

19 · Portolan Charts from the Late Thirteenth Century to 1500

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INTRODUCTION

To the historian of late medieval and early modern European cartography¹ the portolan charts are fundamental documents, if mysterious in their origin and precocious in their precision. Their importance has long been acknowledged, and “The First True Maps” was the enthusiastic title of an article by Charles Raymond Beazley in 1904.² More recently, Armando Cortesão considered the “advent of the portolan chart . . . one of the most important turning points in the whole history of cartography.”³ Alberto Magnaghi went further, describing them as a unique achievement not only in the history of navigation but in the history of civilization itself.⁴ For Monique de La Roncière the work of the first named practitioner, Pietro Vesconte, was so exact that the Mediterranean outlines would not be improved until the eighteenth century.⁵ In terms of the economic history of cartography, Vesconte and his contemporaries may have been the first, in the plausible opinion of a recent writer, “to pursue mapmaking as a full-time commercial craft.”⁶

From the earliest extant copies, probably a little before 1300, the outline they gave for the Mediterranean was amazingly accurate. In addition, their wealth of place-names constitutes a major historical source. Their improvement over the Ptolemaic maps relating to the same area is obvious at a glance, and the North African coast with its clearly defined Syrtes is the most striking advance. Moreover, the Ptolemaic maps began to circulate widely through Europe only in the fifteenth century, by which time the portolan charts were well established. Though a linear scale was implied on Ptolemy’s maps by their grid of longitude and latitude, the medieval sea charts were the first cartographic documents to regularly display one.⁷ This should be contrasted with the history of European topographical mapping, which shows that the first local map since Roman times to be drawn explicitly to scale was a plan of Vienna dating from about 1422.⁸ As P. D. A. Harvey further points out, virtually

ments and identifying a number of errors—though not, of course, sharing any responsibility for those that remain: Janet Backhouse, Peter Barber, and Sarah Tyacke (all of the British Library), P. D. A. Harvey (University of Durham), Thomas R. Smith (University of Kansas), and David W. Waters (formerly of the National Maritime Museum). Thanks are also due to others not specifically mentioned in these notes: Dudley Barnes (Paris) for the loan of enlarged photographs of the Vesconte charts; William Crampton of the Flag Institute, Chester, for lending unobtainable copies of flag articles; O. A. W. Dilke (University of Leeds) for comments on the classical aspect of portolan chart origins; J. P. Hudson (British Library) for assistance on paleographic points; Georges Pasch (Paris) for generously sharing the fruits of many years’ research into portolan chart flags; and Vladimiro Valerio (University of Naples) for help with obscure Italian references. In addition, I received invaluable assistance from librarians and curators, unfortunately too numerous to mention individually.

1. A terminal date of 1500 has been adopted for two main reasons: first, the extension southward and eastward to include the Cape of Good Hope and the route to the Indies occurs close to that date, as does the first cartographic representation of Columbus’s discoveries; second, the earliest surviving charts to incorporate a latitude scale—and thus in some opinions to have outgrown the term “portolan chart”—also date from the very first years of the sixteenth century, see below, p. 386.

2. Charles Raymond Beazley, “The First True Maps,” *Nature* 71 (1904): 159–61, esp. 159.

3. Armando Cortesão, *History of Portuguese Cartography*, 2 vols. (Coimbra: Junta de Investigações do Ultramar-Lisboa, 1969–71), 1:215–16.

4. Alberto Magnaghi, “Nautiche, carte,” in *Enciclopedia italiana di scienze, lettere ed arti*, originally 36 vols. ([Rome]: Istituto Giovanni Treccani, 1929–39), 24:323–31, esp. 330b.

5. Monique de La Roncière, “Les cartes marines de l’époque des grandes découvertes,” *Revue d’Histoire Economique et Sociale* 45 (1967): 5–28, esp. 18. Other writers have made the same point even more strongly. Bojan Beševliev, “Basic Trends in Representing the Bulgarian Lands in Old Cartographic Documents up to 1878,” *Etudes Balkaniques* 2 (1980): 94–123, esp. 100, found that “even up to the middle of the last century there existed no more accurate representations of the Black Sea than those on the portolans” (i.e., charts); and Luigi Piloni, *Carte geografiche della Sardinia* (Cagliari: Fossataro, 1974), unpaginated caption to pl. v, considered the Carte Pisane’s outline of Sardinia so exact that it differed little from a modern map of equivalent scale.

6. John Noble Wilford, *The Mapmakers* (New York: Alfred A. Knopf; London: Junction Books, 1981), 50.

7. Eva G. R. Taylor, *The Haven-Finding Art: A History of Navigation from Odysseus to Captain Cook* (London: Hollis and Carter, 1956), 111.

8. P. D. A. Harvey, *The History of Topographical Maps: Symbols, Pictures and Surveys* (London: Thames and Hudson, 1980), 80.

I wish to acknowledge the generous assistance of the following persons who read a preliminary draft for this essay, suggesting many improve-

no local maps produced during the period under discussion, that is up to 1500, made “the slightest attempt at consistency of scale.”⁹

An even greater gulf divided the portolan charts from the medieval *mappaemundi*, the cartographic content of which was largely shaped by their theological message. It is worth recalling that the earliest known portolan chart is thought to be almost exactly contemporary with the Hereford world map. It cannot be claimed, of course, that the portolan charts were totally free from what today we call superstition, but neither were medieval sailors. Yet Prester John, the four rivers of paradise, the mythical Atlantic islands, and other legendary features found on some charts are all placed in the little-known interior or around the periphery. The continental coastlines that constitute the charts’ primary purpose are in no way affected. The unidentified author of the Genoese world map of 1457,¹⁰ whose depiction of the Mediterranean is based on the portolan charts, neatly sums up the chartmakers’ attitude: “This is the true description of the world of the cosmographers, accommodated to the marine [chart], from which frivolous tales have been removed.”¹¹

The medieval sea chart is the clearest statement of the geographic and cartographic knowledge available in the Mediterranean. Occasionally the coverage was extended to the East, as in the case of the Catalan atlas. Contact with China, however, ceased after the mid-fourteenth century with the collapse of that Tatar empire at which the Polos had marveled. But in the West the portolan charts of the fourteenth and fifteenth centuries provide the best, and at times the only, documentation of the first chapter of Renaissance discovery—the exploration of the Atlantic islands and the charting of Africa’s entire west coast. The Spanish and Portuguese seaborne empires whose foundations were to be laid by Christopher Columbus and Vasco da Gama were the fruits of these preparatory voyages.

The medieval *mappaemundi* are the cosmographies of thinking landmen. By contrast, the portolan charts preserve the Mediterranean sailors’ firsthand experience of their own sea, as well as their expanding knowledge of the Atlantic Ocean. They are strikingly original, signaling, as Gerald R. Crone pointed out, a “complete break with tradition.”¹² Whatever their antecedents might have been, these cannot be identified with any confidence today; but this is only one of the many unanswered questions these documents pose. How was the prototype constructed and when? How were copies manufactured for some four hundred years without steadily increasing distortion? Did the Catalans influence the Italians, or vice versa? And most fundamental of all, what was their function?

A general study has already been devoted to the *map-*

paemundi,¹³ but no broad survey of the pre-Columbian portolan charts has been attempted in English since Nordenskiöld’s in 1897.¹⁴ This lack of recent reassessment has meant that portolan charts have benefited only slightly from the more rigorous analytical methods of contemporary scholarship. Past discussions of portolan charts have tended toward one of two extremes: either sweeping generalizations based on a priori reasoning, or myopic studies of individual works. Where the first approach tended to stretch the limited available evidence beyond the breaking point, the second missed most of the opportunities for comparative analysis, giving as much weight to extraordinary features as to typical ones. This essay attempts to steer a middle course by drawing together the strands scattered among numerous detailed studies and spinning into a single thread—tenuous though it often is—the little that is known of the history of these charts. Various aspects will be considered in turn: the question of their origin, the way they were drawn, their changing content, the social standing of their creators, the likely identity of their first owners, and the purposes for which they were made. But the charts themselves are more important and reliable witnesses than any secondary authorities. New and compelling evidence about the relation of one chartmaker to another and about their response to changing external realities has emerged from a close comparative examination of surviving charts.

The feature subjected to particularly close examination in this way is the toponymy of the early charts. Contrary to the belief in the essential conservatism of the portolan charts through the centuries, strongly voiced by Nordenskiöld and others, a recent survey of their place-names has revealed extensive toponymic change up to at least the middle of the fifteenth century.¹⁵ Less marked in areas little frequented by trading vessels but strongly evident along the northern Mediterranean littoral (and most particularly in the Adriatic), these con-

9. Harvey, *Topographical Maps*, 103 (note 8).

10. Florence, Biblioteca Nazionale Centrale, Port. 1; see Marcel Destombes, ed., *Mappemondes A.D. 1200–1500: Catalogue préparé par la Commission des Cartes Anciennes de l’Union Géographique Internationale* (Amsterdam: N. Israel, 1964), 222.

11. “Hec est vera cosmographorum cum marino accordata des[crip]cio quorundam frivolis naracionibus rejectis.” The translation is from Gerald R. Crone, *Maps and Their Makers: An Introduction to the History of Cartography*, 5th ed. (Folkestone, Kent: Dawson; Hamden, Conn.: Archon Books, 1978), 28.

12. Crone, *Maps and Their Makers*, 11 (note 11).

13. Destombes, *Mappemondes* (note 10). For the historiography of the *mappaemundi*, see pp. 292–99.

14. A. E. Nordenskiöld, *Periplus: An Essay on the Early History of Charts and Sailing-Directions*, trans. Francis A. Bather (Stockholm: P. A. Norstedt, 1897).

