

15 • Introduction to South Asian Cartography

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In terms of surviving numbers of maps, and in some ways in map quality as well, the premodern cartographic achievements of South Asia pale by comparison with those of the neighboring regions of the Islamic world and East Asia. That this should be so is a matter for wonder, given India's major contributions to astronomy, geometry, and other branches of mathematics and the remarkably creative exuberance of its culture. Although there are grounds to suppose that Indians produced maps for various purposes for roughly two millennia before the advent of the Portuguese—and possibly over a considerably longer period—virtually nothing in the way of ancient cartography survives. In fact, apart from some incised potsherds of the second or first century B.C. that bear rough plans of monasteries and a few ancient sculptures depicting sacred rivers, there is no extant cartographic or cosmographic production of a distinctly Indian stamp that can be unequivocally assigned to any date earlier than A.D. 1199–1200, the date of a Jain bas-relief representation in stone of the mythical continent Nandiśvaradvīpa (fig. 15.1), which to European eyes would not appear to be a map at all.¹

Nevertheless, from a variety of written records, both indigenous and foreign, we can infer much about the nature of cartography in its broadest sense, including cosmography, over much of the span of Indian history; and we may reasonably suppose that some of the indigenous maps of the past several centuries carry on traditions of considerable antiquity. For this reason, when I employ the term “pre-European” in the following account, I do not necessarily imply a time before 1498, the date when Vasco da Gama first reached India. Rather, I mean that the artifact being discussed is one in which one can find no clear sign of direct or even indirect European influence. I shall not, however, limit the discussion to works with no discernible European influence. To do so would impose an arbitrary restriction on the inquiry and remove from consideration a substantial corpus of interesting maps in which indigenous and foreign elements are blended in varying degrees. Subsequent volumes of this history will consider other South Asian maps, such as those of the Survey of India, whose inspiration

and execution derive almost solely from European or other modern models.

When I use the term “Indian” in this section, I do not refer only to the area of the present-day Republic of India but include the whole of the Indian subcontinent, including Sri Lanka, other nearby islands, and an indeterminate penumbra of adjacent mountainous terrain within the cultural orbit of India (fig. 15.2). There are also times when I shall refer to an even wider Indic cultural realm that would include the more or less Indianized cultures of mainland and insular Southeast Asia (modern Myanmar [Burma], Thailand, Laos, Cambodia, Malaysia, and much of Indonesia) and the vast region of southwestern China inhabited by Tibetans, an area substantially larger than the present Tibetan Autonomous Region. The Indic realm thus includes the areas of Asia over which the Hindu and Hinayana Buddhist faiths predominate as well as the Tibetan portion of the area of Lamaistic Buddhism, which has been heavily influenced by Indian culture. Some general observations on the peripheral portions of the Indic realm will appear elsewhere in this chapter, but the major discussion of their cartographic and cosmo-

For assistance with this chapter and successive chapters on the cartography of South Asia, I am indebted to numerous individuals who will be individually acknowledged in the appropriate contexts. I must express more general appreciation, however, for the contributions of several scholars. Foremost among these is Mrs. Susan Gole. She and I have regularly exchanged notes on our discoveries relative to South Asian cartography since December 1983. I acknowledge my immense debt to her for sharing with me and others of the *History of Cartography* project staff not only her knowledge of specific maps and relevant literature, but also her extensive collection of photographs of various works, not all of which I had an opportunity to study independently. Others to whom I am particularly indebted include Professor Emeritus C. D. Deshpande, the doyen of Indian geographers and a former education minister of the state of Maharashtra; Professor B. M. Thirunaranan of the University of Madras; Professor B. Arunachalam of the University of Bombay; and Professor Irfan Habib of Aligarh Muslim University, all of whom guided me to Indian maps that I might not otherwise have discovered. Thanks are due also to Mr. Robert Stolper, an art dealer now based in Bath, formerly in London, and to Dr. Chandramani Singh, director of the Jaigarh Fort Museum near Jaipur.

1. This map will be discussed on pp. 367 and 373.

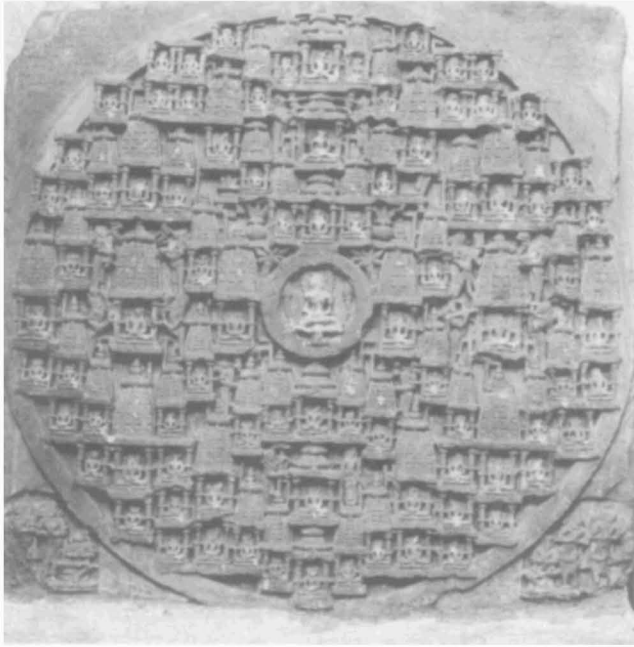


FIG. 15.1. NANDĪŚVARADVĪPA, THE EIGHTH CONTINENT OF THE JAIN COSMOS. This bas-relief in stone is at present in the Sagarām Soni temple, Mount Girnar, Saurashtra, Gujarat; it was originally in a colonnaded cloister of the nearby Neminātha temple. Jains believe this continent is a place of festive gatherings for Siddhas (lesser deities). The tightly clustered rings and the circle in the center represent Jambūdvīpa, the innermost continent, and six additional concentric continents between it and Nandīśvaradvīpa. Dated Śaka 1256 (A.D. 1199–1200).

Size of the original: not known. By permission of the American Institute of Indian Studies, Center for Art and Archaeology, Varanasi, and courtesy of the Archaeological Survey of India.

graphic achievements will be presented elsewhere in a later volume of this history. Finally, I shall include in the discussion of South Asia a consideration of a number of Indo-Islamic works that might equally well have been discussed in other regional contexts. To the extent that these works are influenced by Hinduism or other Indic traditions, this decision seems logically defensible.

The plan of this introductory chapter on South Asia is as follows: I begin with a discussion of the literature bearing on the history of the region's cartography, including both works explicitly concerned with that subject and others throwing more indirect light on it. I then indicate the locales for study and suggest areas where future research might be fruitful. A historical survey follows, suggesting the types of maps that might have been (or are known to have been) produced at different periods in Indian history. The Introduction concludes with a consideration of the wide range of reasons for the relative paucity of maps of Indian provenance.

THE STATE OF OUR KNOWLEDGE

PUBLISHED WRITINGS

The relative paucity of surviving pre-European maps from South Asia is, not surprisingly, reflected in the meagerness of the relevant scholarly literature. Further, what literature does exist failed to do justice to the available corpus of cartography until the appearance in 1989 of Susan Gole's *Indian Maps and Plans* (of which more below), making the picture appear substantially worse than it actually is.² Entire genres of South Asian maps received virtually no notice, and were it not for the contributions of art historians, they would have remained unknown to modern scholarship. This is particularly true for works of an essentially cosmographic nature—which Gole has elected not to discuss—and these loom much larger in importance throughout the Indic cultural realm than in the premodern West.

General histories of cartography, from Santarém to the present day, characteristically either ignore South Asia altogether or dismiss it in one or two pages or even paragraphs.³ Similarly, most have virtually nothing to say about Southeast Asia and Tibet. Bagrow's *History of Cartography* as revised and enlarged by Skelton, for example, asserts that "India had no cartography to speak of" and that "no one in India seems to have been interested in cartography."⁴ The only indigenous map of Indian provenance cited in that history is identified simply—and misleadingly—as a seventeenth-century Persian map.⁵ The world map in question was found in Bombay and is undoubtedly Indian. A more sympathetic, though almost equally cursory, view of Indian cartography will be found in P. D. A. Harvey's *History of Topographical Maps*. Harvey singles out India, along with Mexico, as a source region for "picture maps," a genre that does happen to be among the most common in works of Indian provenance.⁶ Kish's *La carte: Image des civilisations* refers only to Indian cosmography. Its illustrations are limited to secondary drawings taken from an early

2. Susan Gole, *Indian Maps and Plans: From Earliest Times to the Advent of European Surveys* (New Delhi: Manohar Publications, 1989). To a large extent, Gole's work was stimulated by her interest in the *History of Cartography* project.

3. Manuel Francisco de Barros e Sousa, Viscount of Santarém, *Essai sur l'histoire de la cosmographie et de la cartographie pendant le Moyen-Age et sur les progrès de la géographie après les grandes découvertes du XV^e siècle*, 3 vols. (Paris: Maulde et Renou, 1849–52).

4. Leo Bagrow, *History of Cartography*, rev. and enl. R. A. Skelton, trans. D. L. Paisey (Cambridge: Harvard University Press; London: C. A. Watts, 1964; reprinted and enlarged, Chicago: Precedent Publishing, 1985), 207–8, quotation on 207.

5. Bagrow, *History of Cartography*, 208–9 (note 4).

6. P. D. A. Harvey, *The History of Topographical Maps: Symbols, Pictures and Surveys* (London: Thames and Hudson, 1980), 115–20.

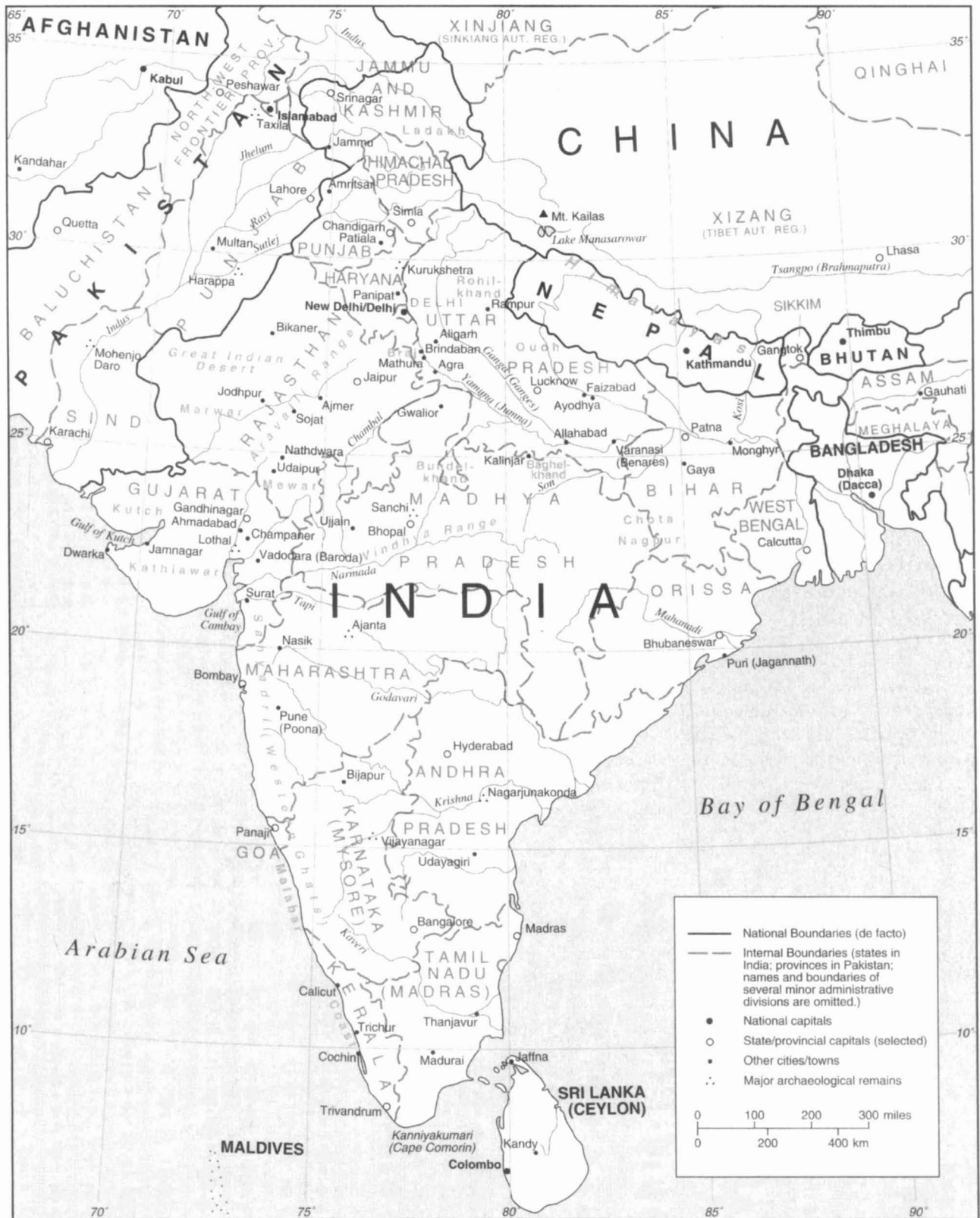


FIG. 15.2. GENERAL REFERENCE MAP FOR THE STUDY OF INDIGENOUS SOUTH ASIAN CARTOGRAPHY.

essay by Francis Wilford.⁷ The histories of Brown and Crone, among others that need not be cited, totally ignore the premodern indigenous cartography of South Asia.⁸ In *Acta Cartographica* from 1967 to 1981, one finds not a single reprint of any article bearing significantly on indigenous South Asian cartography.⁹ *Imago Mundi* makes a somewhat better showing, with four relevant submissions, all by Colonel R. H. Phillimore, formerly of the Survey of India. These total only twelve pages, however, and include only one substantive research paper.¹⁰

Specialized works dealing mainly with South Asian cartography are rare and include but a handful of monographs or book-length texts. No published work compares with the magisterial coverage of cartography in Joseph Needham's *Science and Civilisation in China*.¹¹ Noteworthy as the earliest attempt to provide a comprehensive overview of ancient sources is Francesco Pullé's *La Cartografia antica dell'India*, but most of that work relates to productions of classical European and Middle Eastern provenance.¹² The few supposedly indigenous works Pullé discusses relate almost entirely to cosmography, and most of the images represented are secondary reconstructions derived from analyses of Indian texts.

Other secondary works on Indian cosmography abound, but their thrust is almost uniformly exegetical. Essentially, they seek to translate and explicate a large number of texts, mainly in Sanskrit and Pali, whose meanings are frequently obscure, to account for the development over time of new cosmological concepts and to reconcile, through detailed concordances, the numerous inconsistencies from one primary source to another and even from one part to another of a given text. None seeks to address the concerns of the historian of cartography. A few such monographs, however, are abundantly illustrated. Earliest among these is Adolf Bastian's *Ideale Welten*; but Bastian's engraved illustrations, like most of those in Pullé, are secondary reconstructions.¹³ The first to include a substantial number of photographs of surviving primary cosmographic sources is Kirfel's *Die Kosmographie der Inder*.¹⁴ Among more modern works, *The Jain Cosmology*, by Collette Caillat and Ravi Kumar, provides a striking collection of handsome illustrations, entirely in color.¹⁵ As the title suggests, the work is limited almost entirely to productions derived from a single religious tradition, Jainism, a faith that has provided a profusion of cosmographic maps altogether disproportionate to the small number of its adherents. Much more comprehensive in sweep than any other illustrative work is *Ajia no kosumosu mandara* (The Asian cosmos), a richly illustrated catalog for an exhibition on Asian cosmography mounted in Tokyo in 1982.¹⁶ The great merit of this regrettably untranslated work is that it per-

mits comparisons among the cosmographies of the Hindu, Jain, and Buddhist traditions from India to Japan.

Among texts that seek to deal with both Indian cosmography and cartography in a more narrow, earthbound sense, the most sweeping in compass is Maya Prasad Tripathi's *Development of Geographic Knowledge in Ancient India*, in which he attempts to establish correspondences between Indian practices and concepts, in both the religious and the secular domains, and similar practices and concepts in modern cartography and other forms of geographic exposition.¹⁷ Despite abundant citations from numerous primary texts, mainly in Sanskrit, the author all too often finds what he is looking for on grounds that are less than firm and in the absence of supporting empirical evidence. Hence I cite Tripathi only

7. George Kish, *La carte: Image des civilisations* (Paris: Seuil, 1980), 25–26, pl. 31, and 211–13. The work cited is Francis Wilford, "An Essay on the Sacred Isles in the West, with Other Essays Connected with That Work," *Asiatick Researches* (Calcutta) 8 (1805): 245–375, reprinted verbatim in *Asiatic Researches* (London) 8 (1808) and also in *Asiatic Researches* (New Delhi: Cosmo Publications, 1979).

8. Lloyd A. Brown, *The Story of Maps* (Boston: Little, Brown, 1949; reprinted New York: Dover, 1979), and Gerald R. Crone, *Maps and Their Makers: An Introduction to the History of Cartography*, 1st ed. (London: Hutchinson University Library, 1953); there are four subsequent editions up to 1978.

9. *Acta Cartographica*, 1–27 (Amsterdam: Theatrum Orbis Terrarum, 1967–81).

10. Reginald Henry Phillimore, "Three Indian Maps," *Imago Mundi* 9 (1952): 111–14, plus three map inserts.

11. Joseph Needham, *Science and Civilisation in China* (Cambridge: Cambridge University Press, 1954–), esp. vol. 3, *Mathematics and the Sciences of the Heavens and the Earth* (1959), and within that volume, chap. 22, "Geography and Cartography," 497–590.

12. Francesco L. Pullé, *La cartografia antica dell'India*, Studi Italiani di Filologia Indo-Iranica, Anno IV, vol. 4 (Florence: Tipografia G. Carnesecchi e Figli, 1901); see esp. chap. 2, "Indiani," 8–44.

13. Adolf Bastian, *Ideale Welten nach uranographischen Provinzen in Wort und Bild: Ethnologische Zeit- und Streitfragen, nach Gesichtspunkten der indischen Völkerkunde*, 3 vols. (Berlin: Emil Felber, 1892).

14. Willibald Kirfel, *Die Kosmographie der Inder nach Quellen dargestellt* (Bonn: Kurt Schroeder, 1920; reprinted Hildesheim: Georg Olms, 1967; Darmstadt: Wissenschaftliche Buchgesellschaft, 1967).

15. Collette Caillat and Ravi Kumar, *The Jain Cosmology*, trans. R. Norman (Basel: Ravi Kumar, 1981).

16. Sugiura Keohei, ed., *Ajia no kosumosu mandara* [The Asian cosmos], catalog of exhibition, "Ajia no Ucheukan Ten," held at Rafeore Myeujiamu in November and December 1982 (Tokyo: Kodansha, 1982).

17. Maya Prasad Tripathi, *Development of Geographic Knowledge in Ancient India* (Varanasi: Bharatiya Vidya Prakashan, 1969), esp. chap. 9, "Survey, Cartography and Cartographical Symbolism," 241–316. This is an expanded and revised rendering of the author's "Survey and Cartography in Ancient India," *Journal of the Oriental Institute* (Baroda) 12 (1963): 390–424 and 13 (1964): 165–94. Other relevant works by Tripathi are "Survey and Cartography in the Śulvasūtras," *Journal of the Ganganatha Jha Research Institute* 16 (1959): 469–85, and presumably, "Solution of a Riddle of Maratha Maps," *Allahabad University Studies in Humanities* 2 (1958). I have looked in vain for the last-cited work.

with caution and less frequently than at first might seem warranted. Much more cautious in his reading of the ancient texts, insofar as they relate to ancient maps and geography, is the late D. C. Sircar, an eminent epigraphist whose collection of essays, *Studies in the Geography of Ancient and Medieval India*, puts forward a more modest view of early Indian mapping capabilities.¹⁸ A brief article by A. B. L. Awasthi, "Ancient Indian Cartography," supplements the findings of Sircar by citing a number of specific passages in several ancient texts that refer to various types of maps mainly, but not exclusively, cosmographic in nature.¹⁹

In the extensive *Survey of Research in Geography*, prepared under the sponsorship of the Indian Council of Social Science Research, the chapter titled "Historical Geography" refers without qualification to "the absence of . . . maps prepared in India during the ancient and the medieval periods" and adds that "there exists no evidence of an indigenous tradition of map making," not counting the Puranic cosmographies I will discuss later. Although the works of numerous non-Indian mapmakers are cited, no mention is made of any specifically Indian map.²⁰

Apart from map catalogs and the work by Pullé, the only books devoted exclusively to the premodern mapping of India are by Gole. The first of her works, *Early Maps of India*, is concerned entirely with European maps from the time of Ptolemy up to the end of the eighteenth century.²¹ That initial survey, however, is superseded by a richly illustrated production, *India within the Ganges*, that, while still emphasizing the voluminous corpus of European cartography, does contain a brief opening chapter on indigenous maps, five of them illustrated.²² A later work edited by Gole is *Maps of Mughal India*, which reproduces an atlas commissioned by Colonel Jean Baptiste Joseph Gentil, an adviser to the nawab of Oudh (Awadh), and drawn in 1770 by three Indian artists relying mainly on the gazetteer portion of the *Ā'in-i Akbari* (Institutions of Akbar), an important Indian text (in Persian). This atlas is a valuable and hitherto little noticed work.²³

But by far the most important in our context is Gole's recently published *Indian Maps and Plans: From Earliest Times to the Advent of European Surveys*, in which some two hundred indigenous Indian maps are discussed and illustrated, often in color.²⁴ The treatment of Indian maps differs, however, from the present essay in several respects. Gole largely omits cosmographies and astronomical maps from her discussion or mentions them only in passing, but she is generally more comprehensive in her coverage of topographic maps as well as of large-scale plans of cities, forts, temples, and places of pilgrimage. Moreover, her text is essentially descriptive rather than analytical. Here I aim to deal in greater depth with a more limited set of examples representative of the known cartographic corpus.

Several major monographs dealing with astrolabes and celestial globes devote considerable space to the rather substantial number of such works that are of Indo-Islamic provenance. Earliest among these is Robert T. Gunther's *Astrolabes of the World*, first published in 1932.²⁵ This now rather dated work is supplemented by numerous articles, of both earlier and later date, that deal with specific artifacts, locales, and artisans. A few of these articles will be cited below in the chapter on South Asian cosmography, while others are discussed in the chapter on Islamic celestial mapping (above, pp. 12–70). Partly supplementing and partly superseding Gunther's massive work is that of Sharon Gibbs and George Saliba, *Planispheric Astrolabes from the National Museum of American History*.²⁶ The collection in question is the world's fourth largest. Finally, Emilie Savage-Smith's *Islamicate Celestial Globes: Their History, Construction, and Use* provides an excellent overall conspectus within which the Indo-Islamic corpus forms an exceptionally large part.²⁷

Scholarly articles on South Asian cartography are limited in both scope and number. Only a few merit special citation here; others will be noted at appropriate junctures in this chapter. Early contributions appear to have come entirely from non-Indians. Francis Wilford was the first European to attempt to re-create a systematic visual representation of the cosmographic conceptions of

18. D. C. [Dineshchandra] Sircar, *Studies in the Geography of Ancient and Medieval India* (Delhi: Motilal Banarsidass, 1971), esp. chap. 28, "Cartography," 326–30; reprinted, with an additional paragraph, from "Ancient Indian Cartography," *Indian Archives* 5 (1951): 60–63. Also quite useful, especially for the study of cosmography, is Sircar's *Cosmography and Geography in Early Indian Literature* (Calcutta: D. Chattopadhyaya on behalf of *Indian Studies: Past and Present*, 1967).

19. A. B. L. Awasthi, "Ancient Indian Cartography," in *Dr. Satkari Mookerji Felicitation Volume*, Chowkhamba Sanskrit Studies, vol. 69 (Varanasi: Chowkhamba Sanskrit Series Office, 1969), 275–78.

20. Moonis Raza and Aijazuddin Ahmad, "Historical Geography: A Trend Report," in *A Survey of Research in Geography* (Bombay: Popular Prakashan, 1972), 147–69, quotations on 148 and 153.

21. Susan Gole, *Early Maps of India* (New York: Humanities Press, 1976).

22. Susan Gole, *India within the Ganges* (New Delhi: Jayaprints, 1983). A companion volume, *A Series of Early Printed Maps of India in Facsimile* (New Delhi: Jayaprints, 1980), collected by Susan Gole, is a facsimile atlas exclusively of European productions.

