

# 1 • Introduction to Islamic Maps

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The cartographic heritage of premodern Islamic civilization is extremely varied. Different traditions of theoretical and empirical cartography coexisted for over a millennium, from about A.D. 700 to 1850, with varying degrees of interaction in a cultural sphere that extended from the Atlantic shores of Africa to the Pacific, from the steppes of Siberia to the islands of South Asia. The heterogeneity of premodern Islamic mapping was not due solely to the unusual geographical extent and temporal span of this cultural sphere. Rather, it was primarily a natural outcome of the fact that Islamic civilization developed on the multifaceted and discontinuous cultural foundations of the Middle East. The very core of this foundation, the Semitic-Iranian tradition, was itself marked by radical ruptures that separated the age of cuneiform from that of Aramaic and Middle Persian. Muslims further complicated the picture, not only by deliberately rejecting their own classical Semitic-Iranian heritage but, more dramatically, by appropriating and naturalizing in an enormously creative act the “foreign” classical tradition of Greek science and philosophy. The following chapters attempt to trace the major outlines of the conceptual as well as the practical mapping traditions of the multirooted cultural complex that resulted from this merger of cultures.<sup>1</sup>

This group of essays is organized into five major sections. The first three deal, in order, with celestial mapping, cosmography, and geographical mapping. A separate section is devoted to a survey of cartography in the premodern Ottoman Empire. The final section deals with the role of nautical charts in Islamic navigation in the Indian Ocean and with maritime cartography in the Mediterranean. This particular arrangement is not dictated solely by the relative significance of each type of cartography. The chapter on celestial mapping comes at the beginning largely because of the importance of these maps in Islamic culture. Cosmographical mapping follows, since it was closely associated with celestial cartography. A series of essays on early geographical cartography then forms a large subsection. The separate treatment accorded to Ottoman cartography is justified equally by the particular cultural conjuncture of the Ottoman Empire between Christian Europe and the Islamic Middle East and by the comparative wealth of its carto-

graphic heritage. Two essays on maritime mapping complete the Islamic section.

The distinctive characteristics of Islamic cartography are owed in part to the interaction of Islamic culture with the European societies that lay to the west. In this sense the section as a whole builds on specific cartographic traditions that were studied in volume 1 of the *History*. On one hand, a major concern that runs through the sections on celestial mapping, cosmography, and geographical cartography is the delineation and analysis of the Greek heritage in Islamic cartography, and as such these chapters should be read in conjunction with chapters 8 through 11 of volume 1. On the other hand, the section on cartography in the premodern Ottoman Empire assumes familiarity with cartography in medieval Europe and the Mediterranean, which is the subject of part 3 of volume 1.

Firmly grounded in volume 1 of the *History*, the Islamic section also requires a careful reading of volume 2 as a whole. The question of Chinese influences on Islamic cartography, however minor, is brought into perspective by matters dealt with in the East Asian section. More substantially, Islamic materials deriving from the Indian cultural sphere are studied in the South Asian section. Finally, much of volume 3 of the *History* will also need to be consulted for proper appreciation of the chapters on Ottoman cartography, since Ottoman mapping practices bear clear traces of contemporary developments in European cartography. Owing to these multifaceted cultural connections, therefore, the Islamic section acts as a pivot between volume 1, the remainder of volume 2, and volume 3 of the *History*.

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1. The standard general survey of Islamic history is Marshall G. S. Hodgson, *The Venture of Islam: Conscience and History in a World Civilization*, 3 vols. (Chicago: University of Chicago Press, 1974). The recent survey by Ira M. Lapidus, *A History of Islamic Societies* (Cambridge: Cambridge University Press, 1988), concentrates on institutional history. *The Cambridge History of Islam*, 2 vols., ed. P. M. Holt, Ann K. S. Lambton, and Bernard Lewis (Cambridge: Cambridge University Press, 1970), and Bernard Lewis, ed., *The World of Islam: Faith, People, Culture* (London: Thames and Hudson, 1976), are useful collections.

## GREEK HERITAGE

Roughly a century and a half after the establishment of Islamic rule over the central lands of the Middle East in the mid-seventh century, there began a massive translation movement. By the time the translation activities dwindled away at the beginning of the tenth century, much of the surviving corpus of Greek philosophical sciences was available in Arabic. Most of the translations were carried out in Baghdad, the newly founded capital of the Abbasid Empire, under the patronage of the ruling caliphs, in particular al-Manṣūr (r. 136–58/754–74), Hārūn al-Rashīd (r. 170–93/786–809), and al-Ma'mūn (r. 198–218/813–33). The active adaptation and appropriation of Greek science and philosophy exercised a decisive formative influence on the nascent Islamic civilization. It also had far-reaching consequences for the history of the classical legacy and its revitalization in medieval and Renaissance Europe.<sup>2</sup>

Historians of cartography are concerned equally with many facets of this major event in world history. They are eager to trace both continuities and discontinuities between Islamic and European traditions of cartography. In many ways it is tempting to see the towering figure of Ptolemy as the protagonist of this narrative. His works in Arabic translation (appendix 1.1) formed the backbone of Islamic astronomy and astrology, areas of learning in which the mathematical bases of cartographic thought were developed and cultivated. It is therefore only natural to pay much attention, as the following chapters do, to the delineation of Ptolemy's legacy within Islamic cartography.

In searching for continuity and discontinuity, however, it is crucial to shape our judgments around historically viable questions. More specifically, the temptation to adopt a teleological view of historical processes of transmission is better avoided. That Greek cartographic traditions, as a part of the Greek philosophical curriculum, should have been absorbed into Islamic civilization was not a historical necessity. It is the translation movement itself that requires explanation, rather than those apparent "defects" in the resulting maps that may emerge when it is viewed with a mechanistic understanding of cultural processes of transmitting scientific learning. Thus, when research indicates that not all of Ptolemy's writings on cartography were put into practice by Muslims, it will not do to attribute this to a mysterious failure of comprehension by Muslims simply because these same writings led to quite different results a few centuries later in Europe in substantially different circumstances. Continuity in premodern science across very real cultural barriers is as much in need of historical explanation as is discontinuity, if not more; it should not be taken for granted.

