," in *Historical Relations across the Indian Ocean*, General History of Africa: Studies and Documents 3 (Paris: United Nations Educational, Scientific and Cultural Organization, 1980), 13–22, esp. 13.

32. Michael N. Pearson, "Introduction I: The State of the Subject," in *India and the Indian Ocean, 1500–1800*, ed. Ashin Das Gupta and Michael N. Pearson (Calcutta: Oxford University Press, 1987), 12–14.