23. Susan Gole, ed., *Maps of Mughal India: Drawn by Colonel Jean-Baptiste-Joseph Gentil, Agent for the French Government to the Court of Shuja-ud-daula at Faizabad, in 1770* (New Delhi: Manohar, 1988).

24. Gole, *Indian Maps and Plans* (note 2).

25. Robert T. Gunther, *The Astrolabes of the World*, 2 vols. (Oxford: Oxford University Press, 1932; London: Holland Press, 1976).

26. Sharon Gibbs with George Saliba, *Planispheric Astrolabes from the National Museum of American History* (Washington, D.C.: Smithsonian Institution Press, 1984).

27. Emilie Savage-Smith, *Islamicate Celestial Globes: Their History, Construction, and Use* (Washington, D.C.: Smithsonian Institution Press, 1985).

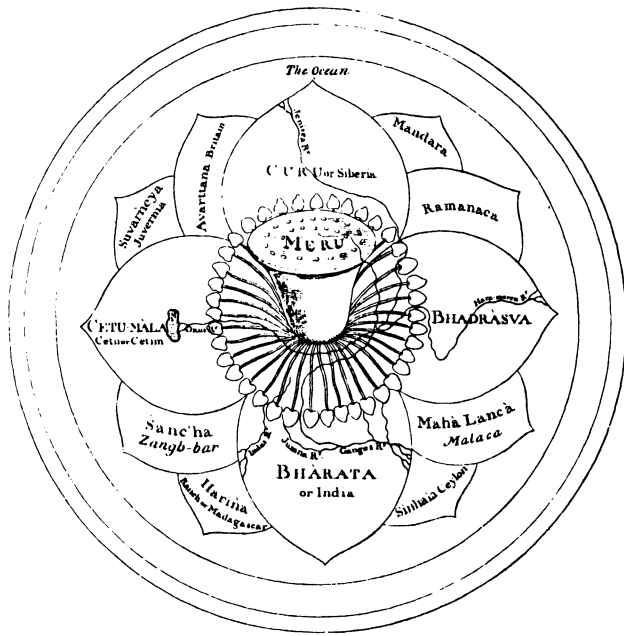


FIG. 15.3. AN EARLY SCHOLARLY ATTEMPT TO INTERPRET INDIAN COSMOGRAPHY. This drawing by Wilford is among several early attempts by European scholars to render visually the descriptions of the cosmos contained in various ancient Hindu texts collectively known as the Puranas. Size of the original: not known. From Francis Wilford, "An Essay on the Sacred Isles in the West, with Other Essays Connected with That Work," *Asiatick Researches* (Calcutta) 8 (1805): 245–376, reprinted verbatim in *Asiatic Researches* (London) 8 (1808) and also in *Asiatic Researches* (New Delhi: Cosmo Publications, 1979).

ancient India, but his work (e.g., fig. 15.3), published in 1805 in *Asiatick Researches*, was carried out when Indological research was still in its infancy. Many of the conclusions he drew from his studies with Brahman pundits, who did not always deal honestly with him, would not be taken seriously today.²⁸ Among the shortcomings of Wilford's efforts was the persistent assumption that most if not all of the places named in the Puranic texts did indeed have real-world referents. No clear boundary was drawn between cosmographic ideas and more mundane terrestrial conceptions. That same shortcoming is reflected in a number of Indian studies of the eighteenth and nineteenth centuries discussed later in this essay. Even twentieth-century authors persist in crediting the Puranas with a degree of verisimilitude that is wholly unwarranted. To account for the enormous differences between the size and shape of the continents, seas, islands, and mountain ranges described in the ancient texts and those of the modern era, they postulate diastrophic events of mind-boggling magnitude occurring

within a few millennia.²⁹ Yet there still appears to be an audience for their untenable views.

Perhaps the earliest scholarly study of a specific surviving pre-European map of Indian provenance is Rehatsek's translation and discussion of a map of the world, in Persian, that he obtained in a small town of the former Bombay Presidency.³⁰ Though Rehatsek's hand-drawn copy of that map was published in 1872, the original work, almost certainly from the seventeenth century, has since disappeared. This map will be discussed below in the section on Mughal cartography. Another notable early study (1905–8) is the brief discussion and translation of an indigenous map of the Vale of Kathmandu by the renowned anthropologist Sylvain Lévi in his magisterial monograph on Nepal.³¹ Following these early and unconnected efforts there is a long hiatus in the study of indigenous maps. Terse notices of several maps appeared in

28. Wilford, "Sacred Isles" (note 7). As an example of Wilford's credulity, we may cite the following (p. 246): "The Sacred Isles in the West, of which *S'weta-dwipa*, or the White Island, is the principal, and the most famous, are, in fact, the holy land of the *Hindus*. There the fundamental and mysterious transactions of the history of their religion, in its rise and progress, took place. The White Island, this holy land in the West, is so intimately connected with their religion and mythology, that they cannot be separated: and, of course, divines in *India* are necessarily acquainted with it, as distant *Muselmans* with *Arabia*. This I conceive to be a most favourable circumstance; as, in the present case, the learned have little more to do than to ascertain whether the White Island be *England*, and the Sacred Isles of the *Hindus*, the *British Isles*. After having maturely considered the subject, *I think they are*."

In fact, Western scholars earlier than Wilford had tried to make sense of the cosmography of the Puranas and even to map it. Several Portuguese Jesuits attempted to grapple with those texts as early as the sixteenth century, though apart from one brief notice, dated 1599, none of the earliest writings on the subject appear to have survived. There is, however, a short study of Hindu cosmography by an anonymous Portuguese missionary that seeks to set forth its most important tenets. Though undated, this work, now in the British Library, is undoubtedly from the seventeenth century. A complete translation is provided by Jarl Charpentier in "A Treatise on Hindu Cosmography from the Seventeenth Century (Brit. Mus. MS. Sloane 2748 A)," *Bulletin of the School of Oriental Studies* (London Institution) 3 (1923–25): 317–42. This manuscript is noteworthy for including maps by the author as well as spaces that appear to have been intended for additional maps that were never actually made. The question arises, Did the anonymous author see, as Wilford claims to have done, any indigenous cosmographic works, or did he simply envisage what the texts sought to describe?

29. See, for example, Amarnath Das, *India and Jambu Island: Showing Changes in Boundaries and River-Courses of India and Burmah from Pauranic, Greek, Buddhist, Chinese, and Western Travellers' Accounts* (Calcutta: Book Company, 1931), and S. Muzafer Ali, *The Geography of the Puranas* (New Delhi: People's Publishing House, 1966).

30. Edward Rehatsek, "Fac-simile of a Persian Map of the World, with an English Translation," *Indian Antiquary* 1 (1872): 369–70 plus foldout map.

31. Sylvain Lévi, *Le Népal: Etude historique d'un royaume hindou*, 3 vols. (Paris: Ernest Leroux, 1905–8), vol. 1, map facing p. 72.

1945 in volume 1 of Phillimore's monumental four-volume history of the Survey of India, and these were later expanded into a short essay.³²

Indians' scholarly contributions to the history of their own cartography effectively begin with C. D. Deshpande's "Note on Maratha Cartography," published in the *Indian Archives* in 1953.³³ Deshpande became the first chairman of the Commission on the History of Cartography, formed in 1982 under the auspices of the Indian National Cartographic Association. But efforts by Deshpande and the exceedingly well-informed B. M. Thirunaranan to stimulate relevant scientific research have yet to bear much fruit in India. A happy exception is provided by B. Arunachalam's carefully researched and well-documented study, published in 1985, on Indian navigational traditions and mapping.³⁴ Yet another signal contribution is that of Irfan Habib in an excellent, but all too brief, essay on Mughal cartography, focusing on a remarkable seventeenth-century world atlas contained within an encyclopedic work by Şādiq Işfahānī (Muḥammad Şādiq ibn Muḥammad Şāliḥ) of Jaunpur. Other cartographic works are noted by Habib only in passing, and there is also cursory discussion of the means of determining latitude and longitude.³⁵

The discussions of Indian maps noted to this point have been concerned mainly with reviewing their specific content and historical context and noting their more obvious conventions with respect to orientation, scale, visual perspective, symbolism, and so forth. In terms of a deeper semiotic analysis, which takes into consideration the "logic" of the map from a particular Hindu cultural perspective, the first two articles of note are Bernhard Kölver's "Ritual Map from Nepal," published in Germany in 1976, and Jan Pieper's "Pilgrim's Map of Benares: Notes on Codification in Hindu Cartography," published in *GeoJournal* in 1979.³⁶ These two sophisticated contributions point to an approach by which we can significantly deepen our understanding of South Asian cartography.

In the meantime, for most of our knowledge of South Asian maps or maplike paintings and drawings we must rely on the writings of art historians. A large proportion of the extant corpus of maps from South Asia owes its survival to the fact that collectors regarded such works as having aesthetic value, however slight their perceived scientific value may have been. The perspective of art historians, however, though useful, differs substantially from that of historians of cartography. Gradual changes in artistic conventions may have little relation to evolving cartographic canons. Nevertheless, let me single out three contributions that illustrate the diversity of studies available to us. An essay by William Norman Brown analyzes an exceedingly complex and cryptic painting dating from the late seventeenth or early eighteenth century that com-

memorates a lengthy pilgrimage by a large party of Jains under the sponsorship of a wealthy patron, who almost certainly commissioned the work. What makes the essay remarkable is that despite the total absence of text on the painting, Brown's knowledge of the relevant iconography enabled him to reconstruct the pilgrimage route in considerable detail—even if not completely—and to recognize that the painting was in effect a map.³⁷ Another sophisticated study is Simon Digby's analysis of a sixteenth-century globe-shaped brass container, intricately etched to indicate the various components of the earth as conceived in the Puranas.³⁸ Digby's discussion, moreover, throws much light on several later works of similar

32. Reginald Henry Phillimore, comp., *Historical Records of the Survey of India*, 5 vols. (Dehra Dun: Office of the Geodetic Branch, Survey of India, 1945–68) (advance copies of the fifth volume were recalled before publication, which was then suspended; publicly accessible copies of the fifth volume exist only in England in the libraries of the Royal Geographical Society, London, and the Royal Engineers Institution, Chatham); vol. 1, *18th Century* (1945); see also Phillimore, "Three Indian Maps" (note 10).

33. C. D. Deshpande, "A Note on Maratha Cartography," *Indian Archives* 7 (1953): 87–94. An earlier article by D. V. Kale, "Maps and Charts," appeared in the *Bharata Itihasa Samshodhaka Mandala Quarterly*, special number for the Indian History Congress of 1948, vol. 29, nos. 115–16, pp. 60–65. Only three pages of this article actually refer to maps, and the author's comments are both disparaging and ill informed, but the article does include a photograph of an important Maratha topographic map of much of peninsular India that is discussed below.

34. B. Arunachalam, "The Haven Finding Art in Indian Navigational Traditions and Its Applications in Indian Navigational Cartography," *Annals of the National Association of Geographers, India*, vol. 5, no. 1 (1985): 1–23; subsequently published in slightly modified and improved form as "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.

35. Irfan Habib, "Cartography in Mughal India," *Medieval India, a Miscellany* 4 (1977): 122–34; also published in *Indian Archives* 28 (1979): 88–105.

36. Bernhard Kölver, "A Ritual Map from Nepal," in *Folia rara: Wolfgang Voigt LXV. Diem natalem celebranti*, ed. Herbert Franke, Walther Heissig, and Wolfgang Treue, *Verzeichnis der Orientalischen Handschriften in Deutschland*, supplement 19 (Wiesbaden: Franz Steiner, 1976), 68–80; and Jan Pieper, "A Pilgrim's Map of Benares: Notes on Codification in Hindu Cartography," *GeoJournal* 3 (1979): 215–18.

37. William Norman Brown, "A Painting of a Jaina Pilgrimage," in *Art and Thought: Issued in Honour of Dr. Ananda K. Coomaraswamy on the Occasion of His 70th Birthday*, ed. K. Bharatha Iyer (London: Luzac, 1947), 69–72; reissued in William Norman Brown, *India and Indology: Selected Articles*, ed. Rosane Rocher (Delhi: Motilal Banarsidass for the American Institute of Indian Studies, 1978), 256–58. Though he was known primarily as an Indologist specializing in Sanskrit philology, Brown's credentials as an art historian were also impressive.

38. Simon Digby, "The Bhūgola of Kṣema Karṇa: A Dated Sixteenth Century Piece of Indian Metalware," *AARP (Art and Archaeology Research Papers)* 4 (1973): 10–31.

conception: a large eighteenth-century papier-mâché globe and two small metal globes produced in the nineteenth century. In contrast to Digby's and Brown's narrowly focused studies is the wide-ranging survey "Early 18th-Century Painted City Maps on Cloth," by Chandramani Singh.³⁹ The variety of mapping styles displayed in this informative, though mistitled, article (not all of it relates to the eighteenth century, to maps of cities, or to maps on cloth) reminds us that in dealing with India we confront a portion of the world no less diverse than Europe. It points to the richness of materials to be discovered as the study of South Asian cartography receives the attention it warrants.

REPOSITORIES FOR INDIAN CARTOGRAPHY

Among the numerous repositories that hold South Asian maps and associated materials, the British Library and the India Office Library and Records, both in London, are of particular importance; but many other major European and American libraries also contain maps and secondary works describing their contexts. Libraries and archives in South Asia itself are as a rule more difficult to use because of restrictions on access and inadequate cataloging. One rather specialized type of library—to which I was unable to obtain entry—are the *bhaṇḍāras* attached to many important Jain temples. Given the Jain preoccupation with cosmological concerns and with the institution of pilgrimage, these *bhaṇḍāras* could prove treasure-houses of useful documents. Yet another potentially valuable resource, especially for Jain materials, is the extensive and well-maintained library of the Lalbhai Dalpatbhai Institute of Indology at Ahmadabad, but circumstances did not permit its exploration for this project.

Published catalogs of South Asian maps are few, but they are of some use in locating indigenous productions. The *Catalogue of the Historical Maps of the Survey of India (1700–1900)* lists some maps by Indians (and others by Burmese), drawn along more or less traditional lines, that are now kept in the National Archives of India, New Delhi.⁴⁰ At the National Library of India in Calcutta there is *A Register of the Maps to Be Found in the Various Offices of the Bengal Presidency Prepared under the Authority of the Right Hon'ble the Governor General of India from Returns Received by the Survey Committee, 1838*.⁴¹ The register lists up to two dozen maps that appear to be "native" productions, though seven of these are of Southeast Asian (principally Burmese) provenance, while most of the remainder appear to have been drawn by Indians working for the British. No more than three or four items listed are unambiguously "indigenous" as defined earlier in this chapter. A similar catalog, *A Register of Maps, Charts, Plans, Etc. Deposited in the Various Offices of the Bombay Presidency*, corrected to

1858, is said to be available in Bombay.⁴² It seems likely that a third register would also have been prepared for the Madras Presidency.

Even earlier than the foregoing was H. H. Wilson's 1828 *Descriptive Catalogue of the Oriental Manuscripts . . . Collected by the Late Lieut.-Col. Colin Mackenzie*. Volume 1 alludes to 79 plans, including at least 40 "Native Plans of Districts"; another 180 "Miscellaneous Plans and Views" and 8 "Hindu Maps" included in portfolios; numerous descriptive geographic texts; and 2,630 drawings, some of which might well have incorporated cartographic elements.⁴³ Much the greater part of the collection of the indefatigable Mackenzie was derived from southern India, an area much underrepresented in the surviving cartographic corpus. After independence, the collection was divided among the archives of the Indian states of Tamil Nadu (formerly Madras) and Andhra Pradesh and the India Office Library and Records in London.

Hundreds of additional catalogs exist, both published and unpublished, documenting the manuscripts and printed books in Sanskrit, Persian, and other South Asian

39. Chandramani Singh, "Early 18th-Century Painted City Maps on Cloth," in *Facets of Indian Art: A Symposium Held at the Victoria and Albert Museum on 26, 27, 28 April and 1 May 1982*, ed. Robert Skelton et al. (London: Victoria and Albert Museum, 1986), 185–92.

40. This work was edited by S. N. Prasad and published in New Delhi by the National Archives of India in about 1975. Relevant notes by the map archivist P. L. Madan include "Cartographic Records in the National Archives of India," *Imago Mundi* 25 (1971): 79–80, and "Record Character of Maps and Related Problems," *Indian Archives* 31, no. 2 (1982): 13–22.

41. The library accession number is 164G 12. It was published in Calcutta by G. H. Huttman, Bengal Military Orphan Press, about 1839. At least two copies of the register survive, but in a serious state of decay.

42. This work was "Prepared under the Authority of the Right Honourable Governor in Council" and published in Bombay in 1859. It is said to be in the Bombay State Archives, but I have not had an opportunity to see it.

43. 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). Note in particular vol. 1, p. xxiii, and vol. 2, pp. cxxix–cxxxii, cxi–cxliii, and ccxxii–ccxxiii.

None of the numerous Indian maps that may have been contained in the vast collection of papers and antiquities Colin Mackenzie amassed during his service in India (mainly with the Madras Engineers, from 1783 to 1821) can at present be located, despite searches in the several British and Indian archives among which they were divided shortly after Indian independence. The investigation was initially launched by correspondence between B. M. Thirunaranan and the India Office Library and Records and other archives. Susan Gole possesses a copy of this correspondence. For a brief biographical note on Mackenzie, see Philimore, *Historical Records*, 349–52 (note 32).

languages. These generally relate to the holdings of particular libraries in South Asia, Europe, and America; they are usually organized by genre or subject and occasionally specify the existence of maps. An excellent compendium that might provide new cartographic leads is David Pingree's four-volume *Census of the Exact Sciences in Sanskrit*. His enumeration of *jyotiḥśāstra* texts—those relating to horoscopic astrology, mathematics and mathematical astronomy, and divination—are particularly promising in this respect.⁴⁴

The world's largest collection of indigenous South Asian maps is undoubtedly that of the Maharaja Sawai Man Singh II Museum (also known as the City Palace Museum) in Jaipur, the capital of a former princely state of the same name. One of Jaipur's rulers, Sawai Jai Singh II (reigning from 1699 to 1743), was renowned for his scientific knowledge and skill. He took a particular interest in astronomy, maps, and architecture, and under his patronage astronomical observatories were built in five cities and many remarkable maps were produced for a wide variety of purposes.⁴⁵ Because the resplendent courtly style of one princely state was often emulated by others, the development of mapping in early eighteenth-century Jaipur was reflected in similar developments elsewhere, especially the nearby states comprising Rajasthan, Gujarat, Punjab, and Kashmir, where most of the known surviving Indian terrestrial maps are to be found. Although no other collection rivals that of Jaipur, diligent search in museums and archives, especially in the erstwhile princely states, seems likely to turn up much new material. Apart from the holdings of Rajasthan's royal families, many cartographic works, especially cosmographies, are held by the state's numerous art dealers and, in at least one case, by a privately managed museum. Individual collectors undoubtedly also possess objects of value.⁴⁶

The written record provides abundant grounds for believing that the British in India generally disparaged such indigenous maps as they came across and took no special pains to preserve them. By contrast, Indian rulers and members of the gentry were more likely to treasure maps as works of art long after they had served their utilitarian purposes.⁴⁷ It is not surprising, therefore, given the formative role of the British with respect to higher education in South Asia, that within scientific and scholarly circles in South Asia virtually no interest has been taken in indigenous mapping. On the other hand, among connoisseurs and art collectors there is both knowledge and appreciation of many surviving productions that this history treats as maps. These maps are to be found not only, as noted, in public art museums, but also in private galleries and individual collections in South Asia and abroad. One suspects that many long-forgotten works are gathering mold in storage chests, closets, and cabinets

where family heirlooms and records are preserved.

Many of the maps produced in India over the centuries and down to the present were made to serve particular religious purposes. Maps in temples, particularly Jain temples, often present cosmographies or depict the routes to specific places of pilgrimage. Cosmographies are still painted on cloth for sale to worshipers and tourists in regions where Jainism exerted a powerful influence. At major places of pilgrimage cheap printed paper maps are sold to guide the faithful to all the *mahātmyas* (glories) for which those places are famous. Such maps exist not merely for Hindu and Jain pilgrimage sites, but also for places sacred to South Asian Muslims—a use of icons quite different from what an orthodox perspective of Islam would find acceptable. Such characteristically vulgar maps are eclectic combinations of traditional and Western conventions, but the traditional element is sufficient to warrant their being discussed. Moreover, at or near a few major religious sites, such as Jagannath in Orissa or Nathdwara in Rajasthan, there still exist small

44. David Pingree, *Census of the Exact Sciences in Sanskrit*, 4 vols., *Memoirs of the American Philosophical Society*, ser. A, vols. 81, 86, 111, 146 (Philadelphia: American Philosophical Society, 1970, 1971, 1976, 1981). A list of catalogs appears on pp. 26–32 of vol. 1 and a bibliography on pp. 4–25. Supplementary bibliographies appear also in vols. 2 (pp. 3–7), 3 (pp. 3–6), and 4 (pp. 3–7). The same volumes also provide brief supplements to the list of catalogs in vol. 1.

45. The agencies through which these maps were produced included two of the state's thirty-four *kārkhanas* (groups of skilled craftsmen attached to a royal court): the *imārat*, concerned with buildings and construction in general, and the *bāghāyat*, whose concern was gardens. The system is explained in an unpublished paper by G. N. Bahura and Chandramani Singh, "The Court as a Cultural Centre," for the Conference on Conservation of the Environment and Culture in Rajasthan, held in Jaipur, Rajasthan, on 14–17 December 1987.

46. The S. R. C. [Sri Ram Charan] Museum of Indology, founded in Jaipur in 1960, claims to possess a "splendid collection of architectural paintings [and drawings] . . . of forts and castles of medieval India and . . . of important historical buildings," as well as astrolabes, cosmographies, and astrological drawings of a cartographic nature of the type illustrated in figure 16.13. I have not visited this museum, having learned of it only after my last research visit to Jaipur, but I have had some correspondence with the founder and chairman, Acharya Ram Charan Sharma "Vyakul," who on 14 September 1989 sent me the institution's sixteen-page unpaginated brochure (dated 1986) and ten photographs of relevant museum holdings.

47. In the aforementioned *Register of Maps . . . in the Various Offices of the Bengal Presidency*, for example, the entry in the "Remarks" column for some of the small number of "native" maps listed is simply "Bad"; in not a few other cases there is no entry at all, and in no case did any entry connote appreciation. In the article "Lost Geographical Documents," *Geographical Journal* 42 (1913): 28–34 (reprinted in *Acta Cartographica* 12 [1971]: 281–87), Clements R. Markham, formerly with the Survey of India, states: "When the East India Company was abolished [in 1858], waggon-loads of papers were carted away and sold as no longer of any use" (p. 33). How many of these papers, one wonders, might have been indigenous maps? For further evidence of how English observers viewed Indian maps, see below (pp. 324–27).

caste groups of artists whose function is to embellish the shrines with sacred paintings and to provide paintings for special ceremonial occasions. As we shall see, maps in a traditional style are among the paintings done by these hereditary craftsmen.

In closing, let me note that the would-be historian of South Asian cartography must be ever alert to the serendipitous leads that come from reading, listening, and looking in a wide variety of contexts. Travel literature and accounts of early mapping by Europeans occasionally reveal their reliance on indigenous cartographic sources. The scholarly literature of art history, in particular, is constantly yielding fresh clues to the discovery of new and interesting artifacts. And purposeful inquiries in bookstores and bazaars in the cities of South Asia hold out the prospect of stumbling on long-lost cartographic treasures. Susan Gole, for example, an avid map hunter, chanced upon a unique wood-block print of a late nineteenth- or early twentieth-century world map that was being used as scrap paper in a Delhi bazaar (illustrated below). In the past decade I have learned about literally hundreds of Indian maps unrecorded in general histories of cartography. But this recently discovered corpus is in all likelihood only a small part of what still survives.