The attempt to study the history of Greek cartographic learning from ancient times through Islam to the Renaissance, however valuable in its own terms, tends to promote an externalist view of Islamic cartography. The historian of this latter subject is essentially concerned with delineating the various cartographic traditions within Islamic civilization and analyzing their place and role within this broad cultural sphere. From this perspective, the question of Greek heritage assumes a different dimension. Unlike the student of Greek cartographic traditions across cultural boundaries, the historian of Islamic cartography must assess the place of Greek learning within Islamic mapping practices *as a whole*, with an eye toward the interplay among the different formative influences. The scope of the inquiries needs expanding. It needs not only to identify all possible cartographic precedents that were available to Muslim cartographers throughout the duration of premodern Islamic civilization, but also to establish how different cartographic practices within this cultural sphere interacted with each other to create distinctly Islamic mapping styles.<sup>3</sup>

The question of the influence of pre-Islamic Arabian, Persian, and Indian—as well as, much later, Chinese and European—cartographic and geographic lore on Islamic cartography is complex. Different aspects of this intricate array of issues are studied with varying emphases in the essays that follow. The relevant historical record is severely discontinuous here, and many questions cannot be clearly conceived, let alone satisfactorily answered. Nonetheless, an awareness of formative influences other than those of Greek cartography serves at the very least to place the classical heritage in Islamic cartography into a broader perspective.

## MAP AND TEXT

Independent map artifacts, excluding astronomical instruments, are the exceptions in the cartographic record of premodern Islamic civilization. Almost all the extant Islamic maps are integral parts of larger manuscript contexts. This prominence of the textual environment generates problems of interpretation for the student of Islamic cartographic representation.

On a technical level, the submergence of maps in texts means that their study is subject to all the difficulties associated with studying the latter. A substantial portion

2. An exhaustive review of the scholarship on the classical heritage of Islamic civilization is Felix Klein-Franke's *Die klassische Antike in der Tradition des Islam* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1980).

3. For a general and incisive statement of the problems associated with the study of the Greek scientific tradition within premodern Islamic civilization, see A. I. Sabra, "The Appropriation and Subsequent Naturalization of Greek Science in Medieval Islam: A Preliminary Statement," *History of Science* 25 (1987): 223–43.

of the textual legacy of premodern Islamic civilization is still preserved only in manuscript form in a great many public and private collections scattered throughout the world. Many of these collections are only partially and inadequately cataloged. The number of individual works that are transcribed or, much less often, critically edited and published, is disappointingly low. The researcher who compares these manuscript codices faces serious problems such as difficulty of access as well as intractable questions of authorship and copying. The student of maps faces additional problems. Often it is difficult to surmise where to search for maps, since they are found in many kinds of texts. Once located, maps present their own problems of dating, provenance, and draftsmanship, though never divorced from similar difficulties associated with the texts in which they are found.

The key question when exploring the map/text relationship, however, concerns the independence of the map artifact. In a cultural-historical account of maps in premodern Islamic civilization, it is crucial to determine how far the idea of the map was accepted as a basic form of human communication with identifiable social functions. Although the multiplicity of the Islamic maps studied in the following chapters clears all doubts about the communicative valence these maps carried within the Islamic sphere, the question whether culturally distinct cartographic traditions existed in premodern Islamic societies is more complex and elicits different responses from the contributors.

For those map artifacts that are found in texts, it seems safe to assume that they served a didactic or illustrative function subservient to the main textual narrative. Even in this context, however, graphic representation holds its own and cannot be explained away through textual comprehension. On a more general level, the Islamic cartographic heritage also harbors more independent strains, such as astronomical instruments (especially globes and astrolabes), maritime atlases, and freestanding world maps, demonstrating the existence of autonomous cartographic traditions within this cultural sphere. It is therefore helpful to view the relationship between text and image as a spectrum that extends from subservience of the image to the text at one end to its independence from textual control at the other.

The relationship of map and text is also intimately related to the question of map audience. The dominance of the textual environment suggests that most Islamic maps were directed toward the literate, cosmopolitan elites of premodern Islamic societies, who alone produced and used books. By and large maps were not available, nor were they meant, for the use of the illiterate majority. The existence of text-free map artifacts does not lead us to modify this conclusion, since these maps too were produced by elite groups such as astronomers

and astrologers, sea captains, and political rulers for their own use. Nonetheless, we very rarely find hard historical evidence for the reception of maps in Islamic societies, and such relevant information is documented wherever possible in the following chapters.

The issue of the relative “cultural weight” of map artifacts in and outside textual settings is intrinsically related to that of the place images held within premodern Islamic cultures as a whole. Some scholarly attention has been paid to this latter subject, especially in the study of Islamic art history, where debate focuses on the permissibility of artistic representation of living beings under Islam.<sup>4</sup> There is indeed little doubt that early generations of Muslims developed an attitude toward the arts that excluded animate beings from the ambit of allowable images and that exercised the central formative influence on practically all the later Islamic artistic traditions. In itself, representational art is generally not relevant to maps in the Islamic context, but its status in the Islamic sphere should be kept in mind in undertaking a comparative perspective, since the general absence of decorative emblems in Islamic maps may appear anomalous when such maps are juxtaposed to European maps of the Middle Ages, the Renaissance, and later.