15. Nordenskiöld, *Periplus*, 45, 56 (note 14). See also pp. 415–28.

stantly changing patterns of place-names proclaim a hitherto unsuspected vitality in the early charts. To Nordenskiöld and his disciples “the most perfect map of the Middle Ages, the Iliad of Cartography,” was the result of a single act of creation, that of the first chart (his “normal-portolano”).¹⁶ Now that we can point to a process of continual toponymic revitalization—marked in the fourteenth century even if diminishing in the fifteenth—the portolan charts must be reinterpreted as a living record of Mediterranean self-knowledge, undergoing constant modification. This is the single most important discovery to have emerged from this investigation.

Through the place-name analysis it has also proved possible to suggest more reliable dates for a number of unsigned works. Approximately half of the atlases and charts assigned to the period up to 1500 lack both signature and date. Agreement about the dating of these documents is an essential precondition for introducing them into a history of portolan charts. Unfortunately, this requirement has not been met. The dates proposed for some important charts have fluctuated widely, while the arbitrary use of unreliable and conflicting dating criteria has led many researchers to adopt untenable positions. Once a conclusion on dating had been reached, it has often been repeated without explanation by subsequent commentators. The student of today thus inherits a legacy in which a number of unfounded dating estimates, and the conclusions unwisely based on them, have come to be treated as received wisdom.¹⁷

Though certainly not a perfect method, the place-name lists provide a far better system of dating than any previously devised, and they enable the undated works to be integrated with some confidence into the general historical account.¹⁸ On the basis of an extensively amended chronological list of fourteenth- and fifteenth-century charts, fresh conclusions can be drawn about the stages of their development, and about the interrelationships between Catalan, Genoese, and Venetian practitioners.

SURVIVAL

The approximately 180 charts and atlases that can now be assigned to the fourteenth and fifteenth centuries must be a minute fraction of what was originally produced, and they are not necessarily representative.¹⁹ Any conclusions based on the body of extant charts must acknowledge this incompleteness. Few charts can have been as highly prized as Gabriel de Valseca’s ornamental production of 1439²⁰ (see plate 24), for which Amerigo Vespucci (1454–1512) was prepared to pay the handsome sum of 130 “ducati di ora di marco.”²¹ Nevertheless, the dozen references to portolan charts in in-

ventories accompanying Genoese probate documents of the period 1384–1404 are evidence that they were then considered to be of some significance, even when, as in one instance, described as being already old.²² These documents also give a clue to the extent of wastage over the centuries.

The factors leading to the destruction of those used at sea are obvious, but the survival of charts in landsmen’s hands was by no means guaranteed. The bookseller in Anatole France’s *La rôtisserie de la reine Pédauque*, who admitted having “nailed old Venetian maps on the doors,”²³ might have been fictional, but obsolete sea charts often fared no better in the real world. When Sir Thomas Phillipps was assiduously collecting manuscripts of all kinds in the nineteenth century, he often found that his rivals were not other bibliophiles, but goldbeaters, glue makers and tailors, all of whom derived some advantage from the destruction of vellum manuscripts.²⁴ A number of unadorned charts suffered the indignity of being dismembered for use in bookbinding. Several fragments, sometimes displaying the needle holes, testify to this. One chart was even chopped up into small pieces by a lawyer for bookmarks.²⁵ Sadly,

16. Nordenskiöld, *Periplus*, 45 (note 14).

17. Giuseppe Caraci was one of the few to question these assumptions; see “A proposito di alcune carte nautiche di Grazioso Benincasa,” *Memorie Geografiche dall’Istituto di Scienze, Geografiche e Cartografiche* 1 (1954): 283–90.

18. There are too many important works among the undated atlases and charts for it to be feasible to restrict such an account to securely dated examples.

19. This figure of 180 charts and atlases derives from a census of early portolan charts in which this contributor is currently engaged and which is to be published in *Imago Mundi*. This total must remain approximate because there are as yet no reliable diagnostic criteria for distinguishing the unadorned works of the fifteenth century from those of the sixteenth.

20. For the location of Valseca’s chart, and of all the signed, dated, or named charts subsequently mentioned in this essay, see appendixes 19.2, 19.3, and 19.4. Locations of pre-1430 unsigned works are given in table 19.3 (pp. 416–20). For references to reproductions of the atlases and charts referred to in this essay, see appendixes 19.2 and 19.3.

21. Nordenskiöld, *Periplus*, 62 (note 14). Cortesão, *History of Portuguese Cartography*, 2:148–49 (note 3), goes in detail into the George Sand spilled inkwell incident, which left its disfiguring mark on this chart.

22. Paolo Revelli, *Cristoforo Colombo e la scuola cartografica genovese* (Genoa: Consiglio Nazionale delle Ricerche, 1937), 452–58, esp. 453 (no. xviii).

23. Ruthardt Oehme, “A Cartographical Certificate by the Cologne Painter Franz Kessler,” *Imago Mundi* 11 (1954): 55–56, quotation on 56.

24. Armando Cortesão, *The Nautical Chart of 1424 and the Early Discovery and Cartographical Representation of America: A Study on the History of Early Navigation and Cartography* (Coimbra: University of Coimbra, 1954), 4.

25. Paris, Bibliothèque Nationale, Rés. Ge. D 3005; see Ernest Théodore Hamy, “Note sur des fragments d’une carte marine catalane du XV^e siècle, ayant servi de signets dans les notules d’un notaire de

loss and destruction continue. The 1463 Grazioso Benincasa atlas was stolen from the Royal Army Medical Corps Library, London, in 1930, and an eastern Mediterranean fragment vanished after the war from the Archivio di Stato, Venice.²⁶ World War II took its toll as well: the Giovanni da Carignano map was totally destroyed and the 1490 Andrea Benincasa chart was partially burned in the 1944 bombing of Ancona—as was Grazioso Benincasa's written portolano.²⁷

There are, besides, a considerable number of references to charts that vanished long ago.²⁸ This applies particularly to Portugal's contribution. "Although it is beyond dispute," wrote Cortesão and Teixeira da Mota in 1960, "that many Portuguese charts were drawn in the time of the Infante [Prince Henry the Navigator] and soon after, possibly some as early as the fourteenth century, it is very odd indeed that only one such chart and a fragment of another have survived."²⁹ Despite this statement, Cortesão could find no reference to charts in Portuguese records earlier than 1443, and the oldest known Portuguese chart is either one by Reinell, dated to about 1483, or an unsigned work in Modena (Biblioteca Estense, C.G.A.5c), assigned to the last quarter of the fifteenth century.³⁰ The Reinell chart's suggested date of 1483 might, however, have to be modified if the fleur-de-lis on the flag of Marseilles is taken as a reference to the town's transfer from Provence to France in 1486. This unusual flag form, replacing the normal blue cross, is also found on some charts of a century or more later.³¹ The 1492 Jorge de Aguiar chart and a fragment in Lisbon, datable "after 1493, perhaps before the end of the century," bring to four the number of known Portuguese works supposedly produced before 1500. The Aguiar chart's existence was first made known at a meeting in Portugal in 1968, when it was described by Alexander O. Vietor.³²

Insofar as the lost charts referred to Portuguese discoveries in western Africa and the Atlantic, their substance did nevertheless find its way onto portolan charts, evidently with Italians formerly in Portuguese employ acting as intermediaries.³³ As a sign of early French activity, de La Roncière drew attention to documents of 1476 commissioning two painters, Jehan Robert and Jehan Morel, to "portray" the coast around the Seine estuary.³⁴ This would presumably have been a panoramic view and as such no exception to the rule that portolan charts (besides Andrea Bianco's London production of 1448) are not known to have been produced outside southern Europe and the Muslim world before the sixteenth century.³⁵ Besides the few original Arab works that survive, one early Western chart, Bertran's of 1482, displays annotations in Arabic lettering.³⁶ On the other hand, the supposed Arabic lettering on the undated chart in Dijon has proved to be imaginary.³⁷ In addition to

Perpignan (1531–1556)," *Bulletin du Comité des Travaux Historiques et Scientifiques: Section de Géographie Historique et Descriptive* (1897): 23–31, esp. 24; reprinted in *Acta Cartographica* 4 (1969): 219–27.

26. On the Benincasa atlas see the unsigned note "Der gestohlene Gratosius Benincasa," *Imago Mundi* 1 (1935): 20; information on the fragment formerly in the Archivio di Stato, Venice, comes in a personal communication from the director, Maria Francesca Tiepolo.

27. Cortesão, *History of Portuguese Cartography*, 1:219, 2:193 (note 3). Paolo Revelli (who sent questionnaires to Italian institutions after World War II) was relieved to find less damage than he expected; see "Cimeli geografici di biblioteche italiane distrutti o danneggiati dalla guerra," *Atti della XIV Congresso Geografico Italiano, Bologna, 1947* (1949): 526–28; and idem, "Cimeli geografici di archivi italiani distrutti o danneggiati dalla guerra," *Atti della XV Congresso Geografico Italiano, Torino, 1950*, 2 vols. (1952), 2:879.

28. See, for example, Julio Rey Pastor and Ernesto García Camarero, *La cartografía mallorquina* (Madrid: Departamento de Historia y Filosofía de la Ciencia, 1960), 59–60, 63, 65–66, 84–86.

29. Armando Cortesão and Avelino Teixeira da Mota, *Portugaliae monumenta cartographica*, 6 vols. (Lisbon, 1960), 1:xxxiv.

30. See Cortesão, *History of Portuguese Cartography*, 2:118 and 211 (note 3), and Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:3–4 (note 29).

31. I owe this point to Georges Pasch.

32. The quotation is from Cortesão, *History of Portuguese Cartography*, 2:218 (note 3). See Alexander O. Vietor, "A Portuguese Chart of 1492 by Jorge Aguiar," *Revista da Universidade de Coimbra* 24 (1971): 515–16, and also Cortesão, *History of Portuguese Cartography*, 2:212–16 (note 3). The Dijon chart, described as Portuguese in Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 5:187 (note 29), is not mentioned in Cortesão's later *History*; the so-called Columbus chart in Paris, Bibliothèque Nationale, Rés. Ge. AA 562, is not considered Portuguese by Cortesão, *History of Portuguese Cartography*, 2:220; and the Munich chart has been reassigned in this essay to the sixteenth century (see p. 386).