THE NATURE OF THE INDIAN CORPUS AS REVEALED BY TEXTUAL SOURCES AND THE ARCHAEOLOGICAL RECORD

TYPES OF MATERIALS PRODUCED

Given the accidents of preservation and the human inclination to value and therefore conserve some things more than others, it is impossible to infer with confidence the volume and distribution of map types over the long span of Indian history. It would certainly be incorrect to assume that the premodern materials available to us today, few of which—cosmographies, celestial globes, and astrolabes excepted—antedate the eighteenth century, are representative of what was produced before the period of extensive contact with Europeans and, one would suppose, exposure to European cartography. Although all the South Asian materials discussed below do retain, in varying degrees, a traditional Indian character, many bear distinct signs of European influence. We may surmise that from at least the seventeenth century on the proportion of terrestrial to cosmographic maps increased steadily, but we have little idea how large a proportion of the total corpus they were at various periods. The following gleanings from the available literature will convey some impression of the types of maps that might have been produced.

PREHISTORIC AND TRIBAL MAPS

From the prehistoric period well into historic times, there is a great abundance of Indian cave paintings. Such paintings were first noted by a European scholar, the archaeologist Archibald Carlleyle, in 1867–68 in the Vindhya escarpment of north-central India and were correctly attributed by him to the Stone Age.⁴⁸ More than a thousand caves with graffiti, mainly in central India, have since been discovered. By the 1930s the body of material brought to light seemed sufficient to enable D. H. Gordon to attempt—prematurely as it turned out—to establish a chronology based on stylistic attributes, successive layers of painting, and similarity to datable ancient Indian art.⁴⁹ It was not until the 1970s, however, after the exhaustive investigations at Bhimbetka, Madhya Pradesh, by V. S. Wakankar of Vikram University, Ujjain, and V. N. Misra of Poona University, that a reasonably clear chronology and typology of paintings emerged. Wakankar and Misra concluded that cave painting began with the advent of a microlithic technology during what many archaeologists term the Mesolithic period, extending back perhaps to roughly 10,000 B.P.⁵⁰

Despite their abundance, none of the Mesolithic works or subsequent cave painting of the Neolithic or Chalcolithic period can unambiguously be called a map. Although most of the paintings are of readily recognizable objects and activities—animals, hunting, dancing, battles, and the like—the interpretation of others is highly speculative. In at least ten Mesolithic sandstone caves in the central Indian state of Madhya Pradesh one finds geometric designs, which could be purely decorative but might also be, in some cases, symbolic plans of huts, depicted in both ground plan and elevation.⁵¹ Figure 15.4 provides three quite disparate examples of the types of rock art we must consider. There are, in such art, unmis-

48. Erwin Neumayer, *Prehistoric Indian Rock Paintings* (Delhi: Oxford University Press, 1983), 1–2.

49. Neumayer, *Prehistoric Indian Rock Paintings*, 3 (note 48). For Gordon's work, see D. H. Gordon, "Indian Cave Paintings," *IPEK: Jahrbuch für Prähistorische und Ethnographische Kunst*, 1935, 107–14, and "The Rock Paintings of the Mahadeo Hills," *Indian Art and Letters* 10 (1936): 35–41.

50. Neumayer, *Prehistoric Indian Rock Paintings*, 3–4 and 11 (note 48). For the distribution of known microlithic sites, see Joseph E. Schwartzberg, ed., *A Historical Atlas of South Asia* (Chicago: University of Chicago Press, 1978), 7, map II.1.c, and relevant text by Lawrence S. Leshnik, 156–57. A radiocarbon date at the central Indian site of Adamgarh is 7450 B.P.

51. Robert R. R. Brooks and Vishnu S. Wakankar, *Stone Age Painting in India* (New Haven: Yale University Press, 1976), 54 and 97. The authors indicate ten Mesolithic or earlier sites in which geometric designs could be interpreted to represent huts, traps, the sun, or water. See also M. D. Khare, *Painted Rock Shelters* (Bhopal: Directorate of Archaeology and Museums, Madhya Pradesh, 1981), fig. 34.

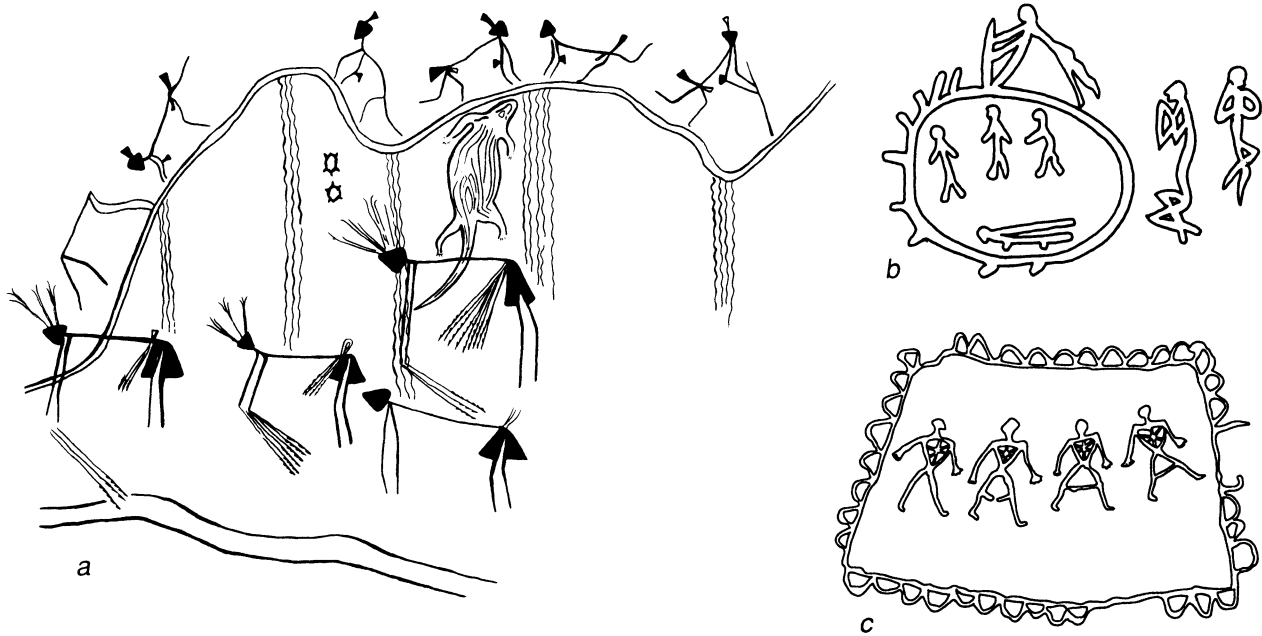


FIG. 15.4. ROCK PAINTINGS INCORPORATING SEEMINGLY CARTOGRAPHIC ELEMENTS. (a) Kathotia, Madhya Pradesh. In this Mesolithic depiction of some cultic activity, the wavy lines are taken as cascades of water, possibly indicating a specific sacred site. Some of the men portrayed are knocking some object against the ground with both hands, while the four large figures are carrying bundles of microlith-tipped arrows. The length of the lizard in this painting is 20 cm.

From Erwin Neumayer, *Prehistoric Indian Rock Paintings* (Delhi: Oxford University Press, 1983), 101 (fig. 62), by permission of Oxford University Press, New Delhi.

(b) Bhimbetka, Madhya Pradesh. This red ocher drawing has been interpreted as a representation of a Mesolithic burial ceremony.

takable depictions of landscape elements (hills, rivers, ponds) and possibly lines signifying various kinds of boundaries, but whether they are generic pictorial representations or indications of specific landscape features is a matter for speculation.⁵² There is also what Neumayer interprets to be a cosmography (fig. 15.5).⁵³

Although the face of South Asia was radically transformed following the Neolithic period and the subsequent advent of cultures with writing, tribal societies still account for a significant fraction of the region's population, approximately 8 percent in India and smaller proportions in neighboring countries. Over the centuries, it seems likely that some cave graffiti of tribal groups would have been of a cartographic nature. The undoubtedly tribal painting in Mirzapur district of Uttar Pradesh (fig. 15.4c), for example, appears to be a plan of a man-made enclosure, within which four persons are dancing, but that "enclosure" might equally well be nothing more than an abstract frame provided by the artist.

Among certain relatively isolated tribal groups the contemporary forms of art are quite distinctive; and though

Size of the original: width 17 cm. From Lothar Wanke, *Zentralindische Felsbilder* (Graz: Akademische Druck- und Verlagsanstalt, 1977), 80 (fig. 64a), by permission of Akademische Druck- u. Verlagsanstalt.

(c) Mahararia, Mirzapur district, Uttar Pradesh. Found on the roof of a rock shelter, this tribal painting in red ocher depicts four persons dancing within an enclosure and is dated between the fourth and tenth centuries A.D.

Size of the original: not known. After Rai Sahib Manoranjan Ghosh, *Rock-Paintings and Other Antiquities of Prehistoric and Later Times*, Memoirs of the Archaeological Survey of India, no. 24 (Calcutta: Government of India, Central Publication Branch, 1932; reprinted Patna: I. B. Corporation, 1982), pl. XXIa (fig. 2) and p. 18.

rarely free from Hindu influences, they draw on other sources of inspiration that presumably have pre-Hindu origins. Cosmogonic themes, especially origin myths, as well as depictions of landscape features, frequently appear in the art of some of the tribes and are sometimes expressed through cartographic symbolism.⁵⁴

52. For figure 15.4 and other related illustrations, see Neumayer, *Prehistoric Indian Rock Paintings*, fig. 62 (p. 101) and text on p. 18 and related figs. 4, 47, 48, 60, and 61 (note 48); Lothar Wanke, *Zentralindische Felsbilder* (Graz: Akademische Druck- und Verlagsanstalt, 1977), fig. 64a, p. 80, and fig. 3, p. 13; and Rai Sahib Manoranjan Ghosh, *Rock-Paintings and Other Antiquities of Prehistoric and Later Times*, Memoirs of the Archaeological Survey of India, no. 24 (Calcutta: Government of India, Central Publication Branch, 1932; reprinted Patna: I. B. Corporation, 1982), pl. XXI and p. 18.

53. Neumayer, *Prehistoric Indian Rock Paintings*, fig. 26c (p. 68) and p. 14 (note 48).

54. See, for example, the numerous Warli tribal paintings that incorporate maplike elements in Jivya Soma Mashe, *The Warlis: Tribal Paintings and Legends*, paintings by Jivya Soma Mashe and Balu Mashe, legends retold by Lakshmi Lal (Bombay: Chemould Publications and

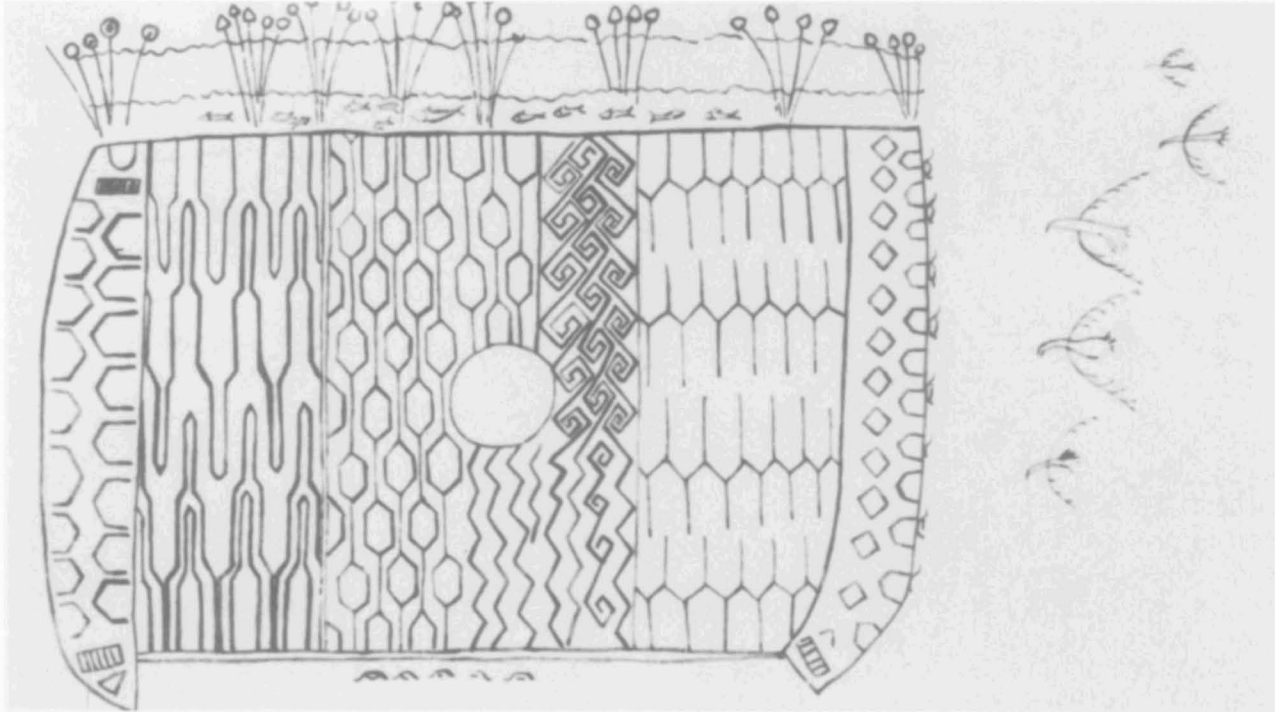


FIG. 15.5. AN INDIAN MESOLITHIC DEPICTION OF THE COSMOS? Jaora, Madhya Pradesh. Original presumably in red ochre. Of this illustration, Neumayer states (p. 14): “[It] shows a rectangular plane divided into seven vertical design stripes; on the upper side of the rectangle there are two wavy lines to denote water out of which reeds are growing; fish are swimming beneath the lower waterline. Ducks are paddling along the right and lower edge of the rectangle. Towards the right of the design are five birds in flight. This picture could be a depiction of the Mesolithic cosmos in which the rectangular plane symbolizes

the earth, the wavy lines signify water with fish and reeds; the air is indicated by flying birds. The seven design stripes could indicate different features of the earth, which, when transferred to the body of an animal or man, would show the same earth quality incarnated.”

Size of the original: length 50 cm. From Erwin Neumayer, *Pre-historic Indian Rock Paintings* (Delhi: Oxford University Press, 1983), 68 (fig. 26e), by permission of Oxford University Press, New Delhi.

ACHIEVEMENTS OF THE HARAPPAN CULTURE

Urban centers of economic and political control took root in South Asia in the middle of the third millennium B.C. This new Harappan or Indus culture endured for more than a thousand years, but it was recognized by archaeologists only in 1922. Since that date literally hundreds of settlement sites belonging to that culture have been discovered and partially explored. These extend not only across the whole of the Indus Plain but westward through the adjoining highlands into Afghanistan, the Pakistani province of Baluchistan, and coastal Iran, eastward to the Gangetic Plain, and southeastward into the Indian state of Maharashtra.⁵⁵

Throughout the Harappan civilization one notes striking homogeneity and firm adherence to established standards. Harappan stone weights and linear measures are accurate and uniform in accordance with a binary-cum-decimal system. Finely engraved steatite seals are virtually identical from one site to another. Remarkable similarity

also characterized the layout of settlements. Mohenjo Daro and Harappa, the two major urban centers, and also the lesser settlements at Kalibangan and Lothal all follow an elevated citadel/lower township model. The citadels were always in the west and contained the major public structures, while commercial activities and most residences were in the lower town, within which streets and lanes were laid out in a grid, crossing one another at orderly right angles. Both citadels and lower towns were fortified by thick mud and brick walls.

Arts, [1982?]), 18–19. Several additional works by Jivya Soma Mashe are held by the Department of Oriental Antiquities of the British Museum.

55. A comprehensive plotting of known sites of remains of the Indus culture appears in a series of maps appended to B. B. Lal and S. P. Gupta, eds., *Frontiers of the Indus Civilization* (New Delhi: Books and Books, on behalf of Indian Archaeological Society jointly with Indian History and Culture Society, 1984). This work is one of several recent anthologies that seek to summarize the major findings in our rapidly burgeoning knowledge of the Indus culture.

It is difficult to contemplate the remains of the Indus civilization, especially its cities, without postulating the existence not merely of a centralized—possibly sacerdotal—planning mechanism, but also of tangible physical plans to guide the architects of the period. The civilization used baked brick lavishly. Although bricks came in several sizes, the ratio among their sides was invariably 4:2:1, and major buildings and individual portions thereof were constructed in even multiples of the brick length. The “Great Bath” at Mohenjo Daro, for example, had a length equal to forty bricks (of a type that was approximately 300 mm long), a width equal to twenty-four bricks, and a depth equal to eight bricks.⁵⁶ Reflecting on the remarkable consistency of Indus weights and measures over many centuries, the archaeologist V. B. Mainkar suggests that “the regulation of denominations, accuracy and shape . . . was exercised through a well organized, direct or indirect, control over the manufacture, use and verification of weights and measures.” And though the Indus civilization is a millennium or so more recent than that of Sumeria and, quite likely, in some ways derivative from it, its system of weights and measures is said to be “the oldest . . . discovered in archaeological excavations anywhere in the world” and “may have influenced Egyptian, Sumerian, Mesopotamian and Greek metrology.”⁵⁷

Baths, toilets, and drains were noteworthy features of the Indus civilization. That the drains at Lothal, a major urban site in what is now Gujarat, had uniform slopes throughout, never exceeding one in ten thousand—if the testimony of A. K. Roy is to be accepted—is one fact among many suggesting that survey instruments had to be employed. At Lothal Roy has found artifacts that he has identified as a sighting instrument, a plumb bob with a hole, a plumb bob without a hole, a plummet, a holder for a plumb line, an instrument for adjusting the length of the copper wire used for a plumb line, and an ivory measuring scale (fig. 15.6).⁵⁸ Nevertheless, no trace of a map or an architectural plan has yet been unearthed; and so long as the Indus script remains undeciphered, we are not likely to find textual support for their putative existence.

In a recent paper Asko Parpola, one of the leading scholars working to decipher the Indus script, has suggested that a symbol with three vertical strokes, appearing on some of the clay seals on which the Indus script is generally written, may represent “the three worlds transcended by Viṣṇu,” who in Old Tamil (early Dravidian) texts is referred to as “he who measured the long earth.”⁵⁹ The presumption here and elsewhere is that the Harappan civilization was that of a Dravidian people, that it contained many proto-Hindu elements, and that there is a connection between this literary allusion and the *R̥g Vedic* (Aryan) myth of a “striding Viṣṇu,” who with three

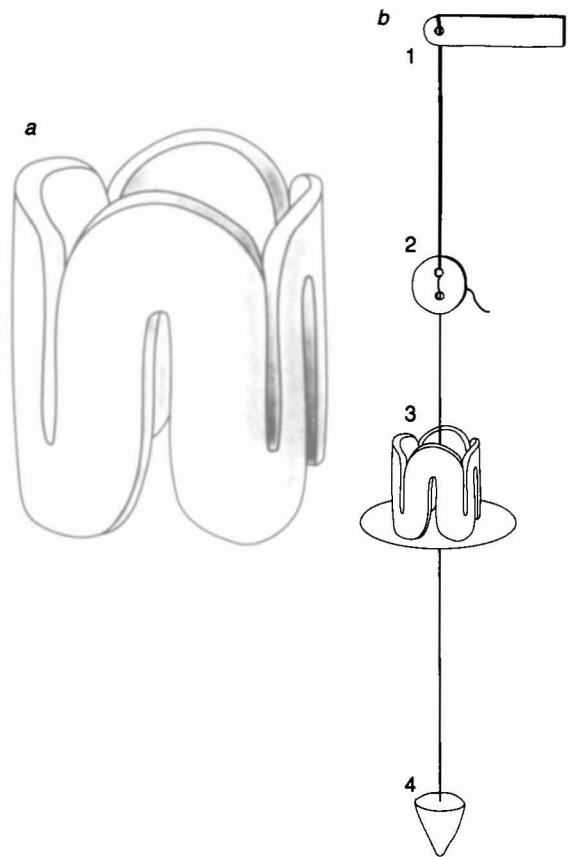


FIG. 15.6. PRESUMED SURVEY INSTRUMENTS OF THE INDUS CIVILIZATION. Found at Lothal, Gujarat, India, the objects depicted have been identified as follows: (a) Sighting instrument (reconstructed). (b) Complete sighting arrangement, with plumb line: (1) holder for plumb line; (2) round piece with two holes to adjust length of copper wire used for plumb line; (3) sighting instrument (a); (4) plumb bob. Several other accessories of surveying instruments were found at Lothal, according to Roy.

After A. K. Roy, “Ancient Survey Instruments,” *Journal of the Institution of Surveyors* 8 (1967): 371.

56. V. B. Mainkar, “Metrology in the Indus Civilization,” in *Frontiers of the Indus Civilization*, ed. B. B. Lal and S. P. Gupta (New Delhi: Books and Books, on behalf of Indian Archaeological Society jointly with Indian History and Culture Society, 1984), 141–51, esp. 147.

57. Mainkar, “Metrology,” 149–50 (note 56).

58. A. K. Roy, “Ancient Survey Instruments,” *Journal of the Institution of Surveyors* 8 (1967): 367–74, esp. 370.

59. Asko Parpola, “Interpreting the Indus Script—II,” *Studia Orientalia* 45 (1976): 125–60, quotation on 147. For a fuller analysis, see Jan Gonda, *Aspects of Early Viṣṇuism*, 2d ed. (Delhi: Motilal Banarsidass, 1969), 55–72 and *passim*.

I am indebted to Frits Staal, of the University of California, Berkeley, who led me to these references. A hypothesis differing from that of Parpola and Gonda is that of R. Shama Sastry, who interprets the idea of a striding Vishnu as having an essentially chronological significance. See his “Vishnu’s Three Strides: The Measure of Vedic Chronology,” *Journal of the Bombay Branch of the Royal Asiatic Society* 26 (1921–23): 40–56. A critical survey of the numerous scholarly analyses of the

steps measured off the sky (heaven), air (atmosphere), and earth. There is an etymological linkage between the *R̥g Vedic* words for “to step” and “to measure,” and as early as 1952, Parpola notes, scholars were “led to propose that the concept which in the human world lies behind the image of the striding Viṣṇu may be that of the surveyor.”⁶⁰ Drawing on the renowned Sumerologist S. N. Kramer, Parpola points out “Mesopotamian parallels of the second half of the third millennium B.C.” and concludes that “it seems quite likely that the surveyor was an important man in the Harappan society, too.”⁶¹

VEDIC ALTARS

Following the decline of the Indus civilization—and quite possibly associated with it—came the advance of the Indo-Aryans out of Central Asia and across northern and central India. Although in most respects the life-style of the originally nomadic Aryans differed greatly from that of the sedentary Harappans, the culture did attach considerable importance to mensuration. The principal reason for regarding mensuration as important for the concomitant development of geometry was the centrality of sacrificial rites in the Aryan religion. The altars (*vedis*) on which the sacrifices were to be performed were of various types, but each had to be constructed according to a precise set of instructions. The ten or so principal texts in which these instructions are enunciated are extensions of the Vedas themselves and are collectively known as the *Sulvasūtras* (*Sulba Sūtras*), which, “as the oldest works on Indian geometry, are of no little importance for the history of Science.”⁶² These texts and a somewhat earlier work, the *Satapatha Brāhmaṇa*, which also deals with the construction of altars, have been dated to the period 900 to 200 B.C.⁶³

Sulva means “measuring string” and suggests one way measurements were laid out in building the altars. Measuring rods, graduated measures, and area measures were also employed. As in other early measuring systems, the units of measurement were generally related to the human body. For measuring some parts of the *vedi* a bamboo rod was prescribed, cut to a length “as much as a man [the sacrificer] with arms extended.” Fire altars were built of brick. “In general a brick . . . is one foot square, or its multiple or sub-multiple.”⁶⁴ The concept of scale was well developed, and certain altars were to be built in specified scalar relationship to others. The directions for laying out the sacrificial ground and for building altars there are, in fact, so precise that modern scholars have had relatively little difficulty in reconstructing how they must have appeared.⁶⁵ Illustrations, in color, from a recently discovered seventeenth-century Indian manuscript commenting on one of the ancient *Sulvasūtras* depict various types of fire altars. These dia-

grams depict the altar bricks in various colors, each indicating a mantra to be chanted while the brick of that color is being laid.⁶⁶

Figure 15.7 provides a reconstruction of the “Six-Tipped Bird Altar,” an important physical element of the elaborate *agnicayana* (fire sacrifice), the last performance of which took place in Kerala in 1975. An exhaustive

R̥g Vedic references to the striding Vishnu is provided by F. B. J. Kuiper, “The Three Strides of Viṣṇu,” in *Indological Studies in Honor of W. Norman Brown*, ed. Ernest Bender, American Oriental Series, vol. 47 (New Haven: American Oriental Society, 1962), 137–51.