On a different level, one could ask whether “the rejection of a certain kind of imagery . . . carried with it considerable uncertainty about the value of visual symbols altogether.”<sup>5</sup> This is an extremely complicated issue that is not directly addressed in the present volume. The historian of Islamic cartography is not on firm ground here, and at this preliminary stage of scholarly inquiry it is essential to resist preconceptions about premodern Muslims’ universal iconophobia or profound ambivalence toward the use of graphic languages. However, it is clear that this broader issue of Islamic attitudes toward visual images should be considered in studying the history of Islamic cartography.

## CONDITIONS OF MAP PRODUCTION

Throughout the length and breadth of the Islamic world, we are concerned with a manuscript culture.<sup>6</sup> Printing was not highly regarded, in spite of the arrival of block-printing techniques derived from China and even a short-lived attempt to print paper money at Tabriz in 693/1294.<sup>7</sup> Such techniques were not adopted for traditional

4. Oleg Grabar, *The Formation of Islamic Art*, rev. and enl. ed. (New Haven: Yale University Press, 1987), 72–98, with bibliography on p. 221. Also Rudi Paret, *Schriften zum Islam: Volksroman, Frauenfrage, Bilderverbot*, ed. Josef van Ess (Stuttgart: Kohlhammer, 1981).

5. Grabar, *Formation of Islamic Art*, 95 (note 4). For a thought-provoking essay on this topic, see Marshall G. S. Hodgson, “Islām and Image,” *History of Religions* 3 (1964): 220–60.

6. I thank David Woodward for his help in writing this section.

7. Thomas Francis Carter, *The Invention of Printing in China and*

Islamic cartography until the eighteenth century. The printing press, which so revolutionized the production and dissemination of knowledge in Europe, had a delayed and muted impact within Islamic culture.

There are accounts of large maps made especially for the delight and gratification of various Muslim rulers.<sup>8</sup> They were constructed of various materials and displayed at court to enhance the glory of the reign. The survival rate of such maps would have been low, but it is curious that not a single fragment has survived. Instead, much of the corpus of Islamic maps, especially for the pre-Ottoman period, comes down to us as illustrations to geographical works and historical annals. The maps we examine today—despite some evidence for independent artisans working outside court circles—were incorporated into imperially commissioned texts or intended for other individuals holding high office. As a result, map production in traditional Islamic cultures, as we are able to reconstruct it from the available evidence, is closely linked to the highly formalized art of illustrated manuscript texts. Even so, the physical aspects of Islamic maps have not been examined systematically or in depth as have the other products of illumination and painting.

Masters of the Islamic book arts included calligraphers, painters, illuminators, gilders, marginators, binders, and preparers of ink and paint, all of whom played an integral role in the stages of manuscript production. Maps, too, often resulted from such a division of labor among artisans, who were typically paid servants of the state working in ateliers within the palace precincts. Just like any other textual illustration, maps were drawn in spaces left in the text by the scribe. Paint was then applied, place-names were written in, and occasionally gilding and a decorative border were added. It is probable that maps constituted only a small part of the artisans' work. The relation between mapmaking and the art of the miniature is paralleled by the case of the instrument makers working in brass and other metals, whose astrolabes, one of the high art forms of Islamic culture, dissolved the barrier between artisan and scholar in a blend of mathematical ingenuity and stylistic harmony.

Cartographic style obviously reflects the aesthetic values of Islamic society. Calligraphy, considered directly linked to the Word of God, was its most highly valued art. The geometric structure and laws of proportion that determined the repertoire of Arabic scripts also guided graphic representation. In fact, the art of illuminating title pages, verse divisions, borders, and colophons had its origin in the ornamentation of script, and the work of Islamic miniature painters has sometimes been described as a "calligraphic art" because it suggests the smooth, rhythmic lines of Arabic characters.<sup>9</sup> It would be a mistake to judge the calligraphic qualities of Islamic maps by the principles of modern cartographic design. The

maps of the Balkhi school, for example, could be criticized for oversimplified and stylized linework and detail and for their failure to indicate precise geographical positions. As with the medieval *mappaemundi* in the West, however, these maps must be judged in their aesthetic context and in relation to their historical purpose. The geometric simplicity of the Balkhi school style is strikingly original and no doubt fulfilled its intended mnemonic function.

Formal calligraphy annotating the maps (often in several languages) afforded greater opportunities for blending with the flowing style of the pen- or brushwork of the map detail itself, a harmony often continued in arabesque borders. Words in Arabic calligraphy could be stretched or contracted at will to fill the areas they referred to. Such a harmony between line and letter was not possible with the roman alphabet. These issues, and examination of other unusual stylistic aspects of Islamic maps, must await the attention of scholars who combine an interest in cartography with the necessary technical and linguistic skills.

Both paper and parchment were used for drawing maps. Papermaking was probably introduced to western Asia from China in the mid-eighth century A.D. From that time onward, at centers of the industry like Samarkand, Baghdad, and Damascus, Arabs monopolized papermaking in the West for several centuries.<sup>10</sup> The fine-quality paper used for illuminated manuscripts was highly prized and its distribution tightly controlled, though Italian sources later provided a cheaper and more accessible supply. The size of the maps was dictated by the size of the written page in the manuscript. A double-page spread on the normal-sized quarto manuscript would permit a map of approximately 80 × 40 cm. Parchment was not as highly valued a medium as paper, and the particular animal skins used for parchment are seldom specified. There are also references to a large map made of silver and another ninth-century "description of the world on Dubayqī cloth, unbleached but with dyes," neither of which has survived.

Paints and inks on maps also followed the tradition of manuscript illumination. Illustrations were sketched with a reed pen (*qalam*) in ink made from lampblack. The characteristically jewel-like, opaque colors were made from mineral pigments, with deep ultramarine (lapis

*Its Spread Westward*, 2d ed., rev. L. Carrington Goodrich (1925; New York: Ronald Press, 1955), 170–71.