33. Alvise da Cadamosto, whose discovery of the Cape Verde Islands was recorded by Grazioso Benincasa in 1468, was a Venetian in Portuguese service, and Fra Mauro on his world map of 1459 claimed to have Portuguese charts in his possession; see Cortesão, *History of Portuguese Cartography*, 2:85, 176 (note 3).

34. Charles de La Roncière, *Les portulans de la Bibliothèque de Lyon*, fasc. 8 of *Les Portulans Italiens* in Lyon, Bibliothèque de la Ville, *Documents paléographiques, typographiques, iconographiques* (Lyons, 1929), 793.

35. A chart, supposedly fifteenth-century French but actually sixteenth-century Italian, is described in Gustavo Uzielli and Pietro Amat di San Filippo, *Mappamondi, carte nautiche, portolani ed altri monumenti cartografici specialmente italiani dei secoli XIII–XVII*, 2d ed., 2 vols., *Studi Biografici e Bibliografici sulla Storia della Geografia in Italia* (Rome: Società Geografica Italiana, 1882; reprinted Amsterdam: Meridian, 1967), vol. 2, no. 403. See also Roberto Almagià, *Monumenta cartographica Vaticana*, 4 vols. (Rome: Biblioteca Apostolica Vaticana, 1944–55), vol. 1, *Planisferi, carte nautiche e affini dal secolo XIV al XVII esistenti nella Biblioteca Apostolica Vaticana*, 84.

36. See Theobald Fischer, *Sammlung mittelalterlicher Welt- und Seekarten italienischen Ursprungs und aus italienischen Bibliotheken und Archiven* (Venice: F. Ongania, 1886; reprinted Amsterdam: Meridian, 1961), 95 (where, following Uzielli, it was wrongly described as a chart of 1491).

37. Paul Gaffarel, "Etude sur un portulan inédit de la Bibliothèque de Dijon," *Mémoires de la Commission des Antiquités de la Côte-d'Or* 9 (1877): 149–99, esp. 160. For corrective, see Roberto Almagià, "Una carta nautica di presunta origine genovese," *Rivista Geografica Italiana* 64 (1957): 58–60, esp. 59, and Isabelle Raynaud-Nguyen,

Muslim works, three charts were drawn by Jehuda ben Zara in Alexandria and Galilee (see appendix 19.2). Lost charts that Bartolomeo Colombo made in England, one of which he presented to Henry VII on 13 February 1488, would need to be set alongside Bianco's 1448 chart as evidence of early chartmaking in England.³⁸

TERMINOLOGY

Ideally, the terminology of a subject should provide a common platform for those working in it. With portolan charts, however, the basic nomenclature continues to divide; it is itself part of the controversy. Most English-speaking writers use the term "portolan chart" (or sometimes the variant "portulan chart"). Derived from the Italian word *portolano*, for a collection of written sailing directions, this stresses (whether intentionally or not) the way the charts are assumed to complement the written account. The term "portolan chart" has been traced back no further than the 1890s.³⁹ The earlier, and incorrect, shorthand form "portolan" continues to cause unnecessary confusion between the charts and the written directions. The British Museum in its 1844 printed catalog of manuscript maps referred to a "portolano or collection of sea charts."⁴⁰ This ambiguous usage has recurred regularly since.

Cortese and Teixeira da Mota sum up a general feeling that, while far from ideal, the designation "portolan chart" is now too well established to be altered.⁴¹ There have, however, been dissenters. In 1925 Max Eckert suggested they be called "rhumb line charts."⁴² It was apparently Arthur Breusing who first proposed in 1881 the charged term "loxodromic charts."⁴³ A loxodrome is a line of constant compass bearing; its employment here thus begs a number of questions about the part played by the magnetic compass in both the construction and the use of the charts. "Loxodromic charts" has found few champions since. A similar term, "compass charts,"⁴⁴ has certainly been in existence for more than a century but has the same drawbacks. To avoid all these overtones, French, Italian, Portuguese (when not writing in English), and Spanish scholars often refer to them simply as "nautical charts" or some variant thereof.⁴⁵ While free from unwanted connotations, the term is too broad to distinguish portolan charts from any other type of marine chart, including those produced today.

Contemporary usage is of little assistance. Eva G. R. Taylor cataloged the following terms employed at the time: *carta de Navegar*, *carta pro Navigando*, *mappamundi*, *mappae maris*, even the confusing *compasso*, which could equally well mean a portolano.⁴⁶ Pietro Vesconte used the Latin words *carta* and *tabula* for his own charts; a Catalan ordinance of 1354 and an official

Portuguese document of 1443 mentioned *carta de marear*; and Antonio Pelechan in 1459 turned the subject of his specialized chart of the Adriatic into a description of the sheet it was drawn upon, terming it *cholfo* (i.e., gulf).⁴⁷ Despite all these designations, the term "portolan chart" seems to be the most convenient for present-day use, and it will accordingly be employed throughout this essay.

"L'hydrographie et l'événement historique: Deux exemples" (paper prepared for the Fourth International Reunion for the History of Nautical Science and Hydrography, Sagres-Lagos, 4–7 July 1983).

38. Fernando Colombo, *Historie del Signor Don Fernando Colombo: Nelle quali s'hà particolare, & vera relatione della vita, e de' fatti dell'Ammiraglio Don Christoforo Colombo, suo padre* (Venice, 1571), fol. 31v.

39. "Portolankarte." Franz R. von Wieser, "A. E. v. Nordenskiöld's Periplus," *Petermanns Mitteilungen* 45 (1899): 188–94, used the term over thirty times in one review. Although Nordenskiöld habitually referred to the charts as "portolani," he did use the term "portolano maps" at least once in an earlier work—see A. E. Nordenskiöld, "Résumé of an Essay on the Early History of Charts and Sailing Directions," *Report of the Sixth International Geographical Congress, London, 1895* (1896): 685–94, esp. 694; reprinted in *Acta Cartographica* 14 (1972): 185–94, esp. 194 (I am grateful to Francis Herbert for the second reference). The statement that "the term 'portolan chart' first occurs in Italy in the thirteenth century," made in a translated article by Hans-Christian Freiesleben, is apparently without foundation; see his "The Still Undiscovered Origin of the Portolan Charts," *Journal of Navigation* (formerly *Navigation: Journal of the Institute of Navigation*) 36 (1983): 124–29, esp. 124.

40. British Museum, *Catalogue of the Manuscript Maps, Charts, and Plans, and of the Topographical Drawings in the British Museum*, 3 vols. (London, 1844–61), 1:16, referring to the 1467 Benincasa atlas. The original title of a recent general study of portolan charts was *Les portulans*, followed by the subtitle, *Cartes marines du XIII^e au XVII^e siècle* (Fribourg: Office du Livre, 1984). It is the English version that is cited in this essay: Michel Mollat du Jourdin and Monique de La Roncière with Marie-Madeleine Azard, Isabelle Raynaud-Nguyen, and Marie-Antoinette Vannereau, *Sea Charts of the Early Explorers: 13th to 17th Century*, trans. L. le R. Dethan (New York: Thames and Hudson, 1984).

41. Cortese and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:xxvi (note 29).

42. "Rhumbenkarten." See Max Eckert, *Die Kartenwissenschaft: Forschungen und Grundlagen zu einer Kartographie als Wissenschaft*, 2 vols. (Berlin and Leipzig: Walter de Gruyter, 1921–25), 2:59.

43. Arthur A. Breusing, "Zur Geschichte der Kartographie: La Toleta de Marteloio und die loxodromischen Karten," *Kettlers Zeitschrift für Wissenschaft: Geographie* 2 (1881): 129–33, 180–95; reprinted in *Acta Cartographica* 6 (1969): 51–70.

44. Sophus Ruge, *Ueber Compas und Compaskarten*, Separat Abdruck aus dem Programm der Handels-Lehranstalt (Dresden, 1868).

45. *Cartes nautiques, carte nautique, and cartas náuticas*.

46. Taylor, *Haven-Finding Art*, 115–17 (note 7).

47. On Vesconte's *carta* and *tabula* see Lelio Pagani, *Pietro Vesconte: Carte nautiche* (Bergamo: Grafica Gutenberg, 1977), 7; on the Catalan ordinance see Ernest Théodore Hamy, "Les origines de la cartographie de l'Europe septentrionale," *Bulletin du Comité des Travaux Historiques et Scientifiques: Section de Géographie Historique et Descriptive* 3 (1888): 333–432, esp. 416; on the Portuguese document see Cortese, *History of Portuguese Cartography*, 2:118 (note 3); and on Pelechan's *cholfo* see pp. 433–34 and note 433.

CHARACTERISTICS AND DEFINITION

A number of features, albeit not necessarily present in all cases, set the portolan charts apart from sea charts in general. The charts of the two centuries we are considering (that is, up to 1500) are almost always drawn in inks on vellum.⁴⁸ Though the larger charts might require more than one piece of vellum, most use a single animal skin. The “neck,” which has sometimes been shaped, is often clearly visible at one side.⁴⁹ Charts were normally rolled⁵⁰—although many have since been straightened out—and a few are still attached to what may well be their original wooden rollers. A leather thong would have fastened the chart, sometimes being passed through paired incisions visible on the necks of some surviving examples—among them Pietro Vesconte’s of 1311.⁵¹ Atlases, which were usually the equivalent of a loose chart spread over several sheets, were necessarily treated differently. Although the separate vellum sheets might be handled like a book and provided with a typical binding, Pietro Vesconte had from the outset appreciated the advantages of pasting the vellum sheets onto wooden boards—a procedure that would have obviated distortion or shrinkage in salt water. Though the boards no longer survive from his 1313 atlas, they are still in evidence on the two he produced



FIG. 19.1. PHYSICAL CHARACTERISTICS OF A PORTOLAN ATLAS. Vellum charts could be mounted on wood, but Grazioso Benincasa used cardboard for this 1469 atlas. As usual, the charts are backed onto one another. Height of the original: 32.7 cm. By permission of the British Library, London (Add. MS. 31315).

in 1318.⁵² Thick cardboard was an adequate substitute for wood, as Grazioso Benincasa found in the 1460s (fig. 19.1).