60. Parpola, “Indus Script,” 148 (note 59).

61. Parpola, “Indus Script,” 148 (note 59).

62. Moriz Winternitz, *A History of Indian Literature*, trans. S. Ketkar, vol. 1, pt. 1, 3d ed. (Calcutta: University of Calcutta, 1962), 240.

63. Satya Prakash and Ram Swarup Sharma, eds., *Āpastamba-Sulbasūtram*, trans. Satya Prakash, Dr. Ratna Kumari Publications Series, no. 5 (New Delhi: Research Institute of Ancient Scientific Studies, 1968). Various authorities have been consulted for the dates.

64. The unit, being related to the body size of the chief sacrificer, was not constant. See “unit square” in figure 15.7.

65. The first Western scholar to translate a major Indian text dealing with the construction of altars was Julius Eggeling. *The Satapatha Brāhmaṇa, according to the Text of the Mādhyandina School*, was published in five volumes—volumes 12, 26, 41, 43, and 44 of the Sacred Books of the East series, ed. F. Max Müller (Oxford: Clarendon Press, 1882–1900). The work is abundantly illustrated to indicate how *vedis* were to be built. Similar illustrated translations by Western and Indian scholars have since been made of other *Sulvasūtras*. In an article titled “Sacrificial Altars: Vedis and Agnis,” *Journal of the Indian Society of Oriental Art* 7 (1939): 39–60, N. K. Majumder provides a number of diagrams that “are exact copies of a set in the collection of the Government Oriental Manuscripts Library, Madras . . . [the importance of which] lies in the fact that they are said to have been procured from a person who was still performing the Yajñas [sacrifices] and was supposed to be conversant with the details of practical construction of the Vedis and Agnis” (p. 47). *Vedi* means altar in general or, more specifically, the part of the altar complex where the sacrifice is carried out; *agni* is the part of the altar on which a sacrificial fire is kept. This passage shows that ordinary priests, as well as scholars, could draw the plans of altars from the sacred texts. Indeed, at the time of sacrifices they were compelled to do so.

66. The work, a commentary on Āpastamba’s *Śrautasūtra*, was brought to light by H. G. Ranade. The diagrams are illustrated by Gole, *Indian Maps and Plans*, 18 (note 2). Published reproductions of diagrams drawn in connection with the construction of specific fire altars also appear in other published works. A group of illustrations, some in color, relating to a *yajña* (fire sacrifice) performed in Rajasthan (and including a ca. eighteenth-century diagram for the *yajña*), is provided by Ajit Mookerjee in *Ritual Art of India* (London: Thames and Hudson, 1985), 34–36 and 38. Two additional diagrams relating to a *yajña* performed in Jaipur in the nineteenth century are presented in Kapila Vatsyayan’s *The Square and the Circle of the Indian Arts* (New Delhi: Roli Books International, 1983), 33–34. Vatsyayan also provides a photograph of the well-preserved remains of the altar for an *aśvamedha* (horse sacrifice) carried out in Nagarjunakonda in what is now the state of Andhra Pradesh. The specific date of that altar is not noted, but it is reported as “one of the earliest” such remains, dating from “many centuries” before the similar Jaipur altar (pp. 32 and 34). Illustrations and discussion of archaeological finds of a number of other altars—dating, in the case of an excavation at Kanšāmbi, perhaps as far back

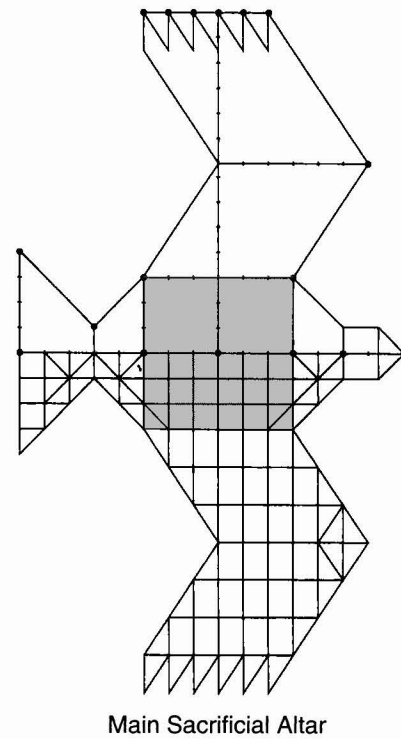
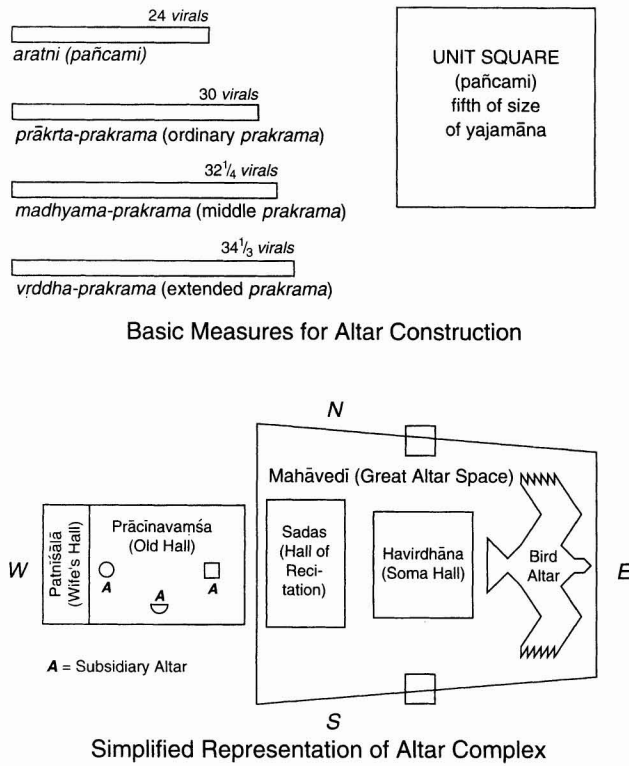


FIG. 15.7. MEASUREMENT UNITS, SCALAR RELATIONS, AND PRESCRIBED LAYOUTS OF THE ALTAR COMPLEX FOR THE VEDIC AGNICAYANA. The Vedic texts that prescribe the rules for building altars and carrying out different types of sacrifices are so specific that later sacrificers, as well as modern scholars, are able to construct or depict altars in precise conformity to those built several thousand years ago. The bird altar, the main sacrificial altar of the *agnicayana* (fire sacrifice), was built up of fired bricks of ten standard sizes of squares, rectangles, and triangles whose dimensions were stipulated multiples or fractions of a unit square designated as a *pañcami* (fifth), so called because the length of its side, one *aratni*, was a fifth of the height above the ground of the fingertips of the sacrificer, standing with his hands above his head. Three other measures, known as *prakramas*, were used in constructing other portions of the altar complex, the principal components of

which are illustrated. All these units are conventionally assigned lengths in numbers of *virals* (finger breadths), as shown above. In the upper half of the depiction of the main sacrificial altar are shown some of the principal points in terms of which the altar is laid out and, by tick marks, some of the key measurements for the ground plan. The lower half shows the arrangement of bricks for the first of the five layers of bricks comprising the altar. (The arrangement of the upper half would be its mirror image.) In all, two hundred bricks form this layer. They include only five of the ten standard types. There are strict rules as to the sequence for laying the bricks and the verses to be chanted for each brick laid. The gray square in the middle of the bird represents its *alman* (body or self). After Frits Staal, *Agni: The Vedic Ritual of the Fire Altar*, 2 vols. (Berkeley: Asian Humanities Press, 1983), passim.

and profusely illustrated account of that sacrifice was provided by Frits Staal.⁶⁷ One among scores of his photographs documenting the *agnicayana* is presented in figure 15.8. Before the actual construction of an altar, its outline was traced on the ground, thus providing in effect an ephemeral map at a one-to-one scale. The orientation was invariably toward the east.

ANCIENT KNOWLEDGE OF GEOGRAPHY

There can be no doubt that the ancient inhabitants of South Asia had amassed a remarkable store of geographic knowledge, not only of the Indian subcontinent but also

of other areas, well before the establishment of large states whose historicity is beyond dispute. Had the Brahmins, who committed numerous ancient texts to memory, wished to do so, there is little doubt they could have

as the mid-first millennium B.C.—are presented by Romila Thapar, “The Archeological Background to the Agnicayana Ritual,” in Frits Staal, *Agni: The Vedic Ritual of the Fire Altar*, 2 vols. (Berkeley: Asian Humanities Press, 1983), 2:3–40, esp. 26–34, including figs. 2–4b.

67. Staal, *Agni*, vol. 1, passim (note 66). See also Staal, *The Science of Ritual*, Post-graduate and Research Department Series, no. 15 (Pune: Bhandarkar Oriental Research Institute, 1982). The place of performance of the sacrifice in question was the village of Panjal, about twenty-five kilometers north-northeast of Trichur (Staal, *Agni*, 1:194–95).



FIG. 15.8. BRAHMAN YAJAMĀNA'S (RITUAL PATRON'S) VIEW OF THE FIRE ALTAR. The customary place for the patron of a sacrifice is to the south of the altar. Here he looks north over the six tips of the southern wing of the bird image depicted in figure 15.7. The sacrificial ceremony at which this

picture was taken lasted from 12 to 24 April 1975. From Frits Staal, *Agni: The Vedic Ritual of the Fire Altar*, 2 vols. (Berkeley: Asian Humanities Press, 1983), 1:580–81. Photograph courtesy of A. de Menil, 1975. By permission of Asian Humanities Press, Berkeley, California.

produced some kind of map based on their contents, as later scholars have in fact repeatedly done.⁶⁸ Oldest of all the texts are the four Vedas of the Aryans (*R̥g*, *Sāma*, *Yajur*, and *Atharva*) which, together with their appendixes, most notably the massive Brahmanas (ca. 1500–600 B.C.), refer to scores of identifiable areas, physical features, and peoples from Bālhika (Balkh) in northern Afghanistan to as far east as Vaṅga (Bengal) and as far south as Andhra in the Deccan.

The two great Indian epics, the *Mahābhārata* and the *Rāmāyaṇa*, are far richer in geographic detail, but their dates are still controversial. The great war described in the *Mahābhārata*, though traditionally dated 3102 B.C., appears to be based on an actual event that took place early in the first millennium B.C. and has an obvious parallel in the *Iliad*, while the *Rāmāyaṇa*, akin to the *Odyssey*, would have followed soon after. However, the oldest composed portions of both epics are assignable only to

about 400 B.C. By about A.D. 200 the bulk of the *Rāmāyaṇa* is thought to have achieved its present form, whereas composition of the *Mahābhārata*, the world's longest poem, probably extended to at least A.D. 400. Modern scholars have been able to identify places mentioned in the epics throughout South Asia and have also equated certain of them with locales in Xinjiang, Tibet, and Myanmar. The following excerpt from the *Mahābhārata* is especially rich and may in effect be considered an example of verbal cartography:

King Bhārata, I shall depict for you this land of Bharata. . . . There are these seven Main Mountains—the Mahendra, Malaya, Sahya, Śuktimat, Ṛkṣavat, Vin-

68. Schwartzberg, *Historical Atlas* (note 50), provides numerous maps of the knowledge of India and adjacent regions revealed in a wide range of ancient texts. See especially plates III.A.1 and 2, III.B.1 and 2, and III.D.3 and associated text.

dhya and Pāriyātra. But thousands more mountains are recognized in their general vicinity, massive and vast ones with colorful ridges. Then, there are other hills less well-known, low ones that are inhabited by short people, both Āryan and barbarian, as well as folk that are a mixture of both. The population drinks from many rivers: the great Ganges, the Indus and Sarasvatī.⁶⁹

Following the passage cited, dozens of additional, identifiable rivers are named; and these are followed in turn by a lengthy listing of *janapadas* (regions/states, together with the groups who inhabit them). Other exceedingly valuable portions of the text are the *tīrthayātrās* (pilgrimage routes) delineated in book 3 of the *Āraṇyaka-parvan* (Book of the forest), several long sections of which are devoted to the regionally organized presentation of *tīrthas* (pilgrimage places).⁷⁰

Of all the types of natural features noted in the texts mentioned above, probably none held greater significance for the ancient Hindus than did rivers. *Tirtha*, the word used for place of pilgrimage, literally means a ford in a river, and rivers in general were regarded as sacred. Not surprisingly, therefore, they were celebrated in stone as well as in painting and literature, and some were personified within the Hindu pantheon and rendered by distinctive icons. Figure 15.9, for example, shows a bas-relief representation of the Ganga (Ganges) and the Yamuna (Jumna) at Prayāga (modern Allahabad). Dated about A.D. 400, it is the earliest such work I am aware of. Though only a few specific features are shown on this image, the work as a whole has been taken as a symbolic representation of Madhyadesa (the central region), the core region not only of the Aryanized portion of India, but also of the then dominant Gupta Empire.⁷¹

Sculptures featuring rivers also appear in later periods and from other parts of India. Although I have not made an extensive investigation of the subject, we may mention, if only in passing, the renowned seventh-century Pallava representation of “the descent of the Ganga” at Mamallapuram (Mahabalipuram) on the Indian coast not far south of Madras. It is noteworthy not only because it forms part of one of India’s greatest sculptural assemblages, hewed in situ from the native rock, but also because the cleft in the rock, said to represent the Ganga, is thought to have provided a channel for running water, either diverted to the site from the Palar River by builders of the period or emanating from some no longer extant receptacle.⁷² If this interpretation is correct, the ensemble would have had a unique kinetic quality.

Yet another interesting work is an eleventh-century stone slab, of unknown provenance, depicting the Ganga flowing through the sacred city of Kāshī (Varanasi). This work, illustrated and discussed by Gole, was interpreted for her by N. P. Joshi. The slab is about one meter high

69. *The Mahabharata*, Bhīṣma (62), “The Earth,” translated by J. A. B. van Buitenen, unpublished volume.

70. This presentation is discussed by Surinder Mohan Bhardwaj in *Hindu Places of Pilgrimage in India (A Study in Cultural Geography)* (Berkeley and Los Angeles: University of California Press, 1973; reprinted 1983), 15–17 and passim. From among the hundreds of *tīrthas* cited in the epic, Bhardwaj has mapped and discussed several dozen of particular importance (figs. 2.1 and 3.1). He has also mapped the major *tīrthas* noted in several of the Puranas and in other texts as well.

71. Explanations of the meaning of this sculpture are provided in Steven G. Darian, *The Ganges in Myth and History* (Honolulu: University Press of Hawaii, 1978), 130 and figs. 40 and 41; and at greater length, in Frederick M. Asher, “Historical and Political Allegory in Gupta Art,” in *Essays on Gupta Culture*, ed. Bardwell L. Smith (Delhi: Motilal Banarsidass, 1983), 53–66, plus ten plates, and in particular 56–57 and pl. 2. Although Prayāga, the capital of the Gupta Empire, occupied a riverine location far from the sea, Asher explains the extensive body of water below the stream confluence as if it were an ocean (*samudra*), rather than a continuing stream, by suggesting that such a sculptural play on words was a way of paying homage to the great Samudra Gupta, the founder of the Gupta state. Thus, the “merging [of] streams into a single mighty river, or great rivers into an enormous ocean” signified the emperor’s drawing together “under a unified central authority the disparate states of India” (Asher, “Allegory in Gupta Art,” 57). I have made no attempt to investigate or catalog Indian paintings symbolizing rivers and other features of the terrestrial landscape as deities but simply note that they are numerous and often supplement the iconic representation with a more natural rendition of the features in question.

Conventionalized representations of rivers and mountains also frequently appear on ancient Indian coins dating at least as far back as the third century B.C. The most common river symbol is a pair of parallel wavy lines with a row of fishes between them. Straight parallel and simple curved parallel lines may also be employed; and as with the Udayagiri sculpture, the personified river goddess, her *vāhana* (mount), or both, may signify a particular stream. The symbols for mountains are more varied than those for rivers but are typically compounded of several inverted U shapes. I am unaware of any personified forms. The specific identification of rivers and mountains is generally conjectural. Among rivers believed to appear with some frequency are the now dried-up Sarasvatī of Punjab, the Sipra and Bina (ancient Veṇvā) in Madhya Pradesh, and usually via the goddess or *vāhana* icon, the Ganga and the Yamuna. Among mountains, Meru seems to be most common. Occasionally legends on the coins contain the names of rivers, mountains, regions, or towns, though not necessarily in combination with a graphic symbol. There are literally millions of old Indian coins in public and private collections throughout the world and a vast corpus of relevant numismatic literature. I have made no attempt to survey this literature and leave to future scholars the task of determining which, if any, of the often enigmatic coins may legitimately be described as cartographic. Perhaps the best single-volume guide is John Allan, *Catalogue of the Coins of Ancient India* (London: Trustees [of the British Museum], 1936). Also noteworthy is Parmanand Gupta, *Geography from Ancient Indian Coins and Seals* (New Delhi: Concept, 1989).

72. Darian, *Ganges in Myth and History*, 17–30 (note 71), including eight photographs. Of this work Darian observes that the Ganga is not flowing through terrestrial space, but rather is the primordial Ganga flowing from heaven to earth as described in the *Rāmāyaṇa*. Other sculptural and architectural versions of the same theme or similar themes are also described by Darian, but their maplike qualities are less apparent than at Mamallapuram. Even in the case of Mamallapuram, an altogether different explanation of the “descent of the Ganga” is offered by some art historians; but Asher, “Allegory in Gupta Art,” 64–66 (note 71), and Susan L. Huntington, *The Art of Ancient India* (New

and of a slightly greater width. In addition to a sinuous band representing the Ganga, it shows, to the right and left of the river, three horizontal registers of sculptured



FIG. 15.9. THE GANGA AND YAMUNA RIVERS. This bas-relief in stone is part of a large sculptured ensemble at Udayagiri, Madhya Pradesh, ca. A.D. 400. These sacred rivers are identifiable by their iconic representations as female deities standing on their emblematic *vāhanas* (mounts), the *mākara* (crocodile) for the Ganga and the *kūrma* (tortoise) for the Yamuna. The confluence of the two rivers occurs at the ancient holy city of Prayāga (Allahabad).

Size of the original: not known. By permission of the American Institute of Indian Studies, Center for Art and Archaeology, Varanasi, and courtesy of the Archaeological Survey of India.

deities associated with the city. Such stones were allegedly made, according to a thirteenth-century text read by Joshi, “so that devotees who lived far from Varanasi or were unable to take a dip in the holy river, might worship the stone at their place of residence, and thus earn equal merit.”⁷³ Similar slabs reportedly depict the religious sites of Prayāga and Gaya.

Other important works—in what must necessarily be a very incomplete sketch—that demonstrate the breadth of ancient Indian geographical knowledge include Pāṇini’s classic *Aṣṭādhyāyī* (late fifth or early fourth century B.C.), in which the author frequently used place-names in the exposition of the rules of Sanskrit grammar; Kauṭilya’s *Arthaśāstra* (fourth century B.C.), a manual of statecraft and geopolitics; and the Jataka stories (third century B.C.), a collection of folktales relating to the previous lives and times of the Buddha (ca. 563–483 B.C. for the historic Gautama Buddha).

A particularly important genre comprises the voluminous encyclopedic compendiums known as the Puranas (*purāṇa* means “old”; hence Puranas may be translated as ancient texts). These texts are, however, exceedingly problematic; for though the original compilation of a particular Purana may be attributable to some period in the first millennium, the extant versions were usually “compiled many centuries later and may have continued to be enlarged and altered even after the mention of the eighteen Mahā-Purāṇas [major Puranas] in the *Mahābhārata* redacted in c. A.D. 400.”⁷⁴ A characteristic feature of the Puranas was a geographical list (*bhuvanakośa*)—a sort of protogazetteer naming peoples and their territories, tribes, mountains, and rivers. Other sections of the Puranas deal extensively with places of pilgrimage and their glories (*mahātmyas*) and significance, which indicates the antiquity of the pilgrimage tradition in India and suggests yet another reason maps might have been desired. Finally, the Puranas were exceedingly rich in cosmographic description and presented views on cosmography considerably at variance with those found in the Vedas, the *Mahābhārata*, and the early Buddhist canons.⁷⁵

EVIDENCE OF ANCIENT COSMOGRAPHIES

In reflecting on the texts just cited, and on others as well,

York and Tokyo: Weatherhill, 1985), 303–4 and fig. 14.18, both suggest that the interpretation I have cited is the view more widely held.

73. Gole, *Indian Maps and Plans*, 22 (note 2). At present the slab is at the Archaeological Museum at Gwalior Fort (acc. no. 285).

74. Schwartzberg, *Historical Atlas*, 182 (note 50), relevant text written in collaboration with Shiva Gopal Bajpai. Some authorities have assigned certain Puranas to periods as early as the eighth century B.C., but David Pingree (personal communication, 21 December 1988) asserts that “this is too early by about half a millennium.”

75. Schwartzberg, *Historical Atlas*, 182–83 (note 50).

various scholars, most notably Tripathi, have inferred from various passages that maps and globes had to have been made in ancient times. Tripathi confidently interprets a number of words in Sanskrit and Pali (the language of the Buddhist canon) as having clear cartographic meaning. As the equivalent of map he gives the Sanskrit word *ālekhyā* and its Pali equivalent, *ālekha*. He translates *samputaka* as either map or atlas, *rekhacitra* as plan, and *parilekhana* as cartography, and in a glossary he offers one or more additional words for globe, equator, prime meridian, zenith, map projection, plane table, surveying, and so forth.⁷⁶ The more cautious D. C. Sircar, however, has this to say:

There is no special word in Sanskrit for “a map.” The word *nakshā* (from Arabic *naqshah*) has been adopted in most modern Indian languages in this sense, although it also signifies “a picture, a plan, a general description, an official report.” In Eastern India, the word *māna-chitra* has been coined to indicate the English word “map.” The absence of any special Sanskrit word raises the question whether map drawing was at all known to the Indians of old. There is, however, reason to believe that in ancient India a map or chart was regarded as a *chitra* or *ālekhyā*, i.e. “a painting, a picture, a delineation.” It will be seen that the Sanskrit word *chitra* and its synonyms have practically the same meaning as the Arabic word *naqshah*.⁷⁷

Tripathi cites numerous passages in the literature indicating to his satisfaction that map drawing was not uncommon in ancient India. He refers, for example, to a passage in Edward Cowell’s translation of the *Mahāummagga Jātaka* that alludes to artists who “made all manner of paintings” and then names a number of identifiable geographic features such as Mount Sineru (Meru), Himavat (the Himalayas), and Lake Anotatta (Manasarowar), as well as such generic features as the four continents, the sea, and the ocean.⁷⁸ Tripathi sees in this passage proof that the early Buddhists drew world maps and that “this work was carried on by expert cartographers.”⁷⁹ The quotation is, however, cut short at the point where the original text states that the artists also painted the “Sun and Moon, the heaven of the four great kings with the six heavens of sense and their divisions.”⁸⁰ Thus it hardly appears that we are dealing here with world maps drawn by “expert cartographers”; rather, it seems that the *Mahāummagga Jātaka* is describing a conventional cosmography of the so-called *catur-dvīpa vasumatī* (the four-continent earth, as described below, p. 352 and figs. 16.1 and 16.14) for the presentation of which “expert” cartographic skills—inferred by Tripathi—would not have been a prerequisite. Tripathi cites similar textual evidence in support of mapmaking from the Vedas, the Brahmanas, the Epics, and especially the Puranas. A full evaluation

of these claims through a study of the original Sanskrit and Pali sources is badly needed.

Other authors also find support in the ancient literature for the drawing of cosmographic maps. Sircar and Awasthi both cite relevant passages from several of the Puranas. The following, translated from the *Padma Purāna*, tells of Kalā, the daughter of a minister of a south Indian kingdom, who to entertain her visiting queen takes from a chest “a wonderful book” within which were revealed, among other things:

the pictorial representation of Bhūgola (earth) having the extent of fifty crores [1 crore = 10 million] of yojanas [a unit of distance, variously taken as 4½ or 9 miles]. . . . golden-land painted dark, Lokālokaparvata [the mountain range ringing the earth], seven continents surrounded by seven seas as well as the rivers, mountains and territorial divisions related to seven *dvīpas* (continents). . . . Bhārata-Khaṇḍa [India] comprising rivers like the Yamunā and the Gaṅgā. . . . the sacred site of Indraprastha [Delhi] placed on the bank of the Yamunā . . . the sacred spot of Prayāga [Allahabad, at the Ganga-Yamuna confluence].⁸¹

This suggests that the book in question, or at least a part of it, was meant to contain maps.