8. See, for example, p. 95.

9. Norah M. Titley, *Persian Miniature Painting and Its Influence on the Art of Turkey and India: The British Library Collections* (London: British Library, 1983), 216–50, and Thomas W. Arnold, *Painting in Islam: A Study of the Place of Pictorial Art in Muslim Culture* (1928; reprinted New York: Dover, 1965), 3.

10. Damascus became a main source of supply to Europe; see Carter, *Invention of Printing in China*, 134–35 (note 7).

lazuli), vermilion (cinnabar), green (verdigris), silver, and gold predominating. There is no explicit reference to the adoption of color conventions for maps beyond those that had already been established in classical times, and frequently the selection of map colors follows that for other illustrations in the manuscript. Nevertheless, in the tenth century, al-Muqaddasī prescribed red for routes, yellow for sand, green for sea, blue for rivers, and brown for mountains. Existing copies of al-Idrisī's *Nuzhat al-mushtāq* (dated from the fourteenth century onward) reflect a general compliance with these standards but at the same time show some originality in color selection. A similar mix of convention and independence characterized the design of cartographic signs on Islamic maps. In later periods the influence of European conventions is felt, and the maritime charts of the Ottoman navigators, for instance, clearly show the appropriation of standard signs from Italian charts.

### THEORY AND PRACTICE

A continuous reading of the chapters in this section will reveal striking gaps between theory and practice in the history of premodern Islamic cartography. Most noticeably, while great sophistication was reached in developing the mathematical and astronomical bases of celestial and geographical cartography, little or no attempt was made to translate the existing theoretical knowledge into cartographic practice. Though much effort was devoted to such issues as determining celestial and terrestrial coordinates, delineating alternative schemes of map projection, and accurately measuring the length of a degree of the earth's circumference, many mapmakers seem to have ignored the implications of such scholarly developments. In a similar vein, the geographical knowledge of Muslims as attested by the rich geographical literature preserved, especially in Arabic and Persian, was certainly impressive, but it was only rarely presented in graphic form. Again, cosmological thought is definitely not an underdeveloped part of premodern Islamic intellectual activity, though it did not find visual expression except in isolated cases.

To explain this puzzling array of circumstances, it is essential to delineate the true dimensions of the problem. On a general level, one might observe that the expectation that cartographic practice should accurately and fully reflect cartographic speculation is not well grounded in history. There is no reason theory and practice should go hand in hand. More specifically, it is crucial to note that theoretical sophistication, even where we retrospectively find it very relevant to cartographic practice, was not necessarily, or even primarily, directed toward producing maps. Thus, much of what can now be identified as the theoretical basis of cartographic practice was never seen in this light by Muslim astronomers, geographers,

and cosmographers. They dealt with cartographic issues as natural parts of a wider intellectual curriculum valid for their time, not as parts of a unified cartographic discourse motivated by the aim of producing maps. From this perspective it is not so surprising that cartographic practice should have been largely incidental to rigorous investigation of the earth and the skies that went on in intellectual circles. In spite of such general explanations, the gap between theory and practice in Islamic cartography remains a puzzle, and specific information contained in the chapters that follow provides a solid basis for speculating on this subject.

### TERMS

Major premodern Islamic languages—Arabic, Persian, and Turkish—did not possess single words that uniquely and unequivocally denoted “map.” Instead a number of words were used, sometimes simultaneously or in juxtaposition to each other, to refer to map artifacts. Most common among these were terms that derived from well-known Arabic roots: *ṣūrah* (“form, figure” from the root *SWR*, “to form, to shape”), *rasm/tarsīm* (“drawing, graph” from the root *RSM*, “to draw, to sketch”), and *naqsh/naqshah* (“painting” from the root *NQSH*, “to paint”). None of these terms solely denoted maps, and all were used broadly to signify any kind of visual representation. The absence of a specific map terminology in premodern Islamic languages, while suggesting a low level of map consciousness, should not be interpreted as a sign of the cognitive insignificance of maps in Islamic civilization. In the Islamic lands, as in the rest of the medieval world, the borders between what now appear to us to be different modes of visual representation were not rigidly drawn. It should not be surprising, therefore, that all modes of visual representation shared a common terminological stock. Standardization and specialization begin only with the modern period. Thus, recent and unequivocal is the term *khariṭah* used in Turkish and Arabic, which is a loan word deriving from the Catalan *carta* through the Greek *kharti*.<sup>11</sup>

An important word in Islamic geographical texts is “climate.” The Arabic word *iqlīm* (pl. *aqālim*) came from the Greek *κλίμα* (literally, “inclination”) in Ptolemy's work and bears the same meaning in Arabic texts as it does in Ptolemy.<sup>12</sup> However, at an early stage it assumed the meaning of a large division of the earth's surface, and from this there developed several other meanings. The

11. Henry Kahane, Renée Kahane, and Andreas Tietze, *The Lingua Franca in the Levant: Turkish Nautical Terms of Italian and Greek Origin* (Urbana: University of Illinois Press, 1958), 158–59 (term no. 177, “carta”), and 594–97 (term no. 875, *ḫarṭī* “kharti”).

12. I thank Gerald Tibbetts for the information in this and the succeeding paragraph regarding terminology related to maps.

Persians had considered the world to be divided into seven regions, each containing a large empire. These regions, known as *kishvars*, were adopted by Muslim geographers, who renamed them *aqālim*, presumably in a belief that the latter term was more Arabic. They may have noticed that the Greek κλυα and the Persian *kishvar* were both seven in number. Yet a third meaning was given to the word by the Balkhī school authors, who equated it with the regions into which they divided the world for the purpose of convenient description. Thus al-Iṣṭakhrī and Ibn Ḥawqal both produce twenty *aqālim* as opposed to other authors' seven. The word has since become a general word for region or province.