Turning to the content of both single charts and atlases, the most obvious of the common denominators that link the earliest survivor (the *Carte Pisane*) to those of several centuries later is the network of interconnecting rhumb lines.⁵³ At first glance an apparent jumble, on closer examination these will prove to be arranged in a coherent pattern. Around the circumference of one or sometimes a tangential pair of “hidden” circles (usually occupying the maximum available area) are sixteen equidistant intersection points or “secondary centers.”⁵⁴ Each is joined to most or all of the others to provide thirty-two directions, which are thus repeated

48. Konrad Kretschmer predicted that any drawn on paper would be exceptional; see *Die italienischen Portolane des Mittelalters: Ein Beitrag zur Geschichte der Kartographie und Nautik*, Veröffentlichungen des Instituts für Meereskunde und des Geographischen Instituts an der Universität Berlin, vol. 13 (Berlin, 1909; reprinted Hildesheim: Georg Olms, 1962), 35. Only two have so far been noted: Rome, Biblioteca Apostolica Vaticana, Rossi. 676 and the so-called Lesina chart of the Caspian (which probably dates from the first quarter of the sixteenth century); see E. P. Goldschmidt, “The Lesina Portolan Chart of the Caspian Sea” (with a commentary by Gerald R. Crone), *Geographical Journal* 103 (1944): 272–78. Paper was not produced in Europe in large quantities until the early fifteenth century; see Janet Backhouse, *The Illuminated Manuscript* (Oxford: Phaidon, 1979), 7–8. Nevertheless, Luca del Biondo, writing from Bruges in 1398 to a Florentine correspondent in Majorca, requested a chart on paper; see Charles de La Roncière, “Une nouvelle carte de l’école cartographique des Juifs de Majorque,” *Bulletin du Comité des Travaux Historiques et Scientifiques: Section de Géographie* 47 (1932): 113–18, esp. 118.

49. For a discussion of alternative western and eastern necks, see below, p. 444.

50. A commentator writing in 1404 described how the sailors “opened their charts”; see Gutierre Díaz de Gámez, *The Unconquered Knight: A Chronicle of the Deeds of Don Pero Niño, Count of Buelna*, trans. and selected by Joan Evans from *El Vitorial* (London: Routledge, 1928), 97.

51. Pagani, *Vesconte*, 20 (note 47).

52. On the 1313 atlas boards see Myriem Foncin, Marcel Desombes, and Monique de La Roncière, *Catalogue des cartes nautiques sur vélin conservées au Département des Cartes et Plans* (Paris: Bibliothèque Nationale, 1963), 10; on the 1318 atlases’ boards see Pagani, *Vesconte*, 20, 27 (note 47).

53. The time-hallowed term “rhumb line” is retained for convenience throughout this essay. This should not be taken to imply acceptance of the idea that these are rhumb lines in the true sense of the word. (See below, p. 385, for discussion on this point.)

54. The unsatisfactory twenty-four intersection point network on the general chart of the British Library’s Cornaro atlas (Egerton MS. 73; see plate 23) is an exception to the general rule, as are the simplified networks devised, for reasons of limited space, on the small Luxoro and Pizigano atlases. See Thomas R. Smith, “Rhumb-Line Networks on Early Portolan Charts: Speculations Regarding Construction and Function” (paper prepared for the Tenth International Conference on the History of Cartography, Dublin, 1983), for the various arrangements that early chartmakers devised for the junction of the two rhumb systems on twin-circle charts.

a number of times across the chart.⁵⁵ This network shares a common orientation with the coastal outlines but is otherwise unrelated to them. The standard practice was for the eight “winds” (i.e., north, northeast, east, etc.) to be drawn in black or brown, the next eight half-winds (north-northeast, east-northeast, etc.) to be in green, and the sixteen quarter-winds (north by east, northeast by north, northeast by east, etc.) to be in red. This consistent convention allowed the navigator to pick his wind or direction without having to count around from one of the recognizable primary directions.⁵⁶

In terms of their geographical scope, portolan charts would usually cover at least the area of Nordenskiöld’s “normal-portolano”—the Mediterranean and Black seas—sometimes adding to this the Atlantic coasts from Denmark to Morocco and the British Isles (plate 23). The scale varies considerably from one chart to another. At a rough estimate, a typical chart might measure about 65 by 100 centimeters and be drawn to an approximate scale of 1:6 million.⁵⁷ The early charts are not provided with a graticule, latitude being first indicated at the beginning of the sixteenth century. A scale bar was usually provided, and one or more of its varying number of larger divisions would be subdivided into five sections, each representing ten *miglia*.⁵⁸ Unfortunately, no key to the unit of measurement was supplied, and this has led to much discussion of the scale(s) involved.⁵⁹

From the Carte Pisane onward there are clear indications of simplification and exaggeration in the coastal drawing. Because of their greater navigational significance, islands and capes tend to be enlarged.⁶⁰ In some sections the stretch between headlands has been formalized into regular arcs, owing more to geometry and aesthetics than to hydrographic reality.⁶¹ The headlands themselves frequently conform to one of a number of repeated types: pointed, rounded, or wedge shaped. River estuaries are regularly conventionalized as short parallel lines leading inward. The tendency toward simplification becomes more noticeable in regions outside the Mediterranean for which there was little or no firsthand experience, such as the Atlantic, Baltic, and inland areas. While the artificiality of these coastal conventions reduces our confidence in the accuracy of the very small hydrographic details, it suggests that the draftsman’s main concern was to locate headlands (which had to be rounded) and estuaries (which provided both fresh water and access to the interior). With these features as fixed points, a remarkably accurate overall picture of the Mediterranean was achieved—at least after improvements had been made to the very earliest attempts. These constantly repeated coastlines and their steadily evolving array of place-names provide the portolan charts with their two most significant features.

Certain conventions were standard. So that there

should be no interference with the detailing of the coast or its offshore hazards, the place-names were written inland, at right angles to the shore. This practice meant that the names have no constant orientation but follow one another in a neat unbroken sequence around the entire continental coastlines. To avoid ambiguity, the names of nearby islands run in the opposite direction from names on the mainland. On the basis of north orientation, the west coasts of Italy and Dalmatia, for example, are the “right way” around, whereas Italy’s Adriatic coastline is “upside down.” The quotation

55. That the rhumb lines terminate at the intersection points on some of the earliest charts makes these appear noticeably different from later examples whose rhumb lines continue to the edges of the chart. No particular significance should be attached to this. Most later draftsmen carried the rhumb lines through the intersection points so as to fill all the sea area with wind directions, but the particular pattern adopted in each case was probably determined as much by a desire for mathematical balance as by any navigational considerations.

56. These and other conventions are described by Bartolomeo Crescenzo in his *Nautica Mediterranea* (Rome, 1602). Nordenskiöld, *Periplus*, 18 (note 14), gives a transcription; an English translation appears in Peter T. Pelham, “The Portolan Charts: Their Construction and Use in the Light of Contemporary Techniques of Marine Survey and Navigation” (master’s thesis, Victoria University of Manchester, 1980), 8–9. Silvanus P. Thompson, “The Rose of the Winds: The Origin and Development of the Compass-Card,” *Proceedings of the British Academy* 6 (1913–14): 179–209, cited a number of works, published between 1561 and 1671, that specified the rhumb line colors to be used (p. 197).

57. Hans-Christian Freiesleben, “Map of the World or Sea Chart? The Catalan Mappamundi of 1375,” *Navigation: Journal of the Institute of Navigation* 26 (1979): 85–89, esp. 87. See also Nordenskiöld, *Periplus*, 24 (note 14).

58. James E. Kelley, Jr., “The Oldest Portolan Chart in the New World,” *Terrae Incognitae: Annals of the Society for the History of Discoveries* 9 (1977): 22–48, esp. 32. The Carte Pisane is the exception to this, with ten subdivisions, each worth five *miglia*. A note on the Carignano map explains how the scale worked; for variant transcriptions of its wording, see Bacchisio R. Motzo, “Note di cartografia nautica medioevale,” *Studi Sardi* 19 (1964–65): 349–63, esp. 357–58.

59. Pagani, *Vesconte*, 14 n. 32 (note 47); see also Kelley, “Oldest Portolan Chart,” 36–39, 46–48 (note 58), and below, p. 388–89.

60. Magnaghi, “Nautiche, carte,” 324b (note 4). The same kinds of features that are emphasized in this way on the charts serve as the intended destinations for the direct voyages described in the mid-thirteenth-century *Lo compasso da navigare*; see Massimo Quaini, “Catalogna e Liguria nella cartografia nautica e nei portolani medievali,” in *Atti del 1° Congresso Storico Liguria-Catalogna: Ventimiglia-Bordighera-Albenga-Finale-Genova, 14–19 ottobre 1969* (Bordighera: Istituto Internazionale di Studi Liguri, 1974), 549–71, esp. 558–59.