Apart from the textual references, there is at least one major surviving cosmographic painting of very great antiquity—the Buddhist *bhavacakra* (wheel of life), painted on the wall of cave 17 in the renowned cave complex at Ajanta. The dating of this fresco is disputed, but it appears to be from not later than the sixth century, and the art historian Walter Spink assigns it a date of roughly A.D. 470.⁸²

Not all cosmographies, it appears, were two-dimensional representations. Tripathi has provided references to passages in the *Bhaviṣya Purāna* describing hinged metal hemispheres, which implies that some attempts were made to construct cosmographic globes as gifts to

76. Tripathi, *Development of Geographic Knowledge*, passim, esp. appendix, “Selected Technical Terms,” 327–32 (note 17).

77. Sircar, “Ancient Indian Cartography,” 60 (note 18).

78. Edward Byles Cowell, ed., *The Jātaka; or, Stories of the Buddha’s Former Births*, 7 vols. (Cambridge: Cambridge University Press, 1895–1913; reprinted London: Pali Text Society, distributed by Routledge and Kegan Paul, 1981), vol. 6 (trans. E. B. Cowell and W. H. D. Rouse), 223; cited in Tripathi, *Development of Geographic Knowledge*, 312–13 (note 17).

79. Tripathi, *Development of Geographic Knowledge*, 313 (note 17).

80. Cowell, *Jātaka*, 6:223 (note 78).

81. Awasthi, “Ancient Indian Cartography,” 276–77 (note 19).

82. Personal communication, 20 September 1988. See also Walter M. Spink, “The Vākātakas Flowering and Fall,” in a forthcoming volume of proceedings of an international conference on the art of Ajanta, held at Maharaja Sayajirao University in Baroda in 1988, ed. Ratan Parimoo.

Brahmans.⁸³ Additionally, several literary references suggest that something akin to relief models may also have been made. The *Skanda Purāṇa*, it is said, “mentions a relief model map prepared on level ground.”⁸⁴ Further, a chapter in the *Matsya Purāṇa* provides a set of rules for gift-giving ceremonies that entail the construction, from rice and wheat, of a model landscape—presumably mythical—of the region of Mount Meru, with associated rock structures, foothills, dales, ravines, streams, lakes, and forests.⁸⁵

INDIAN ASTRONOMY

Although the Indian science of astronomy overlaps to some degree with the speculative cosmological lore associated with Brahmanic Hinduism, Jainism, and Buddhism, it produced, over a period of more than a thousand years beginning about A.D. 400, a very large body of empirically based texts.⁸⁶ Less systematic knowledge of astronomy does, of course, have much earlier roots. There are circumstantial grounds to suppose that the Indus culture had some familiarity with astronomy, but there is no proof of this in the archaeological record.⁸⁷ In Vedic times, however, various texts refer to the proper times for performing the numerous sacrifices that characterized pre-Brahmanic Hinduism according to a diversity of astronomically determined phenomena: *yugas* (periods), *saṃvatsaras* (years), *ayanās* (half-years), *ṛtus* (two-month seasons), *māsas* (months), *adhimāsas* (intercalary months), *pakṣas* (half-months), specific ordinally numbered nights, and some twenty-seven or twenty-eight *nakṣatras* (constellations). “All of these elements,” notes Pingree, “survived into later periods, and profoundly affected the form into which Indian astronomers molded the foreign systems that they adapted to their own use.”⁸⁸

Early historians of Indian science were inclined to ascribe to Indian astronomical texts, many of which were traditionally regarded as revelations, greater originality than is suggested by recent research. Pingree characterizes the situation as follows:

Astronomy shares with other scholarly disciplines in India the characteristic of being repetitive. Indian astronomers did not usually attempt innovations in theory; they wished to preserve their tradition as intact as possible. Most of their energies, therefore, were devoted to devising computational techniques. And they delighted both in simplifications or approximations and in needless complications; each type of change displayed the skill of the master. Much of the history of this science in India, then, must be simply an account of the means by which the traditions were preserved, and a recitation of the often bizarre modifications and elaborations of the basic formulas. . . .

That Indian astronomy was not completely static is due almost entirely to the repeated intrusion of new theories from the West. Five times have such intru-

sions occurred—in the fifth century B.C., from Mesopotamia via Iran; in the second and third centuries A.D., from Mesopotamia via Greece; in the fourth century A.D., directly from Greece; in the tenth to eighteenth centuries, from Iran; and in the nineteenth century, from England. But, although the character of Indian astronomy at each such intrusion was changed, to a greater or lesser extent, these changes were accompanied by the minimum possible alterations of the earlier traditions, none of which ever completely died.⁸⁹

As the early Vedic emphasis on religious sacrifices waned, astronomy was put to new uses. Among these were determining the proper moments for performing *saṃskaras* (personal ceremonies or sacraments); calendric computations, especially in regard to festivals; indicating auspicious and inauspicious times for performing certain types of actions; predicting eclipses; establishing the time of the sun’s entry into successive zodiacal signs; and from at least the second century A.D., computing the positions of planets for the casting of horoscopes.⁹⁰

Basham has summarized some of the more important sun-earth-moon relationships as follows:

For purposes of calculation the planetary system was taken as geocentric, though Āryabhaṭa in the 5th century suggested that the earth revolved round the sun and rotated on its axis; this theory was also known to later astronomers, but it never affected astronomical practice. The precession of the equinoxes was known, and calculated with some accuracy by medi-

83. Tripathi, *Development of Geographic Knowledge*, 291–92 (note 17). Compare the description of a sixteenth-century hinged metal globe at Oxford, pp. 352–55.

84. R. L. Singh, L. R. Singh, and B. Dube, “The Ancient Indian Contribution to Cartography,” *National Geographical Journal of India* 12 (1966): 24–37, esp. 32.

85. Tripathi, “Survey and Cartography,” 415–16 (note 17). In the modern period, in the folk observance of a festival in honor of Lord Krishna, peasants and cowherds make cow-dung models of the sacred Mount Govardhan (see below, p. 379).

86. Some idea of the vast scope of Indian astronomical literature will be gained by consulting, inter alia, the following works by David Pingree: “History of Mathematical Astronomy in India,” in *Dictionary of Scientific Biography*, 16 vols., ed. Charles Coulston Gillispie (New York: Charles Scribner’s Sons, 1970–80), 15:533–633; *Jyotiḥśāstra: Astral and Mathematical Literature*, History of Indian Literature, vol. 6, fasc. 4 (Wiesbaden: Otto Harrassowitz, 1981); and *Exact Sciences in Sanskrit* (note 44). Pingree notes that “at present there exist in India and outside of it some 100,000 manuscripts on the various aspects of *jyotiḥśāstra*” (*Jyotiḥśāstra*, 118).

87. Brij Bhusan Vij, “Linear Standard in the Indus Civilization,” in *Frontiers of the Indus Civilisation*, ed. B. B. Lal and S. P. Gupta (New Delhi: I. M. Sharma, 1984), 153–56, esp. 156. See also Debiprasad Chattopadhyaya, *History of Science and Technology in Ancient India: The Beginnings* (Calcutta: Firma KLM Private Limited, 1986), 82–85.

88. Pingree, “History of Mathematical Astronomy,” 534 (note 86).

89. Pingree, “History of Mathematical Astronomy,” 533 (note 86).

90. Pingree, *Jyotiḥśāstra*, 8 (note 86).

eval astronomers, as were the lengths of the year, the lunar month, and other astronomical constants. These calculations were reliable for most practical purposes, and in many cases more exact than those of the Greco-Roman world. Eclipses were forecast with accuracy and their true cause understood.⁹¹

In reference to the earth, parallels of latitude, meridians of longitude, the equator, and a prime meridian, based since the mid-second century A.D. on the longitude of the ancient Indian city of Ujjayinī (Ujjain), were all utilized.⁹² Diverse astronomical instruments were employed, including various types of gnomons and water clocks, rotating wooden models of celestial spheres (dating from as early as the fifth or sixth century and characterized by Pingree as “basically illustrative . . . or elaborate toys”), and in due course astrolabes (*yantrarājas*), quadrants, complex celestial globes, and other observational devices adapted from those used by Islamic peoples.⁹³

The oldest known “Indian” astrolabe was, in fact, a modification of an instrument of the Islamic type, inscribed in the Cufic style of Arabic and dated 669/1270. The earliest Hindu text on astrolabes is, similarly, based on Arabic and Persian works of the preceding three centuries; it was written about A.D. 1370 by Mahendra Sūri, the son of a court astrologer, for the Tughluq sultan Fīrūz Shāh III. Hindu interest in astrolabes seems to have waned in the fifteenth century, however, only to be revived again with the advent of Mughal rule in the sixteenth.⁹⁴ The culmination of Indian efforts at creating precise astronomical instruments came in the 1720s and 1730s, during the reign of the astronomer king Sawai Jai Singh II of Jaipur, who oversaw the construction of monumental stone observatories at Jaipur, Ujjain, Delhi, Mathura, and Varanasi. These observatories were modeled on that of Ulugh Beg, built in the mid-fifteenth century in Samarkand.⁹⁵ Finally, I must note that numerous metal celestial globes, all ultimately of Islamic origin, though occasionally with text in Sanskrit, were also produced in India from the late sixteenth to the mid-nineteenth century.⁹⁶

From the seventh century onward, most astronomical texts could be classified within three principal genres. The most comprehensive and important were the *siddhāntas*, which deduced the mean motions of heavenly bodies from the beginning of a particular *kalpa* (a lengthy astronomical period discussed below in the chapter on cosmography). *Karaṇas* formed more concise expositions of the mean longitudes of heavenly bodies at various times. And finally, *koṣṭhakas* were sets of astronomical tables for determining planetary positions to solve specific astronomical problems. Additionally, there were more specialized texts, among which those relating to *yantras* (observational instruments) were of particular importance.⁹⁷

The five principal schools (*pakṣas*) of Indian astronomical writing into which authors of the foregoing texts could be grouped are generally of no particular concern for our purposes. However, in South India in the late fourteenth century an important school arose that was distinctive because of its emphasis on careful observation of the heavens rather than on devising new computational manipulations of received data. Epitomizing this approach was the *Jyotirmimāṃsā*, written by Nilakaṇṭha in 1504, in which the author “vigorously defends the necessity constantly to correct astronomical parameters on the basis of observation, especially with regard to eclipses, but also with regard to the planets other than the Sun and the Moon.”⁹⁸

Although the influence of Islamic Ptolemaic theory on Indian astronomy dates from as early as the tenth century, it was not until the sixteenth century that substantial

91. A succinct account of major concepts and contributions is provided by Arthur Llewellyn Basham, *The Wonder That Was India: A Survey of the History and Culture of the Indian Sub-continent before the Coming of the Muslims*, 3d rev. ed. (London: Sidgwick and Jackson, 1967), 491–93, esp. 493.

92. David Pingree, “Astronomy and Astrology in India and Iran,” *Isis* 54 (1963): 229–46, esp. 234.

93. Pingree, *Jyotiḥśāstra*, 52–54, quotations on 52 (note 86). In Pingree’s opinion, “serious observations were [not] made in India before the late fourteenth century, so that the contribution of instruments to the development of Indian astronomy prior to that date was minimal” (“History of Mathematical Astronomy,” 629 [note 86]).

94. Pingree, *Jyotiḥśāstra*, 52–54 (note 86); see also Gunther, *Astrolabes of the World*, vol. 1, *The Eastern Astrolabes*, chapters on “Indian Astrolabes,” 179–220, and “Hindu Astrolabes,” 221–28, esp. 179, 186, and 221 (note 25), and Gibbs and Saliba, *Planispheric Astrolabes* (note 26). Both are beautifully illustrated works. The interest in planispheric astrolabes was accompanied by a concomitant development in the fabrication of celestial globes, for which Savage-Smith offers a remarkably detailed, wide-ranging, and lucid account in *Islamicate Celestial Globes* (note 27).

95. Numerous works have been published on these observatories and on the career of Sawai Jai Singh II. An early, richly illustrated scholarly work is George Rusby Kaye, *A Guide to the Old Observatories at Delhi; Jaipur; Ujjain; Benares* (Calcutta: Superintendent of Government Printing, India, 1920). Also abundantly illustrated (though the photographs are often of poor quality) is Prahlad Singh, *Stone Observatories in India: Erected by Maharaja Sawai Jai Singh of Jaipur (1686–1743 A.D.) at Delhi, Jaipur, Ujjain, Varanasi, Mathura* (Varanasi: Bharata Manisha, 1978). A. Rahman’s *Maharaja Sawai Jai Singh II and Indian Renaissance* (New Delhi: Navrang, 1987) also contains numerous illustrations, not only of Jai Singh’s instruments, but of other works he was associated with, including a town plan of Jaipur and a plan of the Jaipur observatory. Regrettably, these two plans, both apparently from the eighteenth century, are not documented as to date, provenance, and present locale (presumably Jaipur) and came to my notice too late to be included in the discussion of geographical maps below. Additional references will be made in the chapter on cosmography.

96. These are further discussed and illustrated in the chapter on cosmography below and in the chapter on Islamic celestial mapping in part 1.

97. Pingree, *Jyotiḥśāstra*, 13–14 (note 86).

98. Pingree, *Jyotiḥśāstra*, 50–51 (note 86).

numbers of Persian astronomical texts began to be translated into Sanskrit. Among Indian astronomers influenced by these works, one whose approach distinguishes him from virtually all others was Kamalākara, who in 1658 completed in Varanasi the *Siddhāntatattvaviveka*, which appears to be the sole Sanskrit treatise on geometrical optics. This work, states Pingree, “devotes many verses to the physics of the celestial spheres, referring specifically at many points to the (Aristotelian) views of the Yavanas [Greeks] or Muslims,”⁹⁹ following in particular the school of Ulugh Beg of Samarkand.

Few Indian works on astronomy contained drawings that would assist readers in solving the problems they were related to.¹⁰⁰ But, as with other ancient texts we have considered, the descriptions of method are so precise that modern authors have been able to recreate remarkably complex diagrams illustrating the processes for determining at various times the positions and movements of the earth, sun, moon, planets, and certain constellations in relation to one another. (The situation appears to be analogous to the precision of the *Śulvasūtras* in respect to *vedis*, though the intellectual demands which the astronomical texts put upon the reader obviously were substantially greater.) Nor do we find in any of the texts anything that might be described as a celestial chart. Conventional iconic representations of the planets, of signs of the zodiac, and of other celestial phenomena, however, have been extremely common in India since ancient times. Such representations, often in the form of images of the presiding deities or of objects associated with them, occurred in painting, sculpture, and architecture in a wide range of contexts, very few of which would be construed as cartographic.¹⁰¹

Although astronomy had only a negligible impact on traditional Indian cartography, it did alter the cosmographic views derived principally from the Puranas. In particular, it appears to have influenced the preparation of a number of globes, to be discussed in the following chapter on cosmography. To quote Pingree once again:

As . . . geometric models of planetary motion based on the idea of the circularity of their orbits were introduced into India, it became necessary to modify the traditional Indian cosmology as expressed in the Purāṇas and other texts. This was done by transforming the disc of Jambūdvīpa into a sphere and Meru into the terrestrial North Pole; along the equator at 90° distance from each other lie Laṅkā on the prime meridian, Romakaviṣaya, Siddhapura, and Yamakoṭi; opposite Meru at the South Pole is Vaḍavāmukha. The axis of the universe passes through Meru and Vaḍavāmukha and the poles of the spheres of the planets and of the *nakṣatras*; the spheres of the planets rotate from West to East at a uniform velocity, driven by bonds of wind, while they and the sphere of the *nakṣatras* rotate diurnally from East to West.¹⁰²

As in many other cultures, astronomical and astrological “science” were closely intertwined in South Asia, and as we have seen the former was, from at least the second century A.D., to a large extent the handmaiden of the latter. The hold of astrology on the people of India and on many lands influenced by Indian culture remains exceedingly strong. Astrological literature and associated diagrams and devices, used to plot the position of heavenly bodies at specific moments of time and thereby to cast horoscopes, exist in great abundance. I have, however, arbitrarily decided to refrain from any detailed consideration of this genre of writing and illustration and to refer interested readers to Pingree’s thorough bibliographic coverage of the field.¹⁰³ Also omitted in the coverage of South Asia is any discussion or illustration of the numerous charts, often quite detailed, associated with the practice of chiromancy.

SURVEYING IN THE MAURYAN EMPIRE

The first great empire to arise within India was founded by Candragupta Maurya in 321 B.C. Associated with the Mauryan Empire was the *Arthaśāstra*, a manual of statecraft, attributed to Candragupta’s minister Kauṭilya, but in its present form almost surely the work of a number of authors writing over a span of several centuries. A central concern of the Mauryas and of subsequent Indian states was the collection of land revenue, and an elaborate bureaucratic apparatus evolved toward that end. “So complex a system of taxation,” wrote the eminent Indologist A. L. Basham, “could not be maintained without surveying and accountancy.”¹⁰⁴ He cites the Jataka

99. Pingree, *Jyotiḥśāstra*, 30–31 (note 86); and Pingree, “History of Mathematical Astronomy,” 615 (note 86); quotation is from the latter source.

100. Pingree, personal communication, 21 December 1988. Pingree notes that the paucity of illustrations in astronomical texts is in marked contrast to what is found in Sanskrit works on geometry and that he cannot explain the difference.

101. See, for example, Calambur Śivaramamurti, “Geographical and Chronological Factors in Indian Iconography,” *Ancient India: Bulletin of the Archaeological Survey of India* 6 (January 1950): 21–63, with twenty-seven photographic plates, esp. pp. 29–35; David Pingree, “Representation of the Planets in Indian Astrology,” *Indo-Iranian Journal* 8 (1964–65): 249–67; and Stephen Allen Markel, “The Origin and Early Development of the Nine Planetary Deities (*Navagraha*)” (Ph.D. diss., University of Michigan, 1989). In the chapter on nautical maps below, note is also taken of the use of simple directional symbols based on the *nakṣatras* in nautical charts, compass cards, and other navigational aids.

102. Pingree, *Jyotiḥśāstra*, 12 (note 86).

103. Pingree, *Jyotiḥśāstra*, chaps. 4, 5, and 6, “Divination,” “Genethliology,” and “Catachic Astrology,” 67–109 (note 86). I include some representative illustrations in the chapter on cosmography below to convey an impression of the nature of materials in question.

104. Basham, *Wonder That Was India*, 109 (note 91).

stories, which “refer to local officers as ‘holders of the [surveyor’s] cord’ (*rajjugāhaka*),” and notes that Megasthenes, the Seleucid emissary to the Mauryan court, recorded that the “land was thoroughly surveyed.”¹⁰⁵ Land, says Basham,

was only transferred to a new owner after reference to the local land records, and this fact, with the names of the record keepers who had certified its transferability, was often noted in the copper-plate title deeds. The better organized kingdoms evidently kept full and up-to-date records of land ownership corresponding to the English Domesday Book. Unfortunately they were written on perishable materials, and all have long since vanished.¹⁰⁶

Although collecting land taxes remained an important state function throughout subsequent Indian history, we cannot say with certainty that any precolonial Indian state, including the great Gupta, Mughal, and Maratha empires, all of which had highly evolved revenue systems, made any provision for cadastral mapping.¹⁰⁷ Santarém, however, cites the discovery by James Rennell in Monghyr district of what is now Bihar of a very early geographic map engraved on copper and appended to a land grant. The text of the inscription was translated by Wilkins and dated to the time of Jesus Christ. This late eighteenth- or early nineteenth-century find was reportedly transported to England, but its present whereabouts are not known.¹⁰⁸ Of course a map relating to a land grant is not quite the same as a cadastral map; but if the interpretation given the find is correct, the concern for recording the limits of one’s property is relevant, and one hardly expects that the Monghyr inscription would have been unique.

ARCHITECTURAL PLANS FROM ANCIENT AND MEDIEVAL INDIA

Buddhism originated in northern India early in the fifth century B.C. and, after the conversion of the great Mauryan emperor Aśoka, about 261 B.C., spread rapidly throughout the subcontinent and beyond. Buddhist monasteries (*vihāras*) and centers of learning proliferated in this period. From the ruins of several such monasteries, one close to the village of Kasrawad near Maheshwar in Madhya Pradesh and others from Salihundam and Nagarjunakonda, in the Srikakulam and Guntur districts of Andhra Pradesh, come inscribed potsherds bearing the oldest approximately datable Indian artifacts that appear to be unquestionably cartographic in nature. D. B. Diskalkar’s description of the Kasrawad find, uncovered in an excavation carried out in 1937–39, is terse and inconclusive. It merely states that “some geometrical designs which look like rough plans of houses and the compartments in them are incised on the pots.”¹⁰⁹ How many

such pots were uncovered is not stated. A single photograph accompanying the published report shows few details, and other explanations could be adduced for the inscribed design. A noteworthy motif on some of the potsherds was the swastika. The use of the swastika symbol is very ancient, since it appears even at Mohenjo Daro. “The *Ramayana* also speaks of [the] Swastika as one of several ground plans for buildings in Lanka [= (?) modern Sri Lanka].”¹¹⁰ In concluding his analysis of the excavation, Diskalkar states that “the antiquities . . . all belong to one period only . . . the 2nd century B.C.”¹¹¹

The Salihundam excavations, described by R. Subrahmanyam, relate to materials dated from the second or first century B.C. to the first century A.D. Though they are possibly slightly less old than those of Kasrawad, what they portray is not so open to question. A group of five inscribed sherds of black and red ware includes a dish whose exterior bears a “rough plan of a monastery and Swastika mark”¹¹² (fig. 15.10). Similar plans of a monastery, according to Subrahmanyam, also occur on some of the sherds and seals at the Nagarjunakonda site, which is of similar age. The evidence from these sites thus lends credibility to Diskalkar’s interpretations of the map on the Kasrawad sherd and suggests further that the swastika

105. Basham, *Wonder That Was India*, 109 (note 91).

106. Basham, *Wonder That Was India*, 109–10 (note 91).

107. Organizational charts indicating the apparatus of government for all of these states, as well as for the Mauryan Empire, are provided in Schwartzberg, *Historical Atlas*, pls. III.B.4, III.D.4, VI.A.2, and VI.A.3 and associated text (note 50). The prominence of the land revenue system in all of these charts is immediately evident.

108. Santarém, *Essai*, 1:363–64 (note 3). The date of Rennell’s find, not stated by Santarém, would have been about 1780. Santarém cites, but again fails to date, a translation by Wilkins. In William Wilson Hunter’s *Statistical Account of Bengal*, 20 vols. (London: Trübner, 1875–77), vol. 15, *Districts of Monghyr and Purniah*, 63, there is a reference to a “copper tablet found within the fort [of Monghyr] about the year 1780,” and of attempts to date it by William Jones, James Prinsep, and Francis Wilford (not Wilkins), who suggested dates of 24 B.C., A.D. 123, and A.D. 132, respectively. The compiler’s view, however, was that the tablet dated from the Pāla dynasty (eleventh century). Whether the tablet in question was the one Santarém referred to is problematic in that the former describes a royal encampment at the site and the construction of a bridge across the Ganga. It is possible that Rennell’s find was already forgotten by the time *A Statistical Account* was written, though that seems rather unlikely. Gole, *Indian Maps and Plans*, 18 (note 2), adds to the mystery by suggesting that Santarém may have misinterpreted Rennell in the first instance in supposing that his reference to the inscribed copper plate had to be a map though Rennell never explicitly stated that it was.

109. D. B. Diskalkar, “Excavations at Kasrawad,” *Indian Historical Quarterly* 25 (1949): 1–18, esp. 9 and photograph 5.1.

110. R. Subrahmanyam, *Salihundam: A Buddhist Site in Andhra Pradesh*, Andhra Pradesh Government Archaeological Series, no. 17 (Hyderabad: Government of Andhra Pradesh, 1964), 49.