Islamic geographical texts also include words for measurement. Distance measurements are *dhirāʿ* (cubit), *mīl* (mile), *farsakh* (a parasang or league [three miles]), and *marḥalah* (a day's journey). Another word is *manzil* for a stage of a journey, that is, one day's travel. This also means a stage of the moon's journey, a lunar mansion. Al-Idrīsī used *majrā* for one day's sailing distance, but to Aḥmad ibn Mājid *majrā* was not a measurement. Distances at sea, according to him, were measured in *zāms* ("a watch," or three hours' sailing). André Miquel mentions several different *dhirāʿs*, but he gives three thousand *dhirāʿs* to the *mīl*, three *mīls* to the *farsakh*.<sup>13</sup> S. Maqbul Ahmad states that there are twenty-five to thirty *mīls* to the *marḥalah* and that one *majrā* is approximately one hundred *mīls* (see table 7.1, p. 160). Longitude and latitude are measured in degrees and minutes, *darajahs* and *daqiqahs*.

## HISTORIOGRAPHY

Islamic geographical literature has been a generally neglected subject of study and cartography even more so, even though an abridged edition of al-Idrīsī's *Nuzhat al-mushtāq* in Arabic was printed in Italy as early as 1592.<sup>14</sup> The tables of longitude and latitude of Ulugh Beg and Naṣīr al-Dīn al-Ṭūsī (or the greater part of them) were published in 1652, and an edition of Abū al-Fidā' was issued in 1712.<sup>15</sup>

A translation of al-Idrīsī's text by Jaubert in 1840 first focused scholarly attention on the study of Islamic geography.<sup>16</sup> Its publication also marks the initial stage in the investigation of Islamic cartography, an interest that continued to develop with the editing and translation as well as the review, in survey studies, of other major geographical texts in Arabic by Wüstenfeld, Reinaud, Lelewel, and Sédillot.<sup>17</sup> More studies of Islamic geographical texts followed in the late nineteenth and early twentieth centuries by de Goeje and von Mžik,<sup>18</sup> while Nallino and von Mžik also contributed a number of more specialized analyses.<sup>19</sup> The attention given to cartography in these works was restricted to the study of mathematical geography, in the main a comparative scrutiny of tables

13. These words represented various lengths, depending on their use. André Miquel touches on their values in his *La géographie humaine du monde musulman jusqu'au milieu du 11<sup>e</sup> siècle*, vol. 2, *Géographie arabe et représentation du monde: La terre et l'étranger* (Paris: Mouton, 1975), 10–20, and they are given in some detail by Walther Hinz in the article "Dhirā'" in *The Encyclopaedia of Islam*, new ed. (Leiden: E. J. Brill, 1960–), 2:231–32. See also Walther Hinz, *Islamische Masse und Gewichte: Umgerechnet ins metrische System*, Handbuch der Orientalistik, ed. B. Spuler, suppl. vol. 1, no. 1 (Leiden: E. J. Brill, 1955).

14. For the early edition of al-Idrīsī, see *Kitāb nuzhat al-mushtāq fi dhikr al-amṣār wa-al-aqṭār wa-al-buldān wa-al-juzur wa-al-madā'in wa-al-afaq*, cataloged under the title *De geographia universalis* (Rome: Typographia Medicea, 1592), later translated into Latin in *Geographia nubiensis*, ed. Gabriel Sionita and Joannes Hesronita (Paris: Typographia Hieronymi Blageart, 1619).

15. *Binae tabulae geographicae una Nassir Eddini Persae, altera Ulug Beigi Tatari*, ed. John Greaves (London: Typis Jacobi Flesher, 1652). This work was also published along with Abū al-Fidā's description of the Arabian Peninsula in volume 3 of *Geographiae veteris scriptores graeci minores*, ed. John Hudson, 4 vols. (Oxford: Theatro Sheldoniano, 1698–1712).

16. *Géographie d'Edrisi*, 2 vols., trans. Pierre Amédée Emilien Probe Jaubert (Paris: Imprimerie Royale, 1836–40).

17. *Jacut's geographisches Wörterbuch*, 6 vols., ed. Ferdinand Wüstenfeld (Leipzig: F. A. Brockhaus, 1866–73); *Géographie d'Aboulféda: Texte arabe*, ed. and trans. Joseph Toussaint Reinaud and William MacGuckin de Slane (Paris: Imprimerie Royale, 1840), and *Géographie d'Aboulféda: Traduite de l'arabe en français*, 2 vols. in 3 pts. (vol. 1, *Introduction générale à la géographie des Orientaux*, by Joseph Toussaint Reinaud; vol. 2, pt. 1, trans. Reinaud; vol. 2, pt. 2, trans. S. Stanislas Guyard) (Paris: Imprimerie Nationale, 1848–83); Joachim Lelewel, *Géographie du Moyen Age*, 4 vols. and epilogue (Brussels: J. Pilliet, 1852–57; reprinted Amsterdam: Meridian, 1966); Louis Amélie Sédillot, *Mémoire sur les systèmes géographiques des Grecs et Arabes* (Paris: Firmin Didot, 1842). A long introductory section to the first volume of Reinaud's *Géographie d'Aboulféda* provides a general chronological account of Islamic geographical writings that is still worth reading. The mathematics of geography are discussed, although little is said about actual examples of cartography. See also the work by Aloys Sprenger on post routes that contains an interesting introduction: *Die Post- und Reiserouten des Orients*, Abhandlungen der Deutschen Morgenländischen Gesellschaft, vol. 3, no. 3 (Leipzig: F. A. Brockhaus, 1864; reprinted Amsterdam: Meridian, 1962, 1971).