61. Avelino Teixeira da Mota detected a new style of realism in the coastal drawing of the Portuguese chart in Modena, Biblioteca Estense e Universitaria, C.G.A. 5c, which he dated to between 1471 and 1485; see “Influence de la cartographie portugaise sur la cartographie européenne à l’époque des découvertes,” in *Les aspects internationaux de la découverte océanique aux XV^e et XVI^e siècles: Actes du V^{ème} Colloque Internationale d’Histoire Maritime*, ed. Michel Mollat and Paul Adam (Paris: SEVPEN, 1966), 223–48, esp. 227.

marks warn against twentieth-century attitudes. Intended to be rotated, portolan charts have no top or bottom. It is only when there are nonhydrographic details designed to be viewed from one particular direction that we can ascribe any definite orientation to the chart concerned. Examples would be the corner portraits of saints on some of Vesconte's atlases (both those of 1318, the undated Lyons atlas, and the 1321 Perrino Vesconte atlas in Zurich), which establish them as oriented to the south, and the smaller of the two signatures on his chart of 1311. A similar conclusion can be drawn from the majuscules denoting the continents on the Carignano map (in contrast to the majuscules and notes on the Dalorto and Dulcert charts, which are conveniently arranged to face the nearest outside edge). For most of the early charts, however—and this includes the Carte Pisane—there is no way of telling which, if any, of the four main directions they were primarily intended to be viewed from. Nor can it readily be determined which is the front of an atlas, and hence which way its charts are oriented.⁶²

Further indication that the portolan charts belong to one self-conscious family comes from a number of consistent color conventions (plate 24). The three different inks habitually used for the rhumb line network have already been mentioned. To those can be added the use of red to pick out the more significant places. These are not necessarily ports, as has often been assumed:⁶³ for example, among the red names are found cities like Bilbao, Pisa, and Rome, which had their own named outlets (fig. 19.2).

Islands would often be picked out in different colors to distinguish them from one another and from the adjacent mainland, and important river deltas (particularly the Rhône, Danube, and Nile) tended to be treated in the same way.⁶⁴ This attractive device also served the more practical function of emphasis. A few islands were singled out for special treatment. Lanzarote in the Canaries was covered with a red cross, possibly on a silver ground, from the time of its first appearance on Angelino Dulcert's chart of 1339. Although Dulcert attributed its discovery to the Genoese Lanzarotto Malocello, and despite the red cross of Saint George, it appears that Genoa never laid claim to the island.⁶⁵ Khios, too, was occasionally overlaid with the Genoese cross of Saint George. The earliest instances of this are on two charts produced in Majorca by Valseca in 1439 and 1447 and on three undated, or controversially dated, atlases that probably belong to the first half of the fifteenth century.⁶⁶ Rhodes, home of the Knights Hospitalers from 1309 onward, was often identified by a white or silver cross on a red ground.⁶⁷ Despite the fact that the Knights were forced to leave Rhodes in 1523, this custom was continued long afterward. It was later applied to their new home, Malta, as well.

Other conventions found on the more ornate Catalan-style charts will be referred to later. They share with Italian work, however, a consistent approach to navigational symbols. A cross or a series of black dots meant rocks, while red dots indicated sandy shallows.⁶⁸ These oblique references provide the only information on the depth of water.⁶⁹

It must be admitted that this description of a typical portolan chart falls short of a watertight definition; it is in a sense a list of superficial characteristics. What links

62. Since, for religious reasons, medieval *mappaemundi* were usually oriented to the east, there was no well-established tradition in 1300 that north should be at the top. Many later maps, Fra Mauro's of 1459 and Erhard Etzlaub's of 1500, for example, were oriented to the south, as were the sheets in Bianco's 1436 atlas and a chart in Rome, Biblioteca Apostolica Vaticana, Borgiano V. The separate sheets in a portolan atlas would sometimes be oriented to different points of the compass so as better to accommodate the shapes involved. On this see also Cornelio Desimoni, "Elenco di carte ed atlanti nautici di autore genovese oppure in Genova fatti o conservati," *Giornale Ligustico* 2 (1875): 47–285, esp. 283–85.

63. For example, Nordenskiöld, *Periplus*, 18 (note 14); Crone, *Maps and Their Makers*, 12 (note 11); Derek Howse and Michael Sanderson, *The Sea Chart* (Newton Abbot: David and Charles, 1973), 19.

64. On the islands see Magnaghi, "Nautiche, carte," 324b (note 4). Georges Pasch pointed out that the islands around Aigues-Mortes (Rhône delta) were habitually colored yellow and blue; see his "Drapeau des Canariens: Témoignage des portulans," *Vexillologia: Bulletin de l'Association Française d'Etudes Internationales de Vexillologie* 3, no. 2 (1973): 51.

65. Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:xxix (note 29). Aguiar also placed a cross over Flores (Azores) in 1492.

66. London, British Library, Add. MS. 19510 ("Pinelli-Walckenaer atlas"); Lyons, Bibliothèque Municipale, MS. 179; Venice, Biblioteca Nazionale Marciana, It. VI, 213 ("Combitis atlas"). On their dating see table 19.3, pp. 416–20. The convention continued until at least the end of the sixteenth century, although the Genoese were expelled in 1566 after having controlled Khios for two centuries.

67. The chart acquired by Nico Israel of Amsterdam at Sotheby's in 1980 and tentatively dated 1325 gave the island an unusual green backing; Sotheby's *Catalogue of Highly Important Maps and Atlases*, 15 April 1980, Lot A; Nico Israel, Antiquarian Booksellers, *Interesting Books and Manuscripts on Various Subjects: A Selection from Our Stock . . .*, catalog 22 (Amsterdam: N. Israel, 1980), no. 1.

68. Although the Carte Pisane has many instances of the cross symbol, it is not until the 1311 Vesconte chart that the use of stippling for shoals is encountered. Magnaghi made the unconvincing suggestion that the simple isolated crosses, found from the time of the Carte Pisane onward and in deep water, were intended to indicate localized and up-to-date magnetic declination; see Magnaghi, "Nautiche, carte," 328a (note 4). Yet the cross off the southern coast of Italy on the Carte Pisane has the word *Guardate* (Beware) written twice beside it and was clearly intended for a rock. On the hydrographic symbols of early charts, see Mary G. Clawson, "Evolution of Symbols on Nautical Charts prior to 1800" (master's thesis, University of Maryland, 1979).

69. References to depths stated in *parmi* (palms) in Magnaghi, "Nautiche, carte," 325a (note 4), seem to apply more properly to the sixteenth century or later. On early soundings, see Marcel Destombes, "Les plus anciens sondages portés sur les cartes nautiques aux XVI^e et XVII^e siècles," *Bulletin de l'Institut Océanographique*, special no. 2 (1968): 199–222.



FIG. 19.2. MAJOR PLACE-NAMES ON MEDIEVAL PORTOLAN CHARTS. This map shows place-names that were habitually picked out in red on fourteenth- and fifteenth-

century portolan charts as being of greater importance. Modern equivalents are given in parentheses, and questionable locations are indicated with open circles.

the charts is imitation; yet, as will be demonstrated later, this continuous copying failed to curb a constant and wide-ranging development. Thus the charts could change in certain essential respects by barely perceptible stages. The addition of latitude scales in the sixteenth century does not necessarily mark the advent of a new type of chart. Indeed, drafts that have strong claims to be termed portolan charts were still being produced throughout the seventeenth century.⁷⁰

An additional complication concerns the overlap of the charts and a number of contemporary world maps, but though the latter's authors frequently incorporated the portolan chart outlines, the scale was rarely sufficient for more than a sprinkling of names.⁷¹ These maps would have lacked any possible navigational application. So too would the simplified, distorted extracts from the portolan charts that illustrated the margins of fifteenth-century manuscripts of Leonardo Dati's *La sfera*.⁷² Of more questionable status are those manuscripts that borrowed the portolan chart outlines and place-names but not their rhumb lines. Examples can be found in the fifteenth-century island books (*isolarii*) of Cristoforo Buondelmonti and Henricus Martellus Ger-

70. See the comment by the French pilot Dechaies in 1677 that charts without latitude graduations were still in use in the Mediterranean, quoted by Avelino Teixeira da Mota, "L'art de naviguer en Méditerranée du XIII^e au XVII^e siècle et la création de la navigation astronomique dans les océans," in *Le navire et l'économie maritime du Moyen-Age au XVIII^e siècle principalement en Méditerranée: Travaux du II^{ème} Colloque Internationale d'Histoire Maritime*, ed. Michel Mollat (Paris: SEVPEN, 1958), 127–54, esp. 139.

71. For instance, the Catalan world map at Modena, the Genoese world map in Florence, and the acknowledged works of Giovanni Leardo, Fra Mauro, Pirrus de Noha, and Albertin de Virga all incorporated portolan chart outlines. On these see Destombes, *Mappemondes* (note 10 and above, chap. 18). Opicinus de Canistris (1296 to ca. 1350), a Pavian who worked at the papal court in Avignon, drew a series of imaginative maps, while acknowledging in a text written between 1334 and 1338 his use of nautical charts; see Roberto Almagià, "Intorno alla più antica cartografia nautica catalana," *Bollettino della Reale Società Geografica Italiana*, 7th ser., 10 (1945): 20–27, esp. 23–25; and Motzo, "Cartografia nautica medioevale," 349–59 (note 58).