111. Diskalkar, “Excavations at Kasrawad,” 17 (note 109).

112. Subrahmanyam, *Salihundam*, 48–50, esp. 49, fig. 15, and pl. LIV (note 110).

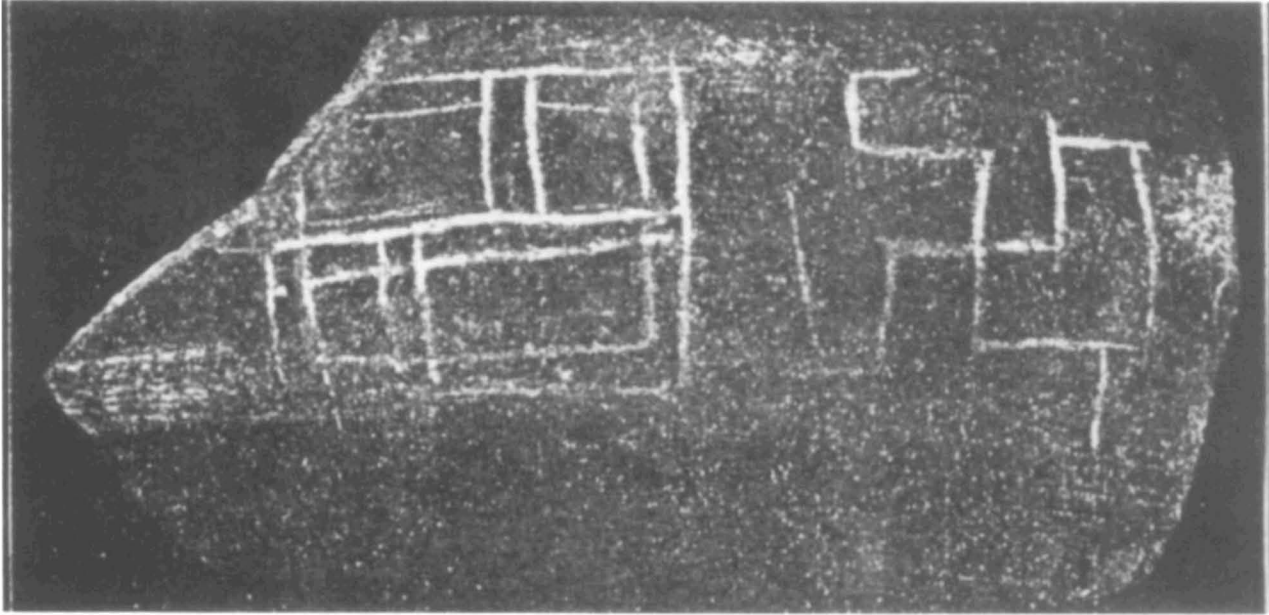


FIG. 15.10. POTSHERD WITH PLAN OF ANCIENT BUDDHIST MONASTERY. Excavated at Salihundam, a Buddhist site in Andhra Pradesh, this object is believed to date from the second or first century B.C.

Size of the original: 4.5×9 cm. Photograph courtesy of Susan Gole, London.

motif in other ancient archaeological contexts could be a cartographic sign.¹¹³

In ancient India, Hindu temples and Buddhist stupas were perceived as microcosmic analogues of the cosmos. Their individual components explicitly symbolized specific portions of the macrocosm, a matter on which historians of art and religion have provided us with abundant literature. As with the preparation of *vedis*, the construction of Hindu temples has, since ancient times, been regulated by an elaborate set of instructions covering every aspect of the work. The various scriptures containing these instructions date from at least as far back as the first century B.C. Known as the *śilpaśāstras* (laws of architecture) or *vāstuvidyā* (knowledge of sites), these texts also relate to construction in general and include chapters on building houses and on planning, laying out, and building villages and towns.¹¹⁴

In her classic work *The Hindu Temple*, Stella Kramrisch sets forth and explains in great detail the rules for temple building. Among these rules is drawing on ground leveled for the temple a plan called the *vāstupuruṣa-maṇḍala*. This was regarded as a “forecast” of the temple, “the fundament from which the building arises,” and “the place for the meeting and marriage of heaven and earth, where the whole world is present in terms of measure, and is accessible to man.”¹¹⁵ Thus temple construction, like building *vedis*, required the preparation of an ephemeral one-to-one scale map. It is probable that smaller-scale plans were also prepared, at least for the large and complex temples that abound in India.¹¹⁶ No

example survives from ancient times, but there are some noteworthy finds from the medieval period of Indian history. In the central Indian village of Bhojpur, twenty-nine kilometers southeast of Bhopal, there stands a huge but never completed eleventh-century Shaivite temple that represents, according to B. M. Pande, a fine example of the way early Indian temples were conceived and built. There is “singularly interesting evidence,” he writes, “in the form of drawings . . . engraved in the rocky area adjoining the temple.”¹¹⁷ Both Pande and Gole provide a number of photographs relating to this site.¹¹⁸ Figure

113. Subrahmanyam, *Salihundam*, 49 (note 110).

114. A list of important texts is provided by Prabhakar V. Begde, *Ancient and Mediaeval Town-Planning in India* (New Delhi: Sagar Publications, 1978), 233–34.

115. Stella Kramrisch, *The Hindu Temple*, 2 vols. (Calcutta: University of Calcutta, 1946; reprinted Delhi: Motilal Banarsidass, 1976), 1:7.

116. A north Indian inscription in Sanskrit, dated Śaka 717 (795 A.D.), “records the construction of a temple for the goddess Chaṇḍikā, for which . . . the architects, appointed for that purpose, duly completed the preparation of the plan . . . complete with such environmental accessories as a grove of different varieties of fruit-bearing trees, a well and a garden.” Further details are provided in K. V. Ramesh, “Recent Discoveries and Research Methods in the Field of South Asian Epigraphy,” in *Indus Valley to Mekong Delta: Explorations in Epigraphy*, ed. Nobaru Karashima (Madras: New Era, 1985), 1–32, esp. 26.

117. B. M. Pande, “The Date and the Builders of the Śiva Temple at Bhojpur,” in *Malwa through the Ages*, ed. M. D. Khare (Bhopal: Directorate of Archaeology and Museums, Madhya Pradesh, 1981), 170–75, esp. 170. The date of the temple is ascribed to the reign of the Paramāra king Bhoja I (A.D. 1010–55).

118. B. M. Pande, “A Shrine to Siva: An Unfinished House of Prayer

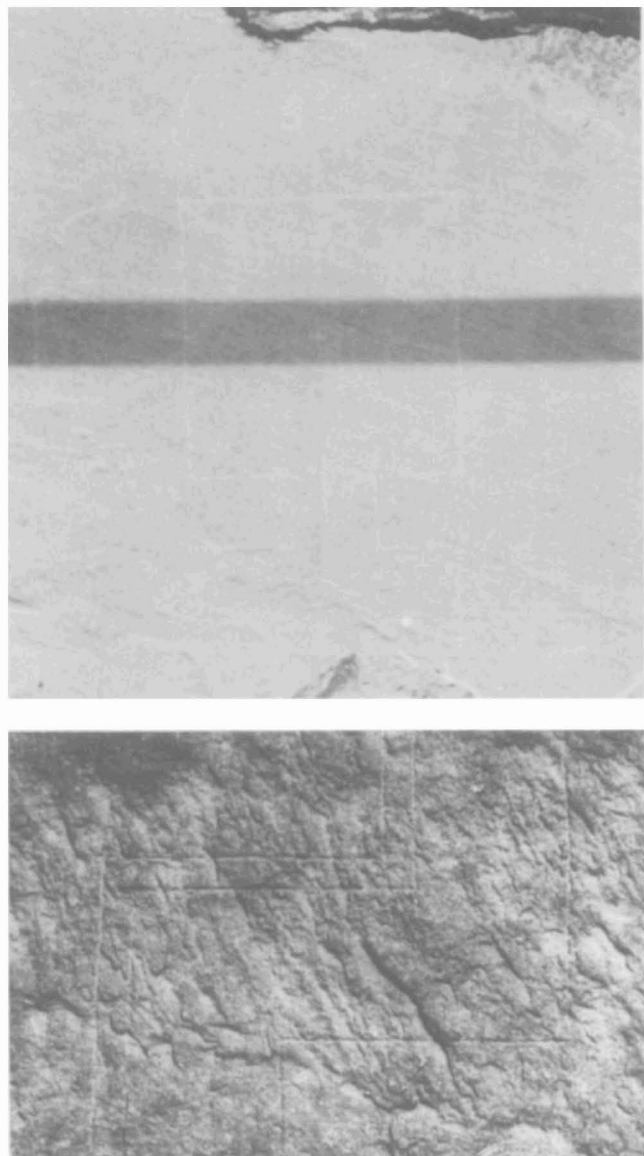


FIG. 15.11. GROUND PLANS OF A NEVER-COMPLETED TEMPLE. Both figures show the etching in the rocky ground of plans for a large temple that was to have been constructed in the eleventh century near the present-day village of Bhojpur in the Indian state of Madhya Pradesh. The upper figure shows the central square of the shrine, the surrounding alcoves, and the stone lintel at the door. The lower figure provides a clearer view of a smaller portion of the intended structure. Photograph courtesy of Susan Gole, London.

15.11, taken from Gole, illustrates some of the exposed ground plans carved in the local stone.

Particularly interesting are a number of texts recently discovered and translated (see fig. 15.12 and below, pp. 466–68) that strongly support the hypothesis that the actual drawing of temple plans is a long-established practice among architects. When the practice commenced

nobody knows, but it may be noted that the oldest surviving Hindu temples date only from the Gupta period (A.D. 320 to ca. 540). Earlier temples were built largely from perishable materials.

The *śilpaśāstras* related not only to temple architecture but also to building and settlement planning in general. Once again, these texts are sufficiently explicit to enable modern scholars to reconstruct literally scores of plans for buildings, villages, and cities. Many such reconstructions appear in published books and articles (fig. 15.13).¹¹⁹ According to the texts, the planning, layout, and actual construction of large settlements, palaces, defensive works, and reservoirs should be entrusted only to a qualified *sthapati* (master builder/architect). Such an individual had to be of high moral and intellectual stature and well versed in surveying, draftsmanship, making perspectives, reconnoitering, and regional planning. Next in rank to the *sthapati* was the *sūtragrahin*, who had to be an expert draftsman and surveyor; and among the subordinates of the latter was the *vardhaki*, whose required specialties were draftsmanship and perspective drawing.¹²⁰

Through such officials, Indo-Aryan town planning was said to be able to fix “beyond controversy the shape, area, method of planning, and distribution of various buildings . . . according to [one’s] caste, rank in society, position in the body-politic, and profession.”¹²¹ In this role, the authority of the master builder was all embracing and frequently exercised. Before a city could be laid out, reconstructed, or enlarged, the master builder was to conduct surveys that “consisted in preparing maps to indicate such matters as the degree of density of population in the different parts of the town, allocation of sites for different castes and professions, . . . distribution of parks, public and other open spaces and the extent of each.” Where reconstruction was contemplated, he had “to take a historical survey of the shrines, buildings, or reservoirs

in Bhojpur,” *India Magazine* 6 (1986): 28–35, and Gole, *Indian Maps and Plans*, 21–22 (note 2). Gole also notes additional ground plans that appear on the walls of the great Sun Temple at Konarak in Orissa, built in the thirteenth century.

119. See, for example, Begde, *Ancient and Mediaeval Town-Planning* (note 114); Bechan Dube, *Geographical Concepts in Ancient India* (Varanasi: National Geographical Society of India, Banaras Hindu University, 1967); Binode Behari Dutt, *Town Planning in Ancient India* (Delhi: New Asian Publishers, 1977); and Andreas Volwahren, *Living Architecture: Indian* (London: Macdonald, 1969). The most important, perhaps, of the original texts is the *Mānasāra*; see *Architecture of Manasara*, translated from the Sanskrit by Prasanna Kumar Acharya, 2d ed., 2 vols., Manasara Series, vols. 4 and 5 (New Delhi: Oriental Books Reprint Corporation, 1980).

120. Begde, *Ancient and Mediaeval Town-Planning*, 117–18 (note 114).

121. Dutt, *Town Planning in Ancient India*, 66–67 (note 119).

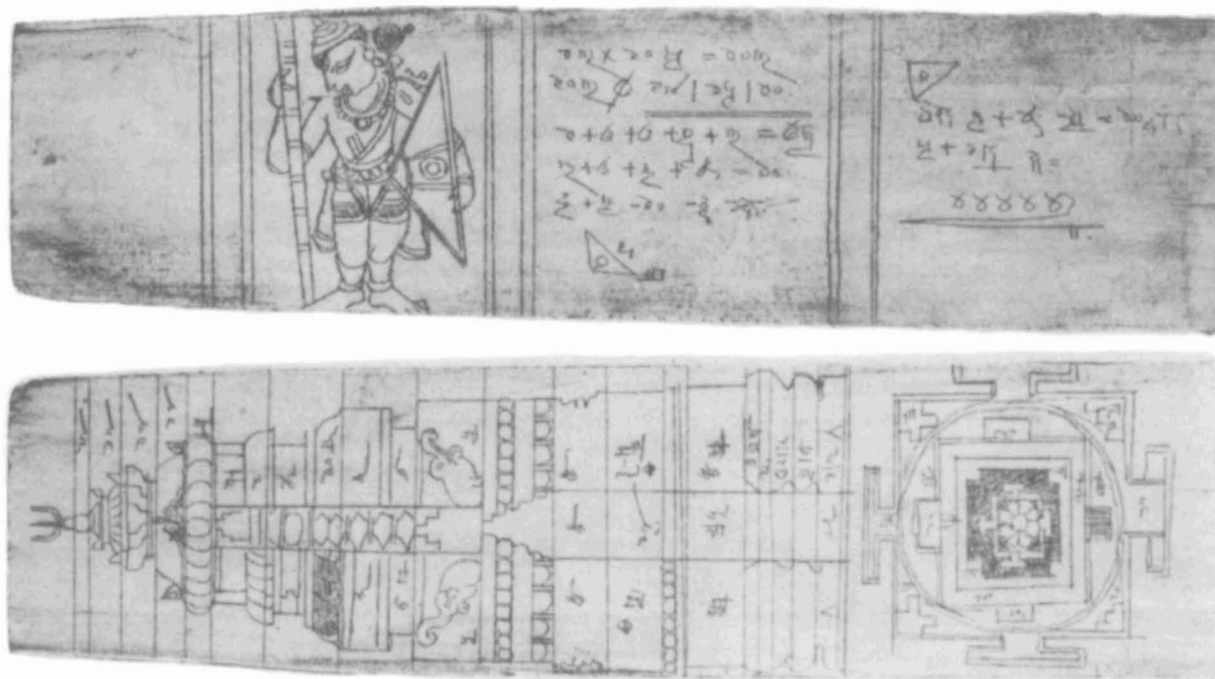


FIG. 15.12. LEAF FROM A PALM-LEAF MANUSCRIPT ON ARCHITECTURE. This excerpt from a seventeenth-century manuscript is from the Indian state of Orissa. The upper illustration depicts a surveyor with his rod and another surveying tool, along with calculations related to the construction of a

temple. The bottom illustration, the reverse of the leaf shown above, indicates the ground plan of the main *śikhāra* (tower) of the temple (right) and the elevation of the tower (left). Size of the original: not known. From Andreas Volwahren, *Living Architecture: Indian* (London: Macdonald, 1969), 54.

of historical importance and traditional sanctity”¹²² so as to do least violence to the existing order. It was as a result of this process that “maps showing the boundaries of different possessions and habitations had to be prepared. Local requirements, traditional prejudices or rules affecting the desirable size or shape of building plots for various purposes and thus influencing the distribution of the streets had to be noted on the chart.”¹²³

The *śilpaśāstras* required that *pādas* (quadrangular plots, either squares or rectangles) be laid out for each village or city “by drawing [on the ground] two to thirty-three rectilinear parallel lines and as many transverse parallel lines.”¹²⁴ The number to be drawn depended not only on the purpose of the settlement but also on certain astrological considerations. From the grid thus created, “mystic diagrams” (yantras) were devised, and from these in turn was derived the layout of the streets, as shown in figure 15.13.¹²⁵

How frequently these normative injunctions were followed in practice is a matter for speculation. Indian writers have often assumed they were regularly observed, but the art historian Amita Ray concludes, after reviewing the archaeological remains of a substantial number of ancient settlements, that the descriptions of the various *śilpaśāstra* texts “reveal most clearly that they represent not what actual city-planning as a socio-economic phenomenon was like . . . , but more a kind of abstraction

following the mechanical set up of different occupational groups, castes and classes in the city with gods, kings and priests, as the centre of the whole scheme.”¹²⁶ Nevertheless, there almost certainly were some planned cities that took into account the ancient architectural canons. Among these, the most notable was the Rajput city of Jaipur (figs. 15.14, 15.15, and 15.16), founded as recently as 1728.

122. Dutt, *Town Planning in Ancient India*, 67 (note 119).

123. Dutt, *Town Planning in Ancient India*, 68–69 (note 119). Without being able to read the relevant primary sources, it is difficult to decide how much of the quoted passages is based on inference and how much on firm textual grounds. Dutt’s exposition seems to depend largely on the account (cf. Dutt, 178–79) of the reconstruction of the major south Indian temple city of Madurai after a great flood as described by C. P. Venkatarama Ayyar in *Town Planning in Ancient Dekkan* (Madras: Law Printing House, [1916]), 31–59, esp. 31–34. The date of this event is lost to history, but the detailed description of the reconstruction conveys a sense of verisimilitude and is buttressed by abundant citations from several ancient Tamil texts. One should, however, be cautious in making pan-Indian generalizations from data drawn from Dravidian sources.

124. Dutt, *Town Planning in Ancient India*, 142–43 (note 119).

125. Dutt, *Town Planning in Ancient India*, 142–43 (note 119), and Volwahren, *Living Architecture: Indian*, 43–50 (note 119).

126. Amita Ray, *Villages, Towns and Secular Buildings in Ancient India, c. 150 B.C.–c. 350 A.D.* (Calcutta: Firma K. L. Mukhopadhyay, 1964), 52.

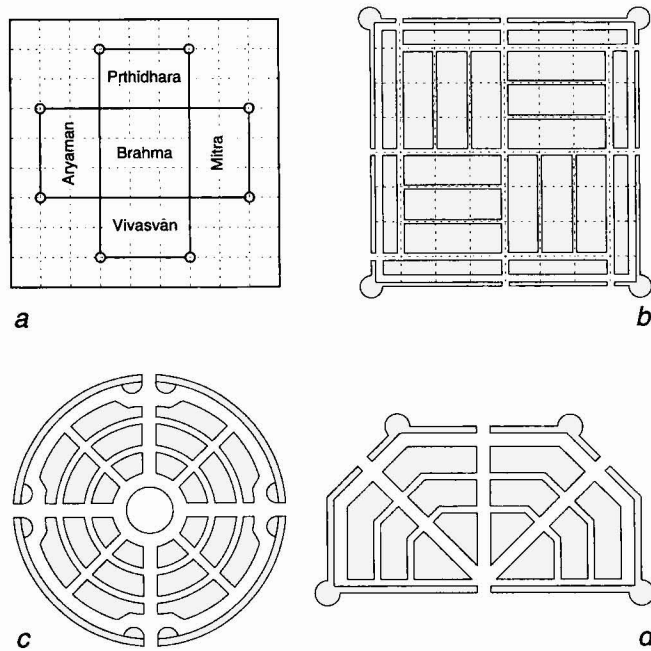


FIG. 15.13. EXAMPLES OF ANCIENT ARCHITECTURAL MANDALAS AND DERIVATIVE PLANS. Ancient canonical texts, known as *śilpaśāstras* (laws of architecture), specified a diversity of basic plans for laying out new cities, often with specifications as to the quarters to be assigned to castes and other socioeconomic groups. Four such plans are shown here. There is very little evidence in the contemporary urban landscape of widespread adherence to these models, which were described rather than drawn in the early texts. The layout of Jaipur, however (figs. 15.14 and 15.15 below), is an obvious exception. (a) *Paramaśāyikamaṇḍala*, containing nine by nine *pādas* (quadrangular plots). (b) Swastika plan for a city based on square *maṇḍūkamaṇḍala*, containing eight by eight *pādas*. (c) Sketch for a circular city based on the *maṇḍūkamaṇḍala* (after the *Mānasāra*). (d) Kheta city for Śhūdras (group of serving castes).

After Andreas Volwahren, *Living Architecture: Indian* (London: Macdonald, 1969), 45 and 49.

MAPS NOTED IN SECULAR TEXTS

Secular literature also provides a few references to maps in ancient and early medieval India. A fifth-century Sanskrit epic, the *Bṛhatkathāślokaśamgraha*, by the poet Budhasvāmin, appears to describe some sort of navigation chart. This work, brought to light by V. S. Agrawala, is especially rich in geographic referents from many parts of India and from Southeast Asia (Suvarṇabhūmi) as well. Several portions of the poem relate to sea voyages, and in one a treasure-bearing ship is blown off course in a hurricane and lands at a mountainous land, Śrīkuṅja (in Indian mythology the home of demons called Yakṣās). The hero of the poem, a prince named Manohara, learning of this mishap,

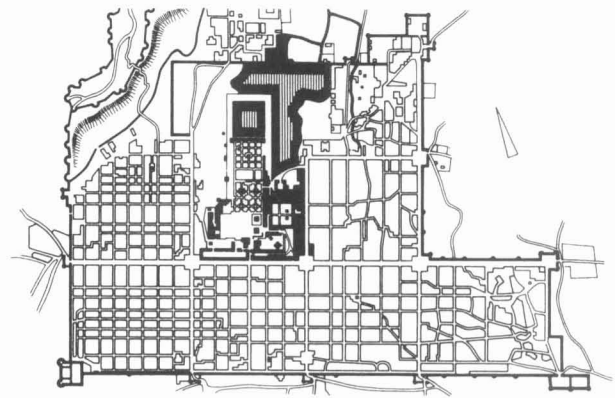


FIG. 15.14. PLAN OF THE EIGHTEENTH-CENTURY CITY OF JAIPUR. This plan shows the general division of Jaipur into nine parts. The departure from plan in the northwest was necessitated by hilly topography, while the southeastern extension represents a later addition to the city. From Andreas Volwahren, *Living Architecture: Indian* (London: Macdonald, 1969), 48.

noted down on a wooden board, having a cover on it (*samputaka*), the details about the particular sea, direction and place. . . . With this information the prince ordered a boat manned by an experienced . . . sailor and went out in the sea in search of that spot. . . . Impelled by favourable wind. . . [and] in accordance with the marks and signs as noted down on the board the prince identified the Śrīkuṅja mountain and reached there.¹²⁷

For a slightly later period, Sircar cites the *Xin Tang shu* (New history of the Tang, compiled 1032?–60), which gives an account of a campaign led by a Chinese general, aided by one thousand Tibetan soldiers and seven thousand Nepalese horsemen, who in A.D. 648 defeated Bhāskaravarman, king of Kia-mu-lu (Kāmarūpa in what is now Assam). As part of his tribute, the king “presented to the Chinese emperor some curious articles including ‘a map of the country.’” What the map may have shown is not stated, but it “appears to have been prepared by the artists at king Bhāskaravarman’s court.”¹²⁸

Sircar also cites an eighth-century Sanskrit drama by Bhavabhūti. In the first act an artist “painted along a walk . . . the experiences . . . of the Ikshvāku King Rāma of Ayodhyā in Daṇḍak-āraṇya, Kiṣkindhyā, Laṅkā and other places. . . . These paintings included some which are said to have depicted particular regions.” Sircar con-

127. Vasudeva Sharana Agrawala, ed., *Bṛhatkathāślokaśamgraha: A Study* (Varanasi: Prithivi Prakashan, 1974), 337–38. I am indebted to Susan Gole for steering me toward this work.