18. See Michael Jan de Goeje's series Bibliotheca Geographorum Arabicorum, 8 vols. (Leiden: E. J. Brill, 1870–94; reprinted 1967); *Das Kitāb ṣūrat al-arḍ des Abū Ġā'far Muḥammad ibn Mūsā al-Ḥwārizmī*, ed. Hans von Mžik, Bibliothek Arabischer Historiker und Geographen, vol. 3 (Leipzig: Otto Harrassowitz, 1926); and *Das Kitāb 'aġā'ib al-aqālim as-sab'a des Suhrāb*, ed. Hans von Mžik, Bibliothek Arabischer Historiker und Geographen, vol. 5 (Leipzig: Otto Harrassowitz, 1930).

19. Carlo Alfonso Nallino, "Al-Ḥwārizmī e il suo rifacimento della Geografia di Tolomeo," *Atti della R. Accademia dei Lincei: Classe di Scienze Morali, Storiche e Filologiche*, 5th ser., 2 (1894), pt. 1 (Memorie), 3–53; idem, "Il valore metrico del grado di meridiano secondo i geografi arabi," *Cosmos* 11 (1892–93): 20–27, 50–63, 105–21 (both republished in *Raccolta di scritti editi e inediti*, 6 vols., ed. Maria Nallino [Rome: Istituto per l'Oriente, 1939–48], 5:458–532 and 5:408–57); Hans von Mžik, "Afrika nach der arabischen Bearbeitung der Γεωγραφικῆ ὑφήγησις des Claudius Ptolemaeus von Muḥammad ibn Mūsā al-Ḥwārizmī," *Denkschriften der Kaiserlichen Akademie der Wissenschaften in Wien: Philosophisch-Historische Klasse* 59 (1917), Abhandlung 4, i-xii, 1–67; idem, "Ptolemaeus und die Karten der arabischen Geographen," *Mitteilungen der Kaiserlich-Königlichen Geographischen Gesellschaft in Wien* 58 (1915): 152–76; and idem, "Osteu-

of geographical coordinates and, in the case of Lelewel and von Mžik in particular, reconstructing maps on the basis of these tables.<sup>20</sup>

The actual Islamic maps—except for the map of al-Ma'mūn, known only through references in other works—were neglected. Orientalists could find little scientific basis for them and so failed to take them seriously. Lelewel preferred to reconstruct maps from tables of coordinates, and his work typifies the resulting neglect of actual examples of Islamic cartography. Maps were considered at best to be useful sources for locating place-names or reconstructing the geography of earlier historical periods. Historians of European cartography, with no knowledge of the literary background of the maps, could make little sense of them, and they were moreover ill equipped to deal with the special problems related to Islamic manuscripts and script. Because of the scattered nature of the manuscripts, no real comparative research was carried out. The sources and date of the content of maps were often misleadingly related to the date and provenance of the manuscripts that contained them.

The publication in the 1920s of a major collection of Islamic maps and the beginning of another, larger compilation that included many examples from Islamic cartography marked the onset of a new phase in its study. Konrad Miller's *Mappae arabicae* still holds the distinction of being the largest anthology of Islamic maps ever published.<sup>21</sup> Miller himself was interested in identifying place-names, but many of his identifications are incorrect, often because of his transliterations of the original Arabic. Miller knew little of the geographical literature on which the maps depended and here as elsewhere his scholarship is in need of major revision. It is likely that his main contribution in the long run will be seen as his publication of an impressive collection of maps. Youssef Kamal's *Monumenta cartographica Africae et Aegypti*, begun in 1926 and continued until 1951, was never intended as more than a chronological survey of references to Africa, beginning with classical antiquity.<sup>22</sup> Its chief merit for the study of Islamic cartography is its inclusion of a large number of Islamic maps side by side with contemporary European examples, which calls for and aids comparison. The works of Miller and Kamal remain as basic sources for the study of Islamic cartography.

The proliferation of articles and monographs relating to Islamic maps after 1950 makes it impractical to review them in detail here.<sup>23</sup> However, it is fair to state that even when the maps are the center of attention, the emphasis of most studies in this phase remains squarely geographical, and comparative cartographic research is still lacking. Rather than artifacts in their own right that reflect the cultural milieu in which they were produced, maps are treated at best as mere bearers of geographical and

historical information—as in the predominant interest in place-names—and at worst as superfluous illustrations. Their unique characteristics, such as their frequent southerly orientation, are often left unnoted and unexplained. There is little attempt to relate individual maps to each other not in terms of genetic affinity (tracing the origin of maps is a fairly common concern of researchers) but in terms of structural similarity.

Significantly, major changes in the study of Islamic geographical texts occurred after the Second World War with the publication of the works of Krachkovskiy and Miquel. The first wrote a classical historical survey of Arabic geographical literature, and the second produced a seminal interpretive study that places early Islamic geographical literature in its wider cultural context.<sup>24</sup> We must also mention that numerous useful facsimiles of geographic works, many with maps, are currently being published by the Institut für Geschichte der Arabisch-Islamischen Wissenschaften in Frankfurt. The attainment of a higher level of sophistication in the study of geographical texts bodes well for the future of research on Islamic terrestrial cartography, which continues to be an integral part of the former. It is no accident that the first—

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ropa nach der arabischen Bearbeitung der Γεωγραφικὴ ὑφήγησις des Klaudios Ptolemaios von Muḥammad ibn Mūsā al-Ḥuwārizmī," *Wiener Zeitschrift für die Kunde des Morgenlandes* 43 (1936): 161–93.

20. These maps have occasionally been reproduced and sometimes identified as Islamic maps, which of course they are not—it must not be imagined that Muslims of the Middle Ages saw anything like these European reconstructions. Nevertheless, scholars continue to work on this legitimate area of research; see, for instance, Hubert Daunicht, *Der Osten nach der Erdkarte al-Ḥuwārizmī: Beiträge zur historischen Geographie und Geschichte Asiens*, 4 vols. in 5 (Bonn: Selbstverlag der Orientalischen Seminars der Universität, 1968–70), and Reinhard Wieber, *Nordwesteuropa nach der arabischen Bearbeitung der Ptolemäischen Geographie von Muḥammad B. Mūsā al-Ḥuwārizmī*, Beiträge zur Sprach- und Kulturgeschichte des Orients, vol. 23 (Walldorf [Hessen]: Verlag für Orientkunde Vorndran, 1974).