72. Almagià, *Vaticana*, 1:128–29 (note 35). Almagià also disposes of Nordenskiöld's belief that the Dati designs were the direct descendants of the detailed skipper charts, to which the latter attributed the origin of the portolan charts; see Nordenskiöld, *Periplus*, 45 (note 14); idem, "Dei disegni marginali negli antichi manoscritti della *Sfera* del Dati," *Bibliofilia* 3 (1901–2): 49–55.

manus (plate 25).⁷³ These have sometimes been treated as nautical charts, even though they clearly had no navigational function.⁷⁴ The same may apply to “charts” reported in Ptolemaic manuscripts.⁷⁵

A definition that insisted on at least potential marine use would also exclude the Giovanni da Carignano map (Florence, Archivio di Stato, CN 2, destroyed in 1943). Produced at some point in the early fourteenth century, this has been seen by a number of commentators as the most important portolan chart after the Carte Pisane. Despite this, the Carignano map’s few place-names are mostly written in the sea and in the opposite direction from those on all other surviving charts. It has, for example, almost exactly half the Carte Pisane’s total for Italy. Islands and coastal features thus become confused, and its priestly author can hardly have had sailors in mind.⁷⁶

THE ORIGIN AND COMPILATION OF THE PORTOLAN CHARTS

Among the research problems connected with the portolan charts, the question of their origin is perhaps the most intractable.⁷⁷ Although a number of the conflicting theories have had their committed champions, the skeptics are probably in the majority, particularly among modern writers. The title of a very recent pronouncement, “The Still Undiscovered Origin of the Portolan Charts,” is a case in point.⁷⁸ Despite the thousands of scholarly words expended on the subject, most of the hypotheses about portolan chart origins have remained just that. In the absence of corroborating data they often appear to be less explanations than creation myths. Cortesão’s comment on portolan chart origins, made fifteen years ago, that “no satisfactory solution has yet been reached,” remains a valid judgment.⁷⁹ Instead of simply endorsing any single existing theory, however venerable, it seems preferable to summarize briefly the principal lines of earlier arguments. Theories of ancient and medieval origin will be contrasted, and the supposed involvement of the magnetic compass in the charts’ compilation will be reviewed, as will other related issues: the nature of any discernible projection, the various ways the initial regional charts might have been constructed, and the portolan charts’ most likely place of origin.

The earliest reliably documented references to the portolan charts date from the late thirteenth century, the first of them to 1270 (see below, p. 439). Regardless of the fact that this date almost coincides with that often assigned to the oldest surviving chart, the Carte Pisane, many attempts have been made to justify an older beginning.⁸⁰ Cortesão, for example, proposed an early thirteenth-century date, and Richard Oldham was for pressing still further back to the twelfth or even the eleventh

century.⁸¹ For all their differences of detail, however, these theories remained compatible with the idea of a medieval invention. On the other hand, a sizable body of scholarly opinion over the past century or so has speculated instead that the portolan charts were the resurrected masterpieces of the ancient world.

ANCIENT ORIGIN

Even among what might be termed the “ancient” rather than the “medievalist” school, there has been great divergence of opinion. Most extreme, in terms of both age and plausibility, is Hapgood’s contention that the inception of the portolan charts should be traced back to Neolithic times.⁸² Less controversial, but still little sup-

73. Aegean and Black Sea sheets are reproduced in *The Netherlands—Bulgaria: Traces of Relations through the Centuries—Material from Dutch Archives and Libraries on Bulgarian History and on Dutch Contacts with Bulgaria*, ed. P. Kolev et al. (Sofia: State Publishing House “Septemvri,” 1981), pls. 4 and 5. An Aegean sheet is illustrated in Pietro Frabetti, *Carte nautiche italiane dal XIV al XVII secolo conservate in Emilia-Romagna* (Florence: Leo S. Olschki, 1978), pl. VII. For a discussion on Buondelmonti’s *isolario*, the earliest known, see below, chap. 20, pp. 482–84.

74. They were treated as nautical charts, for example, by Frabetti, *Carte nautiche italiane*, 33 (note 73).

75. For example, Paris, Bibliothèque Nationale, Département des Manuscrits, MS. Lat. 4801, and Rome, Biblioteca Angelica, MS. 2384.

76. This is somewhat surprising considering that Carignano was rector of a church on the waterfront (San Marco al Molo) and that in 1314 he fell foul of his archbishop for storing sails and other nautical paraphernalia in and around the church and in the clergy house; see Arturo Ferretto, “Giovanni Mauro di Carignano Rettore di S. Marco, cartografo e scrittore (1291–1329),” *Atti della Società Ligure di Storia Patria* 52 (1924): 33–52, esp. 43. Arthur R. Hinks pointed out that the Carignano map’s color conventions are also atypical; see his *Portolan Chart of Angellino de Dalorto 1325 in the Collection of Prince Corsini at Florence, with a Note on the Surviving Charts and Atlases of the Fourteenth Century* (London: Royal Geographical Society, 1929), 8. Nevertheless, it would be unnecessarily pedantic to omit the Carignano map altogether from a history of the portolan charts.

77. Though we do not necessarily have to be as pessimistic about the chances of solving it as is Youssouf Kamal, *Hallucinations scientifiques (les portulans)* (Leiden: E. J. Brill, 1937), 2.

78. Freiesleben, “Still Undiscovered Origin,” 124–29 (note 39).

79. Cortesão, *History of Portuguese Cartography*, 1:223 (note 3).

80. There is no validity for the 1260–69 date suggested for the chart-inspired Brunetto Latini world map, see above, p. 325 n. 200.

81. Cortesão, *History of Portuguese Cartography*, 1:229 (note 3). Richard D. Oldham, “The Portolan Maps of the Rhône Delta: A Contribution to the History of the Sea Charts of the Middle Ages,” *Geographical Journal* 65 (1925): 403–28. Another who supported an eleventh-century date for the portolan chart origin was George Sarton, *Introduction to the History of Science*, 3 vols. (Baltimore: Williams and Wilkins, 1927–48), vol. 2, *From Rabbi ben Ezra to Roger Bacon*, 1047, and he added a strange suggestion of possible Scandinavian origin—on the basis of the hardly relevant Adam of Bremen periplus.

82. Charles H. Hapgood, *Maps of the Ancient Sea Kings: Evidence of Advanced Civilization in the Ice Age*, rev. ed. (New York: E. P. Dutton, 1979).

ported, have been Cortesão's further suggestions that the Phoenicians or Egyptians were responsible for developing the charts, notwithstanding the conflict with his support for a medieval origin.⁸³

It is, however, to the worlds of ancient Greece and Rome that we have most often been directed in the search for a solution to this mystery. Strabo, Agathemerus, and Pliny have all been cited as sources for the contention that sea charts were used in ancient times,⁸⁴ and one writer has detected traces of the work of Eratosthenes in the medieval charts.⁸⁵ Yet the name most frequently mentioned is Marinus of Tyre, known to us through the writings of his near contemporary, Ptolemy. It was Marinus who introduced projections into map-making about A.D. 100; according to some accounts of a disputed text in the *Geography*, Marinus's work has been interpreted as a sea chart.⁸⁶ On this single reference hangs the repeated assertion that the medieval charts were little more than revivals of his work.⁸⁷ Laguarda Trías made the specific claim that the supposedly fifteenth-century chart of the Mediterranean in Istanbul (Topkapi Sarayi, Deissmann 47) was nothing less than a reproduction of the lost Marinus chart.⁸⁸ If, as he suggests, the rhumb line system replaced the original square-grid network, the former, being therefore astronomically determined, would point to true, not magnetic north; but there are weighty arguments for considering the portolan charts to be compass inspired (as discussed below, pp. 384–85). Nor is there any justification for Laguarda Trías's further claim that the atypical and not especially early Istanbul sheet reflects the appearance of the prototype chart.⁸⁹

Attempts have been made to bridge the gap of more than a thousand years between Ptolemy's comment and the medieval charts, but with little conviction, since the tenth-century Arab reference to Marinus was apparently concerned with a world map and not a sea chart.⁹⁰ Nor is it easy to assign to the Arabs the role of intermediaries between the ancient and medieval worlds in this context.⁹¹ The few early Arab charts that survive are lacking in originality, and there are many points of dissimilarity between the best Arab work, that of al-Idrisi, and the earliest Western charts.⁹² Nor is any influence traceable to the imprecisely described Indian Ocean charts, of the type shown to Marco Polo at the end of the thirteenth century.⁹³

A theory of Roman origin has, however, recently been revived by Georges Grosjean.⁹⁴ His contention is not that the Romans produced sea charts as such but that a dependable scaled map of the Mediterranean would have been the indirect result of Roman centuriation. This hypothesis has two major weaknesses besides the absence of irrefutable evidence. First, current archaeological findings indicate that no more than sections of the

Roman Empire were centuriated,⁹⁵ and second, even Grosjean admitted there was virtually no trace of Roman influence in the portolan chart toponymy.⁹⁶

MEDIEVAL ORIGIN

Passing briefly over two further suggestions—that a lost map used by the Ravenna cosmographer (soon after A.D. 700) might have supplied the missing link,⁹⁷ and that the credit for inventing the portolan charts be accorded to the Byzantines shortly after the year 1000⁹⁸—the argument moves on to the medieval period. The “medi-

83. Cortesão, *History of Portuguese Cartography*, 1:223 and 229 (note 3).

84. Richard Uhdén, “Die antiken Grundlagen der mittelalterlichen Seekarten,” *Imago Mundi* 1 (1935): 1–19, esp. 2–4.

85. Rolando A. Laguarda Trías, *Estudios de cartología* (Madrid, 1981), 29–41.

86. The word *pinax* used by Ptolemy in connection with Marinus and the mapmakers who followed him (*Geography* 1.17.1) simply means “map” rather than “chart.” I owe this comment to Professor O. A. W. Dilke.

87. Repeated, for example, by Nordenskiöld, *Periplus*, 48 (note 14); see also Laguarda Trías, *Estudios de cartología*, 22–28 (note 85). For the opposing view, denying discernible links between the ancient periplus and medieval portolan charts, see O. A. W. Dilke, *Greek and Roman Maps* (London: Thames and Hudson, 1985), 143.

88. Laguarda Trías, *Estudios de cartología*, 24 (note 85).

89. Laguarda Trías, *Estudios de cartología*, 24–25 (note 85).

90. On the reference to Marinus see 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), 1:337.

91. Cortesão, *History of Portuguese Cartography*, 1:224 (note 3).

92. Kamal, *Hallucinations*, 15–16 (note 77).

93. Marco Polo, *The Travels of Marco Polo*, trans. Ronald Latham (London: Folio Society, 1968; reprinted Penguin Books, 1972), 240, 259, 303. Even more speculative is the unsubstantiated hypothesis that the portolan chart developed in South China in the twelfth century through Japanese intermediacy, subsequently reaching Europe via Persia; see an editorial note in *Imago Mundi* 12 (1955): 160.