128. Sircar, *Geography of Ancient and Medieval India*, 326 (note 18).

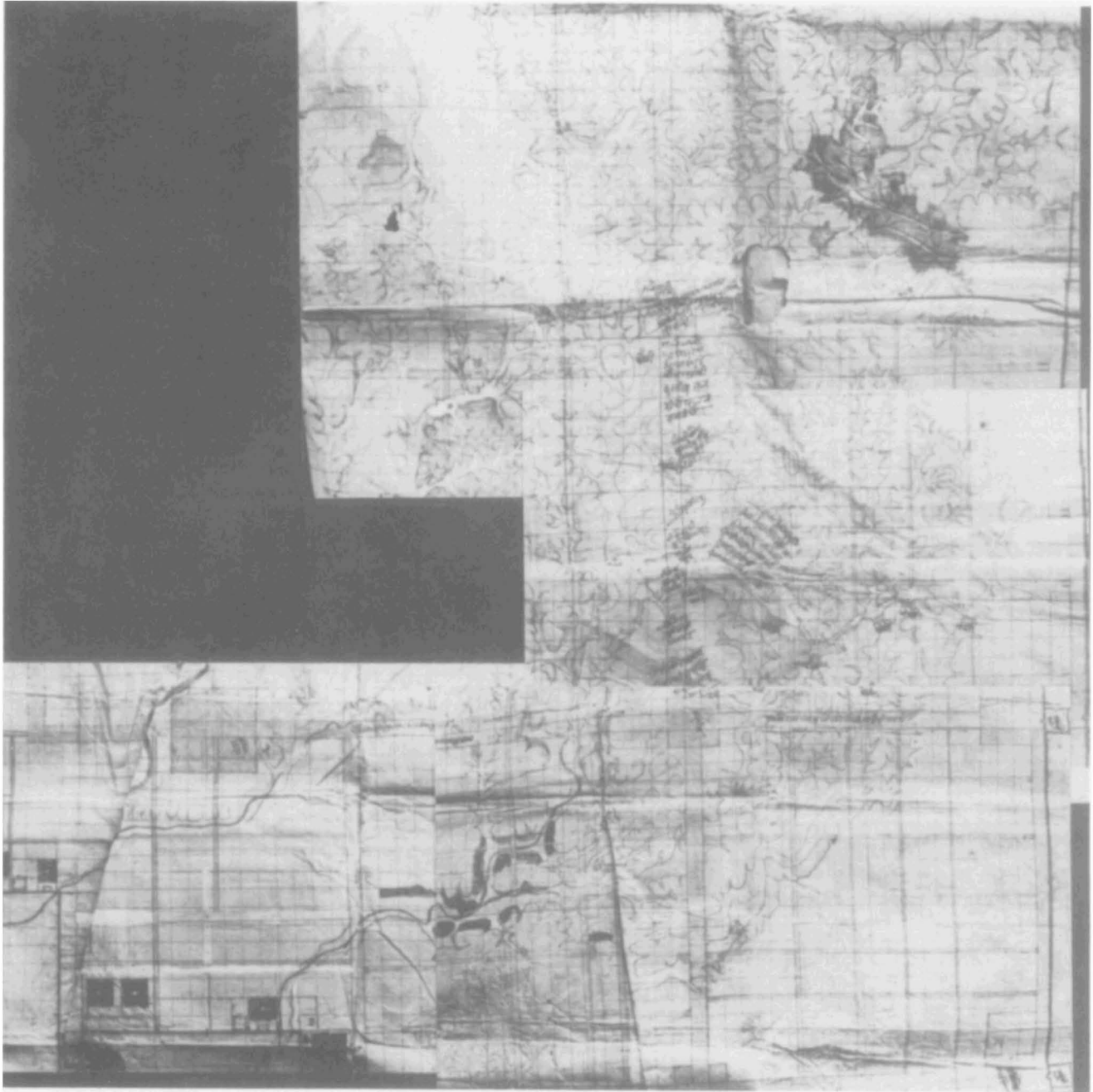


FIG. 15.15. ARCHITECTURAL PLAN, JAIPUR. A portion of the original architectural plan survives in four sheets and is kept at the Maharaja Sawai Man Singh II Museum, Jaipur. Size of the original: not known. By permission of the Maharaja

Sawai Man Singh II Museum Trust, Jaipur. Photograph by Raghubir Singh and Kanwarjit Singh Kang, courtesy of *Mārg* Publications, Bombay.

cludes that they may be regarded as maps.¹²⁹ Though partially mythic, the places shown are all well known from the *Rāmāyaṇa* epic. Sircar introduces the depiction by calling attention to these lines: “‘Here [states Lakṣmaṇa, a character in the play] is the tract . . . of the Daṇḍaka forest, known as Citrakuñjavat, to the west of Janasathāna . . . ; this is the site . . . of the hermitage of

Mataṅga on the Ṛṣyamūka hill; . . . this is the celebrated lake called Pampā.’”¹³⁰

A longer and more vivid passage from a much later

129. Sircar, *Geography of Ancient and Medieval India*, 327 (note 18).

130. Sircar, *Geography of Ancient and Medieval India*, 327 (note 18).

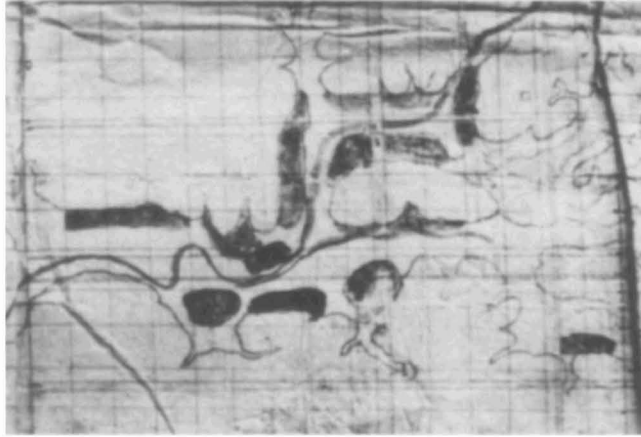


FIG. 15.16. DETAIL FROM ARCHITECTURAL PLAN, JAIPUR. This detail is taken from figure 15.15.

Size of the original: not known. By permission of the Maharaja Sawai Man Singh II Museum Trust, Jaipur. Photograph by Raghubir Singh and Kanwarjit Singh Kang, courtesy of *Mārg* Publications, Bombay.

Sanskrit drama may also relate to a map. It appears in an unpublished play by Gaṅgādharma dating from the mid-fifteenth century. Act 7 of this play relates to the Islamic siege of the fort of Chāmpāner, in what is now Gujarat, during which Sultan Muhammad II asks one of his Hindu vassals about the topography of the fort and important places within it. The vassal, who has not personally seen the fort, consults a priest who has visited it and asks for a description, which the priest then paints for him on cloth. With map in hand, the vassal then describes the fort to the sultan in thirty verses, whose full Sanskrit text and translation are provided by B. J. Sandesara. Its scope is conveyed by the following lines, constituting about a third of the total:

The highest building in the fort, white-washed and having a golden pitcher on its top, is the palace of Gaṅgadāsa. On the north-east of the same is the lake Rāmagaṅgā built by Rāma, and there is also a temple of Mahādeva built by him. The lake on its south is built by Sitā. On the western side is a lake called Bhimagayā with the *Bhīmaprāsāda* ('palace of Bhīma'); it was built by Bhīma. On the far western side of the same is a lake full of water white like lime; it was built by king Gaṅgadāsa. Roundabout this lake there are numerous temples. . . . You can see, yonder, the city of Campakapura (Chāmpāner) full of beautiful houses, like the city of Indra.¹³¹

PAṬA-CHITRAS

In addition to the painted cosmographies noted above, cloth paintings (*paṭa-chitras*) rich in real-world topographical detail, for contemplation in both temples and private homes, became increasingly common in India.

Some surviving examples go back to the fourteenth century. Most of these paintings are not maps, but the distinction between picture and map is difficult to make. Many such paintings combine relatively small areas portraying topographic detail with larger areas devoted entirely to other features, such as pictures of saints, deities, or abstract designs. One type, known as *viññāptipatras*, were long cloth scrolls, sometimes comprising invitations to Jain pontiffs to visit particular places, with the nature of the route given along with accompanying text. Other *paṭa-chitras* were narratives arranged in a series of registers, telling a story more or less in "strip cartoon" style. Though paintings of this type were created in many parts of India, they are particularly associated with the Jain religious community and are most abundant in Rajasthan and Gujarat.¹³²

FRUITS OF HINDU-MUSLIM INTERACTION

From the eleventh century onward, especially after the Ghaznavid occupation of Punjab (ca. A.D. 1018), Indic and Islamic civilization came into increasing contact, and interchange of ideas between the two became inevitable. Among early Islamic scholars no one devoted more attention to learning Indian science, including cosmography and geography, than the celebrated polymath Abū al-Rayḥān Muḥammad ibn Aḥmad al-Bīrūnī (362/973–after 442/1050). It is recorded that he studied with Brahman pundits during a long sojourn in northwestern India. It is not known that al-Bīrūnī ever made a map of India to accompany his celebrated *Taʾrīkh al-Hind* (Description of India, 1032), but he certainly could have done so and would have given a better shape to the country than that shown on any European maps up to the mid-sixteenth century. In 1025, however, he completed his compilation of a text, *Kitāb taḥdīd nihāyāt al-amākin li-taṣḥīḥ masāfāt al-masākin*, that dealt with the preparation of a world map, and like many other Muslim geographers he compiled lists of the latitudes and longitudes of numer-

131. B. J. Sandesara, "Detailed Description of the Fort of Chāmpāner in the Gaṅgadāsapratāpavilāsa, an Unpublished Sanskrit Play by Gaṅgādharma," *Journal of the Oriental Institute* (Baroda) 18 (1968–69): 45–50, esp. 46. This article was transmitted to me by Susan Gole, who in turn received it from R. N. Mehta. In his letter to Gole, Dr. Mehta stated that he had verified the description in the field and found it not only accurate but also useful in identifying many monuments and sites noted in the drama.

132. Relevant publications include Shridhar Andhare, "Painted Banners on Cloth: Vividha-tirtha-pata of Ahmedabad," *Mārg* 31, no. 4 (1978), *Homage to Kalamkari*, pp. 40–44; Moti Chandra, *Jain Miniature Paintings from Western India* (Ahmadabad: Sarabhai Manilal Nawab, 1949), esp. pt. 1, chap. 4, "Miniatures in the Paper Period (circa 1400–1600 A.D.)," 37–45, and pt. 1, chap. 5, "Painting on Cloth," 46–56; and Kay Talwar and Kalyan Krishna, *Indian Pigment Paintings on Cloth*, *Historic Textiles of India at the Calico Museum*, vol. 3 (Ahmadabad: B. U. Balsari on behalf of the Calico Museum of Textiles, 1979).

ous places.¹³³ His lists for cities in India, as well as throughout the Islamic world, appear in his magisterial work on astronomy, the *Kitāb al-qānūn al-Mas'ūdī fī al-hay'ah na al-nujūm* (The Mas'ūdī canon). Additionally, he prepared lists of places along a number of travel itineraries with distances between points specified either in travel time (e.g., “three to four days’ march”) or in linear measure. These itineraries were very likely the proto-sources of a number of Mughal strip maps of travel routes, of which several examples still survive (these will be discussed below).

We have no clear evidence of Hindus’ copying Islamic styles of small-scale geographical cartography, but their observations of both the heavens and the sea were certainly altered by interaction with the Islamic world. Muslims produced astrolabes within India, and that instrument was adopted by Hindu science from such prototypes. Similarly, Indian marine charts may have been influenced by Muslim practice. The indirect evidence provided by Vasco da Gama’s first voyage to India in 1498 in particular, though this is contested, suggests that Indian navigators not only utilized Muslim-style charts but also adopted many of the Muslims’ techniques of navigation.¹³⁴

EUROPEAN ACCOUNTS OF INDIAN MAPPING

After the coming of the Portuguese and later European powers to India, the number of notices of indigenous mapping increases. It seems likely, though most of these maps no longer survive, that enhanced attention to the history of Indian cartography will result in the discovery of additional literary references that point to Indian maps. The following brief and tantalizing notices indicate what might have existed in addition to the known corpus.¹³⁵

The Jesuit Father Monserrate, who spent much time at the court of the great Mughal emperor Akbar (d. 1605), is one of many observers who recorded the care with which the Mughals measured their main roads. Of Akbar’s march to Kabul in 1581, Monserrate wrote:

Furthermore, he [Akbar] orders the road to be measured, to find the distance marched each day. The measurers, using ten-foot rods, follow the king, measuring from the palace. By this one operation he learns both the extent of his dominions, and the distances from place to place, in case he has to send embassies or orders, or meet some emergency. A distance of 200 times the ten-foot rod, called a *coroo* in Persian, or *cos* in the Indian language, equal to two [British] miles, is the measure for calculating distances.¹³⁶

Rennell, too, on more than one occasion, referred to similar measurements and acknowledges the receipt of the registers of the actual measured distances, as taken

by the orders of the Emperors Acbar, Shah Jehan, and others, on the great roads from the city of Lahore, Cabul, Ghizni, Candahar, and Moulton; and back to Lahore again: as well as those between Cashmere and the cities of Lahore and Attock, respectively; and between Cabul, Balk, and Bamiam: besides many other portions of different roads.¹³⁷

These measurements, Rennell states, were “set forth without any intimation concerning their direction, as it respects the points of the compass,” and “latitudes are seldom given.”¹³⁸ He does not indicate that the compilation of registers resulted in maps, but the task of making, at a minimum, route-by-route strip maps from such registers would have been simple; and we know that such strip maps existed for periods both earlier and later than the time Rennell wrote about.¹³⁹ This does not mean, of course, that they were common.

European testimony in regard to seventeenth-century Indian maps was not confined to the Mughals. Of the great Maratha military leader Shivājī, his contemporary Barthélemy Carré, the director general of the French East India Company from 1668 to 1673, wrote that he had mastered geography “to such an extent as to know not merely all the towns including the smallest villages of the country, but even the land and the bushes of which he had prepared very exact charts.”¹⁴⁰ It is therefore hardly surprising that a substantial portion of the surviving corpus of Indian maps is of Maharashtrian provenance and that many of those maps were drawn for military purposes.

Another French observer, who not only saw but used a number of Indian maps, was A. H. Anquetil-Duperron.

133. I prepared a map based on al-Bīrūnī’s lists of latitudes and longitudes of places in and near India, which appears in Schwartzberg, *Historical Atlas*, pl. IV.3, map e, with relevant text on p. 191 (note 50). For an English translation of the *Tahdīd*, see *The Determination of the Coordinates of Positions for the Correction of Distances between Cities*, trans. Jamil Ali (Beirut: American University of Beirut, 1967).

134. Arunachalam, “Haven-Finding Art” (note 34). See also the discussion above on pp. 256–57 and below, pp. 394–95.

135. For most of the notices provided, I am indebted to Susan Gole (various communications).

136. Father Antonio Monserrate, “Mongolicae Legationis Commentarius; or, The First Jesuit Mission to Akbar,” *Memoirs of the Asiatic Society of Bengal*, 3 (1914): 513–704, esp. 580. Quoted in Phillimore, *Historical Records*, 10 (note 32).

137. James Rennell, *Memoir of a Map of Hindoostan or the Mogul Empire*, 3d ed. (London, 1793; reprinted Calcutta: Editions Indian, 1976), 170. (Note: the pagination and text vary among the several editions of Rennell’s *Memoir*.)

138. Rennell, *Memoir of a Map*, 171 (note 137).

139. See, for example, the discussion of Mughal route maps below, pp. 435–42.

140. Quoted in Ramesh Desai, *Shivaji: The Last Great Fort Architect* (New Delhi: Maharashtra Information Centre, 1987), 92. Desai does not cite the source of this quotation.

Writing of his sojourn in Bombay in 1761, he states: “M. Spencer avoit bien voulu me communiquer une grande Carte de l’intérieur & des côtes du Sud de la Presqu’Isle, faite par des Brahmes; je venois d’en achever la copie.” Additionally he refers to “des Cartes Géographiques faites par les Naturels du Pays,” which he was unable to obtain.¹⁴¹ The former map was subsequently published, as copied, by Jean Bernoulli.¹⁴²

Rennell too repeatedly made use of Indian maps, as evidenced by the following quotations from his *Memoir of a Map of Hindoostan*:

The position of this place [Attock], geographically, can only be regulated by the apparent bearings from Lahore and Moulton, in a Persian map of the Panjab, together with the distances collected from the different accounts in the same map; in itineraries; and in the Ayin Acbaree. . . .¹⁴³ [Persian was the most widely used lingua franca in India from the sixteenth to the early nineteenth century and the language in which official Mughal records were written.]

. . . having before me, a map of this country drawn by a native, and preserved in the archives of government in Hindoostan. The names were obligingly translated from the Persian, by the late Major Davy, at the request of Sir Robert Barker. The tract, of which this map serves as a ground work, is a square of about 250 B. [British] miles; and includes the whole soubah [Mughal province] of Lahore, and a great part of Moulton proper. The points of Lahore, Attock, and Sirhind . . . determine the scale of the map; the intermediate distances from place to place in it, being given in writing, and not by a scale.

I consider this MS. as a valuable acquisition; for it not only conveys a distinct idea of the courses and names of the five rivers, which we never had before: but, with the aid of the Ayin Acbaree, sets us right as to the identity of the rivers crossed by Alexander. . . .¹⁴⁴

. . . The Persian map [above] fills up the space pretty amply, between the Lahore road and the mountains from whence we suppose the Panjab rivers to spring. . . .¹⁴⁵

Many other positions are pointed out, or illustrated, by this map; which, I am informed, is the production of a native of Guzerat [Gujarat] . . . but it is remarkable, that it gives the form of Guzerat with more accuracy, than most of the European maps can boast. . . .¹⁴⁶

A Hindoo map of *Bundela* or Bundelcund, including generally the tract between the Betwah and Soane rivers, and from the Ganges to the Nerbudda, was obligingly communicated by Mr. Boughton Rouse, who also translated the names in it, from the Persian. This map points out several places that I had not heard of before, and assists in fixing many others of which I had been partially informed. . . .¹⁴⁷

Cuddapah is determined by the [European] map of

the Pennar river: and the construction agrees with its reputed distance from Arcot in a *Malabar* map; or rather a map drawn by a native of the Carnatic. . . .¹⁴⁸

. . . The [Malabar] map alluded to, is not constructed by a scale, but rudely sketched out without much proportion being observed either in the bearings, or distances of places, from each other: and the names, and the distances between the stages, are written in the Malabar language.¹⁴⁹

Phillimore also notes that other British “political officers were often able also to obtain native maps and surveys.”¹⁵⁰ For example, Rennell cites a certain James N. Rind, an assistant to the resident at Delhi, who “was able

141. Abraham Hyacinthe Anquetil-Duperron, *Zend-Avesta*, 3 vols. (Paris: N. M. Tiliard, 1771; reprinted New York: Garland, 1984), 1:ccccxxviii and 1:dxlj. For other relevant passages referring to maps seen by Anquetil-Duperron in Goa and in Cochin, see pp. ccxix and clxxxvj. I thank Susan Gole for these references.

142. Jean Bernoulli, ed., *Des Pater Joseph Tieffenthaler's . . . Historisch-geographische Beschreibung von Hindustan*, 3 vols. (Berlin, 1785–88). A copy of Bernoulli's map appears in Gole's *India within the Ganges*, 22 (note 22). It bears the note, “Portion d'une Carte du Sud de la Presqu'île de l'Inde Faite par des Brahmes; qui comprend le Tanjaour, le Marava, et une partie considérable du Madurei: de la grandeur à peu près de l'Original / Zend-Avesta T.I.1.° Part. p. CCCXXXVIII . . . 1785.” In that this map is but a “portion” of the original, one wonders about the territorial extent of that initial work.

143. James Rennell, *Memoir of a Map of Hindoostan; or, The Mogul Empire* (London, 1788), 76–77. The *Ā'in-i Akbarī* (Institutions of Akbar) was the most famous of the numerous gazetteers and manuals used within the Mughal Empire and by other contemporaneous Indian states in administration and revenue collection. These provided systematic descriptions, usually in tabular form, of provinces and lower-order administrative subdivisions, noting, inter alia, their general location and their territorial extent. Although such works largely obviated the need for maps, they also provided any would-be cartographer with a clear basis for compiling remarkably detailed maps. This is evident from the atlas prepared in 1770 by the French colonel Jean Baptiste Joseph Gentil, adviser to the nawab of Oudh (discussed in chapter 17), and by the modern scholar Irfan Habib in creating *An Atlas of the Mughal Empire: Political and Economic Maps with Detailed Notes, Bibliography and Index* (Delhi: Oxford University Press, 1982). The rarity of surviving Mughal maps is underscored in that among the plethora of primary sources Habib used there is not a single map. On the other hand, it is reported that during the daily *darbārs* (audiences) held by Akbar's grandson, Shāh Jahān (r. 1627–58), “nobles and princes exhibited their plans for buildings and gardens and often in the evenings he [Shāh Jahān] would look at maps of the provinces and the designs of buildings under construction.” Stephen P. Blake, *Shahjahanabad: The Sovereign City in Mughal India, 1639–1739* (Cambridge: Cambridge University Press, forthcoming), 26–27. Blake cites as his authority Muḥammad Šāliḥ Kanbūh, *Āmal-i Šāliḥ*, 3 vols., ed. G. Yazdani (Calcutta: Asiatic Society of Bengal, 1912–39), 1:248.

144. Rennell, *Memoir of a Map*, 81 (note 143).

145. Rennell, *Memoir of a Map*, 90 (note 143).

146. Rennell, *Memoir of a Map*, 150 (note 143).

147. Rennell, *Memoir of a Map*, 156 (note 143).

148. Rennell, *Memoir of a Map*, 202 (note 143).

149. Rennell, *Memoir of a Map*, 206 (note 143).

150. Phillimore, *Historical Records*, 42 (note 32).

to get material for a *Map of the Country of the Seiks* [Sikhs], . . . and a *Plan of Scindia's Country* [now in Madhya Pradesh]."¹⁵¹ Rind's map, said Phillimore, gives a crude but correct and recognizable representation of the five rivers of the Punjab.¹⁵²

Wilford, the first serious British student of Indian systems of geography and cosmography, wrote in 1805 as follows:

Besides geographical tracts, the *Hindus* have also maps of the world, both according to the system of the *Paurân'ics*, and of the astronomers: the latter are very common. They have also maps of *India*, and of particular districts, in which latitudes and longitudes are entirely out of question, and they never make use of a scale of equal parts. The sea shores, rivers, and ranges of mountains, are represented in general by straight lines. The best map of this sort I ever saw, was one of the kingdom of *Napâl*, presented to Mr. HASTINGS. It was about four feet long, and two and a half broad, of paste board, and the mountains raised about an inch above the surface, with trees painted all round. The roads were represented by a red line, and the rivers with a blue one. The various ranges were very distinct, with the narrow passes through them: in short, it wanted but a *scale*. The valley of *Napâl* was accurately delineated: but toward the borders of the map, every thing was crowded [*sic*], and in confusion.

These works, whether historical or geographical, are most extravagant compositions, in which little regard indeed is paid to truth. . . . Geographical truth is sacrificed to a symmetrical arrangement of countries, mountains, lakes, and rivers, with which they are highly delighted.¹⁵³

Another "old Hindu map of this type" was allegedly picked up by Reuben Burrow when he was traveling through Rohilkhand, an area bordering on Nepal, in 1789.¹⁵⁴

Most indigenous maps presumably served either religious purposes or the needs of the state, but some may have been drafted with other ends in view. We cannot state with certainty that any maps were drawn explicitly for sale, but there is evidence that some maps did find their way into native markets. In the journal of Thomas Twining, a servant of the East India Company, an entry relating to a day of shopping in the bazaars of Delhi in 1794 reads: "I purchased also an accurate map of Dehli, neatly delineated with red and black lines on fine paper of a yellow hue. I already possessed a similar one of Agra, and another of the Taje [the Taj Mahal]."¹⁵⁵

Legend notes to British and other European maps of the eighteenth and early nineteenth centuries sometimes acknowledge native sources for the information portrayed, albeit so obliquely that the nature of the sources and the degree of dependence is unclear. From the fore-

going it is probable that indigenous maps or sketch maps made by Indians at the specific behest of Europeans were among those sources. Occasionally the legend is more explicit, as on an 1831 map entitled "A sketch of Cachar [in Assam], compiled from a Native Map."¹⁵⁶

That there were in India numerous individuals who could have provided detailed mappable information, even for very large areas, cannot be doubted. The point may be illustrated by reference to a document, probably dating from the late eighteenth century, in the manuscript collection of the historian Robert Orme, titled "The Names of the Principal Rivers from the River Gangoe [Ganga] to the Cape Comareen [Kanniyakumari/Cape Comorin]." This document, stated Orme, gives river

151. Cited in Phillimore, *Historical Records*, 42 (note 32).

152. Phillimore, *Historical Records*, 233 (note 32).

153. Wilford, "Sacred Isles," 271–72 (note 7).

154. Reginald Henry Phillimore, "Early East Indian Maps," *Imago Mundi* 7 (1950): 73–74, esp. 74.

155. Thomas Twining, *Travels in India a Hundred Years Ago with a Visit to the United States: Being Notes and Reminiscences by Thomas Twining, a Civil Servant of the Honourable East India Company Preserved by His Son, Thomas Twining of Twickenham*, ed. William H. G. Twining (London: James R. Osgood, McIlvaine, 1893), 256. The casual tone of Twining's account suggests that the acquisition of indigenous maps was not regarded as a matter of great moment. That architectural plans were used in India well before Twining's day is evident from various references to the period of Shāh Jahān (one is cited in note 143). The biography of the imperial architect Mukramat Khān notes that "one day Shāh Jahān stated after looking at maps of Baghdād and Isfahān where the *bāzārs* were octagonal and covered, and which had appealed to his fancy, that those in the new city had not been . . . finished as he would have liked." Shāhnavāz Khān Awrangābādī, *The Maāthir-ul-Umarā: Being Biographies of the Muḥammadan and Hindu Officers of the Timurid Sovereigns of India from 1500 to about 1780 A.D.*, reprint ed., 2 vols. (Patna: Janaki Prakashan, 1979), vol. 2, pt. 1, 270–71. Additionally, in an inventory of the booty carried away by Nādir Shāh of Persia after his sack of Delhi in 1739, there is listed a "Draught of the Castle and City of *Shahjehanabad*"; James Fraser, *The History of Nadir Shah, Formerly Called Thamas Kuli Khan, the Present Emperor of Persia* (Delhi: Mohan Publications, 1973; reprint of 2d ed., London 1742), 221. This plan, according to Blake, so impressed Nādir Shāh that he used it as a model for a much smaller city that he had built in the Persian province of Khurāsān in 1741; *Shahjahanabad*, 71–72 (note 143). Blake's source is Khwaja Abdal-Karim, "Bayan-i Waqa'i," Persian Manuscript Collection, British Museum, fols. 43a–b. I am indebted to Professor Blake for all the sources cited in this note (various personal communications).