21. Konrad Miller, *Mappae arabicae: Arabische Welt- und Länderkarten des 9.–13. Jahrhunderts*, 6 vols. (Stuttgart, 1926–31).

22. Youssef Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51), facsimile reprint, 6 vols., ed. Fuat Sezgin (Frankfurt: Institut für Geschichte der Arabisch-Islamischen Wissenschaften, 1987).

23. Among these works should be noted *Ḥudūd al-'ālam*: "The Regions of the World," ed. and trans. Vladimir Minorsky (London: Luzac, 1937; reprinted Karachi: Indus, 1980); Ahmed Zeki Velidi Togan, ed., *Birūnī's Picture of the World*, Memoirs of the Archaeological Survey of India, no. 53 (Delhi, 1941); J. H. Kramers, "Djughrāfiyā," in *The Encyclopaedia of Islam*, 1st ed., 4 vols. and suppl. (Leiden: E. J. Brill, 1913–38), suppl. 61–73; and idem, "Geography and Commerce," in *The Legacy of Islam*, 1st ed., ed. Thomas Arnold and Alfred Guillaume (Oxford: Oxford University Press, 1931), 78–107.

24. Ignatiy Iulianovich Krachkovskiy, *Izbrannyye sochineniya*, vol. 4, *Arabskaya geograficheskaya literatura* (Moscow, 1957), translated into Arabic by Ṣalāḥ al-Dīn 'Uthmān Hāshim, *Ta'rikh al-adab al-jughrāfi al-'Arabī*, 2 vols. (Cairo, 1963–65), and André Miquel, *La géographie humaine du monde musulman jusqu'au milieu du 11<sup>e</sup> siècle*, 4 vols. to date (Paris: Mouton, 1967-).

and until this work the only—essay dealing with a large corpus of Islamic maps, the article “*Kharīṭa*” in the new edition of *The Encyclopaedia of Islam*, was written by S. Maqbul Ahmad, the same scholar who prepared the much longer article on geography for that encyclopedia.<sup>25</sup>

Despite such developments, it is clear that adequate understanding of Islamic maps will not be possible without the contributions of researchers from other fields, in particular art historians. The publication of the present volume should bring the known specimens of Islamic

cartography to the attention of a much broader circle of scholars than has hitherto been possible and should generate further research.

25. S. Maqbul Ahmad, “*Kharīṭa*” and “*Djughrafiya*,” in *The Encyclopaedia of Islam*, new ed. (Leiden: E. J. Brill, 1960-), 4:1077–83 and 2:575–87, respectively. Another recent summary of geographical and navigational literature can be found in M. J. L. Young, J. D. Latham, and R. B. Serjeant, eds., *Religion, Learning and Science in the ‘Abbasid Period* (Cambridge: Cambridge University Press, 1990), chap. 17.

## APPENDIX 1.1 WORKS OF PTOLEMY IN ARABIC

### ALMAGEST = *KITĀB AL-MAJISŪTĪ* (OR *AL-MIJISŪTĪ*)<sup>a</sup>

- 1 An early Syriac version (lost)
- 2 A version by al-Ḥasan ibn Quraysh made at the request of al-Maʿmūn (r. 198–218/813–33) (lost)
- 3 Another version made for al-Maʿmūn by al-Ḥajjāj ibn Maṭar al-Ḥasib and Sarjūn ibn Hiliyā al-Rūmī, completed in 212/827–28 (extant)
- 4 A version made for the vizier Abū al-Ṣaqr Ismāʿīl ibn Bulbul by Iṣḥāq ibn Ḥunayn, completed 266–77/879–90 (lost)
- 5 A revision of Iṣḥāq ibn Ḥunayn’s translation by Thābit ibn Qurrah (d. 288/901) (lost)

### HANDY TABLES = *KITĀB AL-QĀNŪN FĪ ʿILM AL-NUJŪM WA-ḤISĀBIHĀ WA-QISMAT AJZĀʾIHĀ WA-TAʿDĪLIHĀ* (THEON’S REVISED VERSION)

- 1 A version by ʿAyyūb and Simʿān ibn Sayyār al-Kābulī made for Muḥammad ibn Khālid ibn Yaḥyā bin Barmak, ca. 200/815–16 (lost)<sup>b</sup>

### PLANETARY HYPOTHESES = *KITĀB AL-IQTİŞĀŞ* OR *KITĀB AL-MANSHŪRĀT*

- 1 Anonymous version corrected by Thābit ibn Qurrah (extant)<sup>c</sup>

### TETRABIBLOS = *KITĀB AL-ARBAʿAH*<sup>d</sup>

- 1 A version by Abū Yaḥyā al-Biṭrīq, perhaps made during the reign of al-Manṣūr (136–58/754–75)
- 2 A version by Ibrāhīm al-Ṣalt, apparently made ca. 200/815–16
- 3 A revision of Ibrāhīm al-Ṣalt’s version by Ḥunayn ibn Iṣḥāq

### GEOGRAPHY = *KITĀB JAGHRĀFIYAH FĪ AL-MAʿMŪR WA-ṢIFAT AL-ARD*

- 1 A version made either by or for Abū Yūsuf Yaʿqūb ibn Iṣḥāq al-Kindī (d. ca. 260/874) (lost)<sup>e</sup>
- 2 A version that was either translated or simply corrected by Ibn Khurradādhbih, probably completed between 232/846–47 and 272/885–86 (lost)<sup>f</sup>
- 3 A version by Thābit ibn Qurrah (d. 288/901) (lost)<sup>g</sup>

<sup>a</sup>The following list of the different translations of the *Almagest* into Syriac and Arabic reflects the findings of Paul Kunitzsch as recorded in his recent study *Der Almagest: Die Syntaxis Mathematica des Claudius Ptolemäus in arabisch-lateinischer Überlieferung* (Wiesbaden: Otto Harrassowitz, 1974), esp. 15–82. This work is reviewed by G. J. Toomer, “Ptolemaic Astronomy in Islam,” *Journal for the History of Astronomy* 8 (1977): 204–10, where a similar list of translations is given. For somewhat different views on this issue as well as complete listings of the extant manuscripts, see Fuat Sezgin, *Geschichte des arabischen Schrifttums*, vol. 6, *Astronomie bis ca. 430 H.* (Leiden: E. J. Brill, 1978), 88–94.