94. Georges Grosjean, ed., *The Catalan Atlas of the Year 1375* (Dietikon-Zürich: Urs Graf, 1978), 17–18 (also an edition in German). A similar thesis had been proposed earlier in a work not mentioned in Grosjean's bibliography: Attilio Mori, “Osservazioni sulla cartografia romana in relazione colla cartografia tolemaica e colle carte nautiche medioevali,” in *Atti del III Congresso Nazionale di Studi Romani*, 5 vols. (Bologna: Cappelli, 1934), 1:565–75. This was discussed in the Monthly Record section of the *Geographical Journal* 87 (1936): 90–91.

95. O. A. W. Dilke, *The Roman Land Surveyors: An Introduction to the Agrimensores* (Newton Abbot: David and Charles, 1971), 134–58.

96. Grosjean, *Catalan Atlas*, 18 (note 94).

97. Giovanni Marinelli, “Venezia nella storia della geografia cartografica ed esploratrice,” *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti*, 6th ser., 7 (1888–89): 933–1000, esp. 946–47; Uhdén, “Die antiken Grundlagen,” 10–12 (note 84).

98. Matteo Fiorini, *Le proiezioni delle carte geografiche* (Bologna: Zanichelli, 1881), 648.

evalist” school is generally agreed that the portolan charts originated in the period leading up to their first documented existence in the late thirteenth century. Notwithstanding this broad consensus on the “when” of the problem, there have been widely differing answers to the “how” and “where” components of the same question. It is convenient, first of all, to divide this further group of conflicting opinions into two sections: those positing a single master copy and those offering theories of gradual or collaborative origin.

Among single-origin hypotheses, undoubtedly the most intriguing is Destombes’s hint that the Knights Templars might have been involved.⁹⁹ The members of this powerful order would certainly have had wide experience of the Near East before it was suppressed in 1312. Although the similarity between their red cross and that used to indicate east on Angelino de Dalorto’s chart of 1325/30 has been mentioned, this suggestion, like so many others, must languish for want of evidence.

Attempts have even been made to identify by name the supposed originator of these early sea charts. Noting that the Genoese admiral Benedetto Zaccaria had, from 1261 onward, served under different masters throughout the Mediterranean and Black seas, in commissions that ranged as far north as Scotland and France, de La Roncière wondered if he might have been the person responsible.¹⁰⁰ This theory, however, assumes but does not demonstrate the vital step from navigational experience to hydrographic innovation. Nor does de La Roncière’s claim that Zaccaria should be credited with improvements to the Atlantic toponymy between the time of the Carte Pisane and that of Vesconte provide proof of the admiral’s hydrographic abilities.¹⁰¹

Another suggestion was made by Nordenskiöld, that Ramón Lull was “if not the author at least the guiding spirit in the compilation of this master-piece” (the prototype chart).¹⁰² This hypothesis flowed naturally from Nordenskiöld’s conviction that the portolan charts had a Majorcan origin; yet this cannot be substantiated. On the other hand, the claim made by Motzo in 1947 that he had identified, in general terms, the author of a single prototype chart has attracted favorable comment.¹⁰³ In his commentary on the mid-thirteenth-century *Lo compasso da navigare*, the oldest systematic portolano, or collection of sailing directions, that survives for the Mediterranean,¹⁰⁴ Motzo concluded that *Lo compasso da navigare* and the prototype chart (not necessarily the Carte Pisane) formed part of the same work. In his opinion they were composed by the same person and based on the same data.¹⁰⁵ He proposed that the chart’s author might be looked for in the mathematical school of Leonardo Pisano (Fibonacci) or of his pupil Campano da Novara.¹⁰⁶

Examination of place-names in *Lo compasso da na-*

vigare pointed to its compilation between 1232, the date of the reestablishment of Agosta (Augusta) in Sicily (or possibly 1248, about which time a port was constructed in Aigues-Mortes), and the creation of Manfredonia in 1258.¹⁰⁷ Thorough comparison, however, of the toponymic lists extracted from *Lo compasso da navigare* and the Carte Pisane exposes notable discrepancies, and these make Motzo’s thesis less appealing. When the Black Sea is excluded, we find that roughly 40 percent of the Carte Pisane’s continental names are not to be found in *Lo compasso da navigare*.¹⁰⁸ This is unexpected, since *Lo compasso da navigare*’s author was free from the space restrictions imposed on the compiler of the Carte Pisane and frequently goes into far greater detail than was possible on a chart.

99. Marcel Destombes, “Cartes catalanes du XIV^e siècle,” in *Rapport de la Commission pour la Bibliographie des Cartes Anciennes*, 2 vols., International Geographical Union (Paris: Publié avec le concours financier de l’UNESCO, 1952), vol. 1, *Rapport au XVII^e Congrès International, Washington, 1952 par R. Almagià: Contributions pour un catalogue des cartes manuscrites, 1200–1500*, ed. Marcel Destombes, 38–63, esp. 38–39.

100. Charles de La Roncière, *La découverte de l’Afrique au Moyen Age: Cartographes et explorateurs*, Mémoires de la Société Royale de Géographie d’Égypte, vols. 5, 6, 13 (Cairo: Institut Français d’Archéologie Orientale, 1924–27), 1:40. However, Roberto Lopez in a special study on Zaccaria was unable to find any actual evidence in support of de La Roncière’s theory; see Roberto Lopez, *Genova marinara nel duecento: Benedetto Zaccaria ammiraglio e mercante* (Messina-Milan: Principato, 1933), 202–3, 212 n. 106.

101. De La Roncière, *Afrique*, 1:41–42 (note 100). See also Pagani, *Vesconte*, 17 (note 47). The improved toponymy found on Vesconte’s earliest charts affects all parts of the Mediterranean, not just the French coasts about which Zaccaria supposedly had special knowledge.

102. Nordenskiöld, *Periplus*, 34 (note 14).

103. Bacchisio R. Motzo, “Il Compasso da navigare, opera italiana della metà del secolo XIII,” *Annali della Facoltà di Lettere e Filosofia della Università di Cagliari* 8 (1947): 1–137.

104. An earlier fragment, covering a journey between Acre and Venice, survives in Venice, Biblioteca Nazionale Marciana, It. XI, 87. Kretschmer, *Die italienischen Portolane*, 200 (note 48), thought it belonged to the thirteenth century; see pp. 235–37 for his transcription.

105. Motzo, “Compasso da navigare,” XLVIII (note 103).

106. Motzo, “Compasso da navigare,” LI–LIV (note 103).

107. Motzo, “Compasso da navigare,” XXVII, XXX (note 103). See elsewhere for other estimates of *Lo compasso*’s date: between about 1250 and 1265 (p. v) and about 1245 and 1255 (p. XLVIII). When Louis IX acquired Aigues-Mortes, the area was uninhabited and there was no artificial harbor. However, the natural refuge Louis developed was already referred to as a port in a document of 1226; hence the mention of Aigues-Mortes in *Lo compasso* does not necessarily provide a terminus post quem of 1248; see Jules Papezy, *Mémoires sur le port d’Aiguesmortes* (Paris: Hachette, 1879), 36, 84–90.

108. The Black Sea is considered to have been added later to *Lo compasso*, though certainly before 1296, and the area is largely obliterated on the Carte Pisane.

Lo compasso da navigare's strange lacunae, involving whole stretches of coastline—Manfredonia to Fermo, Venice to Trieste (and with scattered exceptions, to Durazzo), Valona to Moton, Landrimiti to Bodrum, and the Libyan coast between Tolometa and Tripoli—provide only a partial explanation for the disagreement between the two works. Even if *Lo compasso da navigare*'s omitted coastlines are excluded from the comparison, on the grounds that these sections might have been present in the original manuscript and then been lost during subsequent copying, some 30 percent of the Carte Pisane's names still derive from a source independent of *Lo compasso da navigare*. Given the importance of Genoa at the time, it is also surprising that *Lo compasso da navigare* should omit the ports between Savona and Genoa, which were invariably named on the charts. Among the noteworthy individual omissions on *Lo compasso da navigare* are Arles, Amalfi, Rimini, and Sousse (Tunisia). All these are picked out in red on the Carte Pisane. Simonetta Conti came to similar conclusions through analysis of the coastal names between Spain and Venice.¹⁰⁹ She also contrasted the pure Italian of *Lo compasso da navigare* with the Carte Pisane's varied dialects. In short, it is hard not to conclude that, since only one generation, or at most two, divides the two works, their dissimilarities point to separate origins rather than to progressive stages of a single development.