156. London, India Office Library and Records, Map Catalog, A.C. 114. Over the centuries, the Assamese appear to have displayed a greater propensity for keeping accurate state chronicles than did most other peoples of India. These chronicles, known as *buranjis*, date back as far as A.D. 568, and the record, in either the Ahom language or Assamese or both, is relatively complete and credible from A.D. 1228 until A.D. 1810. Particularly noteworthy is "an account of the political geography of Assam in the seventeenth century," though we have no evidence of its having been accompanied by a map. These *buranjis* were collected by Sir Edward Albert Gait when he was on government service in Assam and formed the basis for his book *A History of Assam*, 3d rev. ed. (Calcutta: Thacker Spink, 1963).

“names, sources, course, mouths. I believe by a black fellow.” A sample entry reads as follows: “Tungabhadra [Tungabhadra] springs from the above mountains [Sahyadri/Western Ghats] and country [Satara, Moratta (Maratha) country] and runs from Badamore [Bednur (= Nagar)], Cammara [Kanara] Country and from Thence to Vizianagarapatnam [Vijayanagar] Country where the Tintoo [presumably a mistranscription of Gentoo (= Hindu)] king Resides and from thence to Cundanoor [presumably Kurnool] Country and Joines Kistnah [Krishna].”¹⁵⁷ The detail indicates an uncommonly good mental map.

Finally, despite its late date, let me call attention to a “map held by the Survey of India . . . prepared for the Amir [of Afghanistan] during the war of 1879–82, showing the north frontiers of Kabul territory, with the Hindu Kush, Turkistan, and the Oxus River, all in bold coloured lines and Persian lettering, somewhat in schoolboy style, but showing the most valuable information as regards positions of towns and villages and place-names.”¹⁵⁸ In Phillimore’s view this map—whose present location is not known—“shows no evidence of European influence”; but he does not rule out its having been drawn by a British-trained native.¹⁵⁹

The preceding paragraphs, for all their lacunae, make several important points clear. Indigenous maps were obtained by the British and other Europeans from all parts of South Asia: from Nepal in the north to Malabar in the south, from Assam in the northeast to Afghanistan in the northwest, and from many localities in between. The languages these maps were made in included not only Persian—which, as the official language of the Mughal Empire, was most common—but also Sanskrit (for Puranic world maps) and various regional vernaculars (Marathi, Malayalam, etc.). The authors were largely, but by no means exclusively, Brahmans and were generally anonymous. The areas of coverage ranged from individual forts or towns to tracts extending over hundreds of thousands of square miles. The quality and content of the maps must have varied substantially. None, however, had a scale. The direction of map orientation is not noted in the descriptions.

Whatever the British may have thought about Indian maps when first encountering them, their opinions became generally disparaging as their own maps improved in accuracy. Phillimore’s surmise that many Indian maps may “have been deliberately destroyed as valueless, or as having exhausted their value, for geographical purposes” is almost certainly true.¹⁶⁰

REASONS FOR THE RELATIVE PAUCITY OF SOUTH ASIAN MAPS

Although the foregoing account makes it clear that the number and variety of premodern South Asian maps was

substantial, and certainly far greater than conventional wisdom would lead one to believe, I am not suggesting that maps played a role in traditional India comparable to their importance in Europe at corresponding periods, or that they were comparably abundant. Nevertheless, the surviving corpus fails to reflect what once presumably existed. Various reasons may be adduced for the relative paucity of South Asian maps. Perhaps the principal factors accounting for the dearth of premodern South Asian maps are environmental. In the hot, humid monsoon environment that characterizes the greatest part of the region, paper, cloth, palm leaf, and other organic materials on which records might be kept are likely to rot and crumble in only a few decades, if not years, unless pains are taken to preserve them. Even with special care, preservation cannot long be guaranteed; what dampness and mildew fail to destroy may fall victim to white ants and other vermin. More durable materials, such as metal and stone, are also, though in lesser degree, subject to the ravages of time. Many, possibly most, of the traditional Indian maps that I have personally inspected are in various stages of decay. While we cannot attest to specific maps that the elements are known to have completely destroyed, the lack of any extant copy of works once known to have existed suggests an environmental cause for their disappearance.

The fate of noncartographic manuscripts is instructive. Most of the many millions that have survived are written on paper, which was first introduced into India by the Muslims. The oldest of these go back at least to the twelfth century.¹⁶¹ Before the advent of paper, most manuscripts were set down on less durable palm leaves and strips of bark. Because of their cheapness and abundance, the writers and copiers of religious texts, including cosmographies, continued to use those materials extensively well into the nineteenth century. Not counting inscriptions, only a few manuscripts from India proper date as far back as the eleventh and twelfth centuries, whereas others of Indian provenance found in the cooler and drier climates of Nepal, Xinjiang, and Japan are con-

157. Orme manuscripts in London, India Office Library and Records, vol. 65, item 12.

158. Phillimore, “Early East Indian Maps,” 73 (note 154).

159. Phillimore, “Early East Indian Maps,” 73 (note 154).

160. Phillimore, “Early East Indian Maps,” 74 (note 154); see also Markham, “Lost Geographical Documents” (note 47).

161. In Winternitz, *Indian Literature*, 34 (note 62), it is stated that the oldest Indian paper manuscripts date from 1223–24, but it seems likely that this observation is carried over, without correction, from the original 1908 edition. David Pingree notes that numerous manuscripts were copied before that date and cites one from the year 1179–80 (personal communication, 21 December 1988). The S. R. C. [Sri Ram Charan] Museum of Indology in Jaipur claims (in a brochure dated 1986) to possess the oldest Indian manuscript on paper, dating from 1143; the validity of this claim has not been established, however.

siderably older.¹⁶² The finds from Xinjiang include some five hundred small wooden tablets covered with writing, unearthed by Marc Aurel Stein in 1900, which date from at least the fourth century. Other ancient writing was on cotton, leather, stone, and various metals. Copper tablets were especially important and numerous, and writings on gold plate are also known. Among readable texts, the oldest that one can date are of Mauryan origin. These include the renowned edicts of the emperor Aśoka carved in metal and stone in the third century B.C. and at least one pre-Aśokan inscription.¹⁶³ These, however, are antedated by two millennia or more by the thousands of as-yet-undeciphered inscribed clay seals of the Indus civilization. How much—if any—information on the nature of early Indian maps is still locked in these seals or, for the period of recorded history, lost to the elements one can only surmise.¹⁶⁴

Intentional destruction of maps or of relevant texts also appears to have been a factor contributing to their present scarcity. The iconoclasm of the early Muslim conquerors, especially in northern India, was not limited to the destruction of Hindu idols, but led also to the razing of innumerable temples, monasteries, and libraries. The destruction of the monastic Buddhist university at Nalanda, at which—if the Chinese traveler Xuan Zang (603–64) is to be believed—no fewer than ten thousand students were simultaneously trained, was an especially great loss.¹⁶⁵ Though temples, unlike monasteries, did not as a rule contain many books, they were almost ubiquitously painted. It is probable that cosmographic conceptions were among the religious ideas commonly portrayed on the walls, just as they are today on the walls of many Jain religious establishments and Buddhist monasteries in Tibet and adjoining regions of India and Nepal. Destruction of manuscripts through war need not, of course, have involved a clash of differing faiths. Most wars in India were fought between contending Hindu states, and struggles between rival Islamic sultanates were also common. But whatever their origins, wars, their attendant looting, and the unsettled nature of affairs in their aftermath must have exacted a toll on the corpus of literary and cartographic records. However, insofar as most manuscripts were privately owned and even now an estimated thirty million survive, one should not carry this argument too far.¹⁶⁶

Breakdowns of central authority as a result of internal insurrection, external military pressure, and cessions of territory following military defeat must have provided frequent incentive and opportunity for landed interests to destroy or falsify records. These may have included cadastral maps, which might have either established the extent of fiscal indebtedness or weakened claims to proprietary rights in land. John Beames, writing in 1885 of his attempts to reconstruct the detailed political geo-

graphy of the Mughal Empire in the reign of Akbar, not only complains of the inadequate maintenance of the tax records, but also states that “there has been . . . an effort to obliterate all traces of them.” He further notes the “intentional falsification of the fiscal records by the later Muhammadan Subahdars [provincial governors].”¹⁶⁷ Such actions probably extended beyond the cases Beames has commented on.

Until recently, rates of literacy in India were remarkably low. Apart from the traditionally learned priestly castes of Brahmans, there were few social groups among whom learning was especially advanced.¹⁶⁸ Before Islamicization, in fact, higher learning was virtually a monopoly of the Brahmans, though even among that group literacy was far from universal. Thus the portion of the total population that might have been called on to prepare maps—at least maps deemed of consequence for other than narrow, short-term utilitarian purposes—was relatively small, and the total corpus of maps produced would have been commensurately limited. Further, Brahmans not only constituted the mass of the literati but occupied a relatively large proportion of state offices, both high and low, and tended also to monopolize the profession of teaching. As gurus (teachers), they were not merely respected but, in the Indian tradition, revered, and their authority was not lightly challenged.¹⁶⁹ Few would have insinuated themselves into a position in which the

162. Winternitz, *Indian Literature*, 33 (note 62).

163. Winternitz, *Indian Literature*, 24 (note 62), and personal communication from David Pingree (21 December 1988).

164. See the preceding pages, esp. 321–23, for published references to maps in or noted by specific texts, the extant recensions of which are without maps, and to genres of map production of which no specific example has survived. Many additional examples, not necessarily trustworthy, are given in the several works by Tripathi cited in note 17.

165. Basham, *Wonder That Was India*, 166 (note 91); see also Xuan Zang, *Da Tang xi yu ji* (Records of the Western countries in the time of the Tang, 646) (Shanghai: Renming Chubanshe, 1977), 216–17.

166. David Pingree (personal communication, 21 December 1988) writes that almost all the surviving manuscripts were copied in the past three hundred years from even earlier manuscripts. It seems likely, then, that a very large fraction, if not an absolute majority, date from after the establishment in India of the Pax Britannica. How many manuscripts disappeared without any surviving copy is an open question.

167. John Beames, “On the Geography of India in the Reign of Akbar, Part II (with a Map), No. II, Subah Bihar,” *Journal of the Asiatic Society of Bengal* 54, pt. 1 (1885): 162–82, esp. 162.

168. One group of particular note was the scribal caste of Kayasthas (Prabhu in the Deccan), many of whom worked in the fiscal and other administrative services of the Mughal Empire and other Muslim-ruled states in which Brahmans were generally more reluctant to serve. A large number of young men from this caste have found employment as cartographic draftsmen in modern India. On Kayastha mobility see David G. Mandelbaum, *Society in India*, 2 vols. (Berkeley and Los Angeles: University of California Press, 1970), 2:433.

169. “A Brahman was a god on earth,” states Daniel Ingalls in “The Brahman Tradition,” *Journal of American Folklore* 71 (1958): 209–15, esp. 212.

wisdom of a Brahman was required.¹⁷⁰ Hence, if a map prepared by a Brahman official or savant did not square well with reality, it is questionable that others, however well informed they may have been, would have had the temerity to advance a contrary view.

What maps, then, might Brahmans and other literati have prepared? In their capacity as servants of the state, it is conceivable that they may have produced maps to serve a variety of practical ends, a number of which have already been discussed. But little of such work survives. Rather, most of what remains relates to a wide variety of religious needs—ritual, didactic, and soteriological—that characterize not only Hinduism but Buddhism and Jainism as well. Horoscopic charts were common and, insofar as they fix the position of the major heavenly bodies at the moment of one's birth, may also be thought of as maps. The dominant and ultimate concern of all three faiths has little to do with a single lifetime on earth. The span of a single terrestrial existence is, after all, an infinitesimal moment in the vast and endless cycle of time. The earthly home is, similarly, but a tiny speck in the stupendous expanse of only one among many universes. The principal purpose of a properly lived life is to enable rebirth into a higher state. Only thus might an individual move somewhat closer to release from the painful and potentially never-ending cycle of birth and rebirth—that is, to the attainment of moksa (in Hinduism) or nirvana (in Buddhism and Jainism).

In short, then, to those of a religious bent—which for many centuries probably included most learned persons—so mundane a task as preparing a seemingly accurate map of the finite terrestrial earth or a small segment of it could not have appeared particularly important. By contrast, making manifest the structure of the cosmos, through which the soul makes its long cosmic journey, must have been regarded as an act of considerable importance. To the devout, the diverse cosmographies put forward provided, as it were, a choice of road maps for the soul.¹⁷¹ In comparison with the transcendent importance of this need, the necessity for route maps of a more mundane nature was probably not very keenly felt. And who among the laity would in any case have had the courage to posit conceptions of the universe or even of a small part of it at variance with those of the Brahmans?

The apparent lack of deep concern for maps in pre-Islamic India finds an interesting echo in a similar inattention to the writing of narrative history. What one can reconstruct of Indian history before the thirteenth century, therefore, is based largely on the accounts of foreign travelers and the evidence of epigraphy, numismatics, architecture, and archaeology. Much of the extant record with regard to political history, including many important inscriptions, is panegyric in nature and must be interpreted with appropriate caution. The concern was with

making events conform to a divinely sanctioned ideal of kingship, rather than with strict historicity.¹⁷² Whether coincidental or not, it is noteworthy that the few surviving early South Asian approaches to an extended narrative chronicle all come to us from the periphery of India. These include the Buddhist *Mahāvamsa* (fifth to sixth century) from Sri Lanka, the *Rājatarāṅgini* (twelfth century) from Kashmir, and the *buranjis* (histories; thirteenth to nineteenth century) of the immigrant Ahom dynasty of Assam.¹⁷³

In the Indian tradition of higher Brahmanical learning, which has persisted for millennia, rote memorization plays an important role. Memory training may begin by age eight or even earlier. The oral tradition, in which one learns directly from the mouth of one's guru, places great emphasis on mastery of the spoken—not the written—word, including for certain texts the proper rhythmic incantation and accent of each memorized *śloka* (verse).¹⁷⁴ It has little need for visual imagery. Conceivably, the relative unimportance of graphic aide-mémoires, such as characterize primary education in so many cultures, even those of preliterate societies, is tied in with the relative scarcity of premodern Indian maps.¹⁷⁵

170. An eleventh-century treatise on architecture, the *Samarāṅgaṇa-sūtradhāra*, states, "He, who begins to work as an architect . . . without knowing the science of architecture [the oversight of which was entrusted to Brahmans] . . . and proud with false knowledge must be put to death by the king." The Brahman architect or *sthapati* was expected to act as a guru to the actual workers, *śilpin*. The passage cited and relevant discussion are from Kramrisch, *Hindu Temple*, 1:8 (note 115).

171. Some of the many works dealing with cosmography have already been mentioned; see especially Kirfel, *Die Kosmographie der Inder* (note 14), Caillat and Kumar, *Jain Cosmology* (note 15), and Sircar, *Cosmography and Geography* (note 18).

172. This problem is succinctly discussed by Basham, *Wonder That Was India*, 45–46 (note 91), and Schwartzberg, *Historical Atlas*, xxix (note 50).

173. On the *buranjis*, see Gait, *History of Assam*, x-xiv (note 156).

174. Winternitz, *Indian Literature*, 32 (note 62), and Ingalls, "Brahman Tradition," 209–10 (note 169) discuss the learning process and the prodigious feats of memorization of which young Brahman boys are capable.

175. Many practical manuals and religious texts omitted plans or cosmographies that would have been extremely helpful to ordinary readers and substituted verbal descriptions. These include the *Āpastambiyāśulvasūtra* and *Baudhāyanaśulvasūtra*, the two most important guides to the layout and construction of sacrificial altars, both composed some centuries before the Christian Era; the *Mānasāra*, a guide to town planning and architecture and most celebrated of the *śilpāśāstras* (treatises for builders), compiled about the sixth century A.D.; numerous works in astronomy, and many of the encyclopedic Puranas, which were composed over many centuries and typically contained sections on both geography and cosmography. Modern translations of these texts and commentaries on them often include clear diagrams drawn from their explicit instructions. Some of these appear elsewhere in this chapter and subsequent chapters. The point to note here is that many of the diagrams produced by modern scholars are

Mastery of the Vedas and other sacred texts was a key to the power of the Brahmins. The recitation of particular texts was essential for the performance of the numerous sacrificial rites and other ceremonies from which many—but by no means a majority—of that caste derived their livelihood. There was a vested interest, therefore, in keeping certain branches of learning secret; for what was written down could be learned independently of a master. That this is not mere speculation is evident from certain passages in works that have been committed to writing. “This mystery of the gods,” says the *Sūryasiddhānta*, a Hindu treatise on astronomy, “is not to be imparted indiscriminately: it is to be made known to the well-learned pupil, who remains a year under instruction.”¹⁷⁶

Along with the learned *śāstrins*, the class of Brahmins included another sizable group, the *paṇḍitas/panḍās*. The two groups were not mutually exclusive, but the livelihood of the latter was derived especially from the management of pilgrimages and the care of pilgrims at the innumerable *tirthas* (pilgrimage places) that dot the Indian landscape. In plying their profession they relied on Sanskrit texts, called *mahātmyas*, that extolled the sanctity of specific *tirthas*, described the merit to be derived from visiting them, and in some cases provided directions for going from *tirtha* to *tirtha* along well-established circuits. *Mahātmyas* have existed at least since the time of the *Mahābhārata* and were read to pilgrims and explained by the *paṇḍitas* at each *tirtha*. It was obviously in the economic interest of the *paṇḍitas* to have no guide to the *tirthas* other than themselves and the *mahātmyas*.¹⁷⁷ Were maps available, they might have been consulted even by unlearned and impecunious pilgrims. But whatever the cause, maps do not appear to have been associated with Hindu pilgrimage until a relatively recent date.¹⁷⁸

If, then, pilgrimages did not provide a major early impetus for mapmaking in India, what might one say of long-distance commercial travel by both land and sea? Here again we can do no more than speculate. Much trade, over long periods of Indian history, especially in the Deccan, was in the hands of rival merchant guilds. Such guilds, like those of medieval Europe, had their trade secrets. Maps, if they were available, and the knowledge they portrayed may have been among those secrets.¹⁷⁹

In seeking to explain why India did not develop mapping more vigorously than it did, we finally revert to the propensity of a cosmically attuned society to attach relatively little importance to the mundane concerns to which most terrestrial maps relate. This tendency, presumably, would have gained considerable strength among learned Hindus after the brief but remarkably successful pan-Indian career of the philosopher Śaṅkara (?788–820), founder of the advaita (monistic) Vedānta school of

Indian philosophy. To this day this has remained the most important of the orthodox *Ṣaḍdarśana* (Six doctrines of salvation). According to Vedānta, “on the highest level of truth the whole phenomenal universe, including the gods themselves, was unreal—the world was *Māyā*, an illusion, a dream, a mirage, a figment of the imagination. Ultimately the only reality was *Brahman*, the impersonal World Soul . . . with which the individual soul was identical.”¹⁸⁰ Similar conceptions infuse Buddhism and Jainism. If, then, to most South Asians over much of the course of history the world of the senses was only an illusion, why take pains to map it?¹⁸¹

fairly complex—so much so, in fact, that one cannot but wonder why the written word was preferred to graphic devices for the exposition of the concepts of the ancient works. But, writes David Pingree, “the Sanskrit manuscripts on geometry almost universally are illustrated with diagrams; . . . [while] diagrams are far less frequent in astronomical manuscripts—a difference I can not now explain” (personal communication, 21 December 1988).

176. Ebenezer Burgess, *Translation of the Sūrya-Siddhānta: A Textbook of Hindu Astronomy, with Notes and an Appendix*, reprint of 1860 edition as edited by Phanindralal Gangooly in 1935, with an introduction by Prabodhchandra Sengupta (Varanasi: Indological Book House, 1977), 186. The passage cited relates to the construction of armillary spheres.

177. The importance of pilgrimage in Indian history and the nature of pilgrim circuits at various times are outlined in Bhardwaj, *Places of Pilgrimage* (note 70). The way *paṇḍitas* organize pilgrim traffic is explained by Anita L. Caplan in “Prayag’s Magh Mela Pilgrimage: Sacred Geography and Pilgrimage Priests,” in *The Geography of Pilgrimage*, ed. E. Alan Morinis and David E. Sopher (Syracuse, N.Y.: Syracuse University Press, forthcoming). The extent of *mahātmyas* and the way they were used were described by Mark Aurel Stein, who, about a century ago, in searching for aids for his analysis of the twelfth-century *Rājatarāṅgini*, collected fifty-one such texts in Kashmir alone. The relevant text appears in his *Memoir on Maps Illustrating the Ancient Geography of Kaśmīr* (Calcutta: Baptist Mission Press, 1899), reprinted from the *Journal of the Asiatic Society of Bengal* 68, pt. 1, extra no. 2 (1899): 46–52. See also discussion of Kashmiri *tirtha* maps below, p. 457.

178. This is in contrast to the Jain tradition, in which picture maps for the use of pilgrims appear to have a rather longer history (see below, pp. 441–42 and 457–60).

179. For a discussion of trading guilds and overland caravan trade within ancient India, see Basham, *Wonder That Was India*, 225–28 (note 91). Caravan leaders (*sārvabhāva*s) and land pilots (*thalaniyyāmakas*) were important figures in the commercial communities.

180. Basham, *Wonder That Was India*, 330 (note 91). See also William Norman Brown, *Man in the Universe: Some Continuities in Indian Thought*, Rabindranath Tagore Memorial Lectures, 4th ser., 1965 (Berkeley and Los Angeles: University of California Press, 1966), esp. lecture 1, “The Search for the Real,” 16–42.

181. Readers should not take the foregoing speculative paragraph on faith. David Pingree, on reading it, expressed (personal communication, 21 December 1988) a sharply dissenting view: “The . . . paragraph on Maya I find totally irrelevant. The world of perception may be an illusion, but most Indians did and still do live by those perceptions. Even Śaṅkara did. It is only *after death* that one who has attained mokṣa ceases to perceive; before death there’s no reason in the world why he shouldn’t consult a map. I might point out that embedded in every local *pañcāṅga* [local almanac]—and they were made (and are

made) in the hundreds throughout India—are the local latitude and longitude. . . . This geographical knowledge was present everywhere in the subcontinent from c. 500 A.D. on.” The geographic knowledge of ancient Indians is of course not in question; evidence of it has been put forward abundantly in this chapter. Rather, the issue is the extent to which Indians were disposed to put such knowledge into cartographic form. Willingness to *use* an existing map is one thing; being inclined to *construct* a map, knowing (i.e., believing) that its content is ultimately illusory is quite another. Unfortunately, the point at issue is not susceptible to proof, and differing interpretations may legitimately be held. For additional discussion of the concept of *māyā*, see the views of Lannoy in the section “Microcosmic Analogues of the Cosmos” in the following chapter.