<sup>b</sup>Sezgin, *Geschichte des arabischen Schrifttums*, 6:95–96 (note a).

<sup>c</sup>B. R. Goldstein, “The Arabic Version of Ptolemy’s Planetary Hypotheses,” *Transactions of the American Philosophical Society*, n.s., 57, pt. 4 (1967): 3–55, and Sezgin, *Geschichte des arabischen Schrifttums*, 6:94–95 (note a).

<sup>d</sup>All three versions listed below are recorded in Fuat Sezgin, *Geschichte des arabischen Schrifttums*, vol. 7, *Astrologie—Meteorologie und Verwandtes bis ca. 430 H.* (Leiden: E. J. Brill, 1979), 42–44. It is not clear which of these three translations are preserved in the extant manuscripts listed by Sezgin on p. 43.

<sup>e</sup>Muḥammad ibn Iṣḥāq ibn al-Nadīm (d. ca. 385/995), *Fihrist*; see *Kitāb al-Fihrist*, 2 vols., ed. Gustav Flügel (Leipzig: F. C. W. Vogel, 1871–72), 1:268, English translation, *The Fihrist of al-Nadīm: A Tenth-Century Survey of Muslim Culture*, 2 vols., ed. and trans. Bayard Dodge (New York: Columbia University Press, 1970), 2:640, and Jamāl al-Dīn Abū al-Ḥasan ʿAlī bin Yūsuf al-Qifṭī (568–646/1172–1248), *Taʾriḫ al-ḥukamāʾ*; see *Ibn al-Qifṭī’s Taʾriḫ al-ḥukamāʾ*, ed. Julius Lippert (Leipzig: Dieterich’sche Verlagsbuchhandlung, 1903), 98. There is confusion in the sources about whether the translation was made for al-Kindī or by al-Kindī himself. It should be observed in this connection that al-Kindī most probably “did not know Greek well enough to translate directly from that language”: Jean Jolivet and Roshdi Rashed, “al-Kindī,” in *Dictionary of Scientific Biography*, 16 vols., ed. Charles Coulston Gillispie (New York: Charles Scribner’s Sons, 1970–80), 15:261–67, esp. 261. This lends some credibility to von Mzik’s view that al-Kindī probably did no more than “correct” an Arabic translation that was carried out for him; see Hans von Mzik, “Afrika nach der arabischen Bearbeitung der Γεωγραφικὴ ὑφήγησις des Claudius Ptolemaeus von Muḥammad ibn Mūsā al-Ḥwārizmī,” *Denkschriften der Kaiserlichen Akademie der Wissenschaften in Wien: Philosophisch-Historische Klasse* 59 (1917), Abhandlung 4, i–xii, 1–67, esp. 5 n. 2.

<sup>f</sup>Abū al-Qāsim ʿUbayd Allāh ibn ʿAbdallāh ibn Khurradādhbih, *al-Masālik wa-al-mamālik*; see the edition by Michael Jan de Goeje, *Kitāb al-Masālik waʾl-mamālik (Liber viarum et regnorum)*, Bibliotheca Geographorum Arabicorum, vol. 6 (Leiden: E. J. Brill, 1889; reprinted, 1967), Arabic text, 3, French text, 1. The interpretation of the relevant passage in the *Kitāb al-masālik wa-al-mamālik* is problematic, though it seems plausible to agree with T. Nöldeke’s reading, according to which Ibn Khurradādhbih simply corrected the Arabic of a translation



he had someone else make for him; see the report of Nöldeke's view in von Mzik, "Afrika," 5 n. 2 (note e), based on a private letter of Nöldeke to von Mzik dated 28 April 1915. The dating of the translation in question follows Michael Jan de Goeje's dates for the two different recensions of the *Kitāb al-masālik wa-al-mamālik*.

¶Ibn al-Nadīm, *Fihrist*; see Flügel's edition, 1:268, or Dodge's edition, 2:640 (note e). This version of Thābit ibn Qurrah might have been accompanied by a world map originally constructed by Qurrah ibn Qamiṭā, see p. 96.

Among references by later Muslim writers to Arabic translations of the *Geography*, the earliest and the most detailed is one by al-Mas'ūdi

(d. 345/956): "And all these seas [of the world] were drawn in the *Book of Geography* [of Ptolemy] in different sizes and shapes with various kinds of paint," *Murūj al-dhahab wa-ma'adin al-jawhar*, edited and translated as *Les prairies d'or*, 9 vols., trans. C. Barbier de Meynard and Pavet de Courteille, Société Asiatique, Collection d'Ouvrages Orientaux (Paris: Imprimerie Impériale, 1861–77), 1:183–85; rev. ed. under the supervision of Charles Pellat, 7 vols., *Qism al-Dirāsāt al-Ta'rikhiyah*, no. 10 (Beirut: Manshūrāt al-Jāmi'ah al-Lubnāniyah 1965–79), 1:101–2 (author's translation). A much later translation from the Greek, carried out by George Amirutzes of Trebizond for the Ottoman sultan Mehmed II, ca. 869–70/1465, was not included in this table; see p. 210.