It has often been assumed that charts were designed to accompany a written portolano, or even that a chart was derived from a series of sailing directions. The acid test, of course, is to construct a chart using nothing more than *Lo compasso da navigare*. This has recently been attempted. To overcome the manuscript's shortcomings, however, occasional adjustments were allowed, and these introduced the risk that, albeit inadvertently, hindsight was leading the researcher's hand toward the familiar Mediterranean shape.¹¹⁰ The creator of the first chart would have had no mental map against which to test the portolano's deficiencies, and he would unknowingly have introduced inevitable errors. These would have led to cumulative distortion as he worked around the coast. Given further that *Lo compasso da navigare* does no more than relate one place to the next by bare statements of distance¹¹¹ and direction, the predictably angular and simplified outline that resulted from this attempted reconstruction is noticeably dissimilar to the sophisticated coastal patterns found on the earliest surviving charts.¹¹²

Any skepticism about *Lo compasso da navigare*'s potential in this respect must be far greater in face of the claims made for earlier sailing directions. Though properly belonging with the previous comments on the ancient world, they involve an extrapolation similar to that made by Motzo and are more conveniently considered

here. The earliest of these periploj, as the ancient sailing directions were termed, was a Mediterranean pilot-book, allegedly compiled by Scylax of Caryanda, an admiral of the late sixth century B.C. but actually written in the fourth century B.C.. This, it has been argued, "possibly served as explanatory text to a map or chart of the Mediterranean and the Black Sea, which, however, is no longer extant, and is not expressly referred to in the text."¹¹³ The existence of this hypothetical chart was assumed by some scholars, even though no wind directions were supplied and most distances were loosely conveyed in terms of the sailing days required.¹¹⁴ Another Greek periplus, the *Stadiasmus*, or measurement in stades of the great sea (Mediterranean), was compiled about the third or fourth century A.D.¹¹⁵ The same unsubstantiated claim for an accompanying map was repeated.¹¹⁶

From such theories of a single or portolano-inspired beginning, we can move to the last main group of claimants: arguments that see the earliest portolan chart as a piecemeal creation. A belief in multiple origins unites many scholars of past and present. The details, however, are disputed. Nordenskiöld saw the prototype chart of the Mediterranean and Black seas (his "normal-portolano") as cobbled together from a number of separately compiled "sketch-maps and reports by skippers."¹¹⁷ Unfortunately, he went on to identify the fifteenth-century Dati illustrations as revivals of these same skipper

109. Simonetta Conti, "Portolano e carta nautica: Confronto toponomastico," in *Imago et mensura mundi: Atti del IX Congresso Internazionale di Storia della Cartografia*, 2 vols., ed. Carla Clivio Marzoli (Rome: Enciclopedia Italiana, 1985), 1:55–60.

110. The exercise was discussed theoretically by Eva G. R. Taylor, "Early Charts and the Origin of the Compass Rose," *Navigation: Journal of the Institute of Navigation* (now *Journal of Navigation*) 4 (1951): 351–56, esp. 355. The actual attempt was made by Jonathan T. Lanman, "On the Origin of Portolan Charts" (paper prepared for the Eleventh International Conference on the History of Cartography, Ottawa, 1985). Lanman noted, for example, that twelve of the instructions omitted direction and two left out distance; he also identified gaps at the straits of Otranto and Gibraltar.

111. The distances were rounded off, normally to the nearest ten miles, and usually understated; see Taylor, "Early Charts," 355 (note 110).

112. Greece and Asia Minor are good examples of this; see Lanman, "Origin of Portolan Charts," figs. 3a and 3b (note 110). Expressing a contrary view that inverted the supposed progression from portolano to portolan charts, Kelley, "Oldest Portolan Chart," 47 (note 58), thought that some of the information in the pilot books was derived from the charts, not vice versa.

113. Nordenskiöld, *Periplus*, 5 (note 14). See also Dilke, *Greek and Roman Maps* 130–44, esp. 133–37 (note 87).

114. For example, Lloyd A. Brown, *The Story of Maps* (Boston: Little, Brown, 1949; reprinted New York: Dover, 1979), 120.

115. Nordenskiöld, *Periplus*, 10–14 (note 14).

116. For example, Brown, *Story of Maps*, 120 (note 114).

117. Nordenskiöld, *Periplus*, 45 (note 14).

charts—an assertion that has been roundly refuted.¹¹⁸ On a broader geographical front than that involved in the small Dati sections, Nordenskiöld noted regional discrepancies. It seemed to him “as though a map of the East Mediterranean and one of the West had been joined to coast-maps of the Black Sea, England, the countries around Gibraltar etc.”¹¹⁹ Working from the more reliable evidence of scale variation, rather than differences in rhumb line grids (or “loxodrome nets”) to which Nordenskiöld called attention, Kelley amended the areas concerned and demonstrated the apparently independent origin of the Atlantic, Mediterranean, and Black Sea surveys by reference to their conflicting scales.¹²⁰

THE COMPASS AND MAGNETIC VARIATION

Central to much of the argument about a medieval origin has been the part that the compass played, or did not play, in this process. Its involvement has been both assumed and denied at a theoretical level and supposedly detected in cartometric analysis. A brief résumé of the controversy surrounding the magnetic compass is also an essential preface to any discussion of the related issue of magnetic variation.

The mariner's compass is considered to have come into use in the Mediterranean in the thirteenth century, but a simplified lodestone, consisting of a magnetized needle pushed through a floating piece of wood, can be traced back to the preceding century.¹²¹ Though Amalfi's claim to have invented the compass by the beginning of the twelfth century rests on slender evidence, the writings of the English monk Alexander Neckham provide confirmation of its existence by the last two decades of that century.¹²² Besides Neckham's account, several other references from the period leading up to that of the earliest surviving charts show that the use of the magnetic compass at sea was unexceptional. One commentator, Jacques de Vitry, a bishop of Acre, even wrote in 1218 of its necessity for navigation.¹²³ The rhumb line network found on the charts enabled them to be used with a compass, but it remains a matter of debate whether the instrument was actually concerned in the initial construction of the portolan charts.¹²⁴ There is, however, some measure of agreement that the compass card, divided into sixteen points or multiples thereof, came into being about the year 1300.¹²⁵ It has even been suggested that this compass card imitated the system on the charts instead of inspiring it.¹²⁶

In support of the contention that the early charts were “compass charts,” some scholars have claimed that their overall distortion is consistent with the magnetic variation supposedly in force at the time. This phenomenon seems not to have been appreciated until the fifteenth century,¹²⁷ and any bearings taken during the charts'

initial compilation would certainly have been from magnetic north.¹²⁸ Unfortunately, there is no agreement either about the extent of distortion on the earliest charts or about the degree of magnetic variation in the later thirteenth century. Working from the charts' own repeated north-south rhumb line, several commentators have detected an easterly variation on the charts, but estimates of its extent have ranged from four to eleven degrees.¹²⁹

Reconstructing the true medieval variation is fraught with difficulties, although recent calculations have been made of historical variation of declination, for example, at Mount Etna.¹³⁰ If further research could identify with more certainty the degree of variation—on the one hand that embodied in the charts, on the other that in force

118. See note 72.

119. Nordenskiöld, *Periplus*, 56 (note 14).

120. Kelley, “Oldest Portolan Chart,” 48 (note 58). See Magnaghi, “Nautiche, carte,” 326a (note 4), who points out that the fifteenth-century Pietro de Versi portolano gives Atlantic distances in leagues and Mediterranean figures in *miglia*; and also Laguarda Trías, *Estudios de cartología*, 3–11 (note 85).

121. Joseph Needham, *Science and Civilisation in China* (Cambridge: Cambridge University Press, 1954–), vol. 4, *Physics and Physical Technology (Part 1: Physics)*, 245–49.

122. Taylor, *Haven-Finding Art*, 92, 95 (note 7).

123. On de Vitry see Taylor, *Haven-Finding Art*, 94–95 (note 7).

124. Among those who considered the compass to be relevant to the charts' construction were Fischer, *Sammlung*, 56 (note 36); Cortesão, *History of Portuguese Cartography*, 1:230 (note 3); and Crone, *Maps and Their Makers*, 16 (note 11). Among those who denied the connection were Nordenskiöld, *Periplus*, 47 (note 14); Eckert, *Kartenwissenschaft*, 2:59 (note 42); Uhden, “Die antiken Grundlagen,” 5 (note 84); Kamal, *Hallucinations*, 15 (note 77); and Frederic C. Lane, “The Economic Meaning of the Invention of the Compass,” *American Historical Review* 68, no. 3 (1963): 605–17, esp. 615–17.

125. Kretschmer, *Die italienischen Portolane*, 74 (note 48).

126. Pelham, “Portolan Charts,” 110 (note 56).

127. David W. Waters, *Science and the Techniques of Navigation in the Renaissance*, 2d ed., Maritime Monographs and Reports no. 19 (Greenwich: National Maritime Museum, 1980), 4.

128. Taylor, *Haven-Finding Art*, 102 (note 7).

129. A. Clos-Arceud, “L'énigme des portulans: Etude sur le projection et le mode de construction des cartes à rhumbs du XIV^e et du XV^e siècle,” *Bulletin du Comité des Travaux Historiques et Scientifiques: Section de Géographie* 69 (1956): 215–31, esp. 225, found a range from 4° to 9°; Hapgood, *Sea Kings*, 98 (note 82), estimated the error of the 1339 Dulcert chart at 6°; Magnaghi, “Nautiche, carte,” 327b (note 4), discerned a 6°–7° variation in the Tyrrhenian Sea and 11° in the eastern Mediterranean; and Heinrich Winter, “A Late Portolan Chart at Madrid and Late Portolan Charts in General,” *Imago Mundi* 7 (1950): 37–46, esp. 40, cited a 10° variation.

130. Pelham, “Portolan Charts,” 84 (note 56), citing J. C. Tanguy, “An Archaeometric Study of Mt. Etna: The Magnetic Direction Recorded in Lava Flows Subsequent to the Twelfth Century,” *Archaeometry* 12 (1970): 115–128; idem, “L'Etna: Etude pétrologique et paléomagnétique, implications volcanologiques” (Ph.D. diss., Université Pierre et Marie Curie, Paris, 1980). On palaeomagnetism see also Robert W. Bremner, “An Analysis of a Portolan Chart by Freduci d'Ancone” (paper prepared for the Eleventh International Conference on the History of Cartography, Ottawa, 1985).

in the Mediterranean at different dates in the thirteenth century—it might prove possible to place a firmer date on the initial compilation of the portolan charts. Viewed in this light, secular magnetic variation is potentially as valuable in the history of cartography as the radiocarbon method in archaeology, though the calibrations have yet to be worked out.¹³¹ In addition, researchers have exploited the fact that there are differences in variation between the separate Mediterranean basins and that these differences remain in a constant relationship to one another.¹³² If a full-scale cartometric analysis were to confirm that localized distortions on the earliest charts coincide with the pattern of regional magnetic variation,¹³³ then the part played by the compass in the compilation of the portolan charts would be definitely established.¹³⁴

THE PROJECTION

Relevant to many of the arguments about portolan chart origins is the nature of the projection on which the charts were constructed. Here again, a controversy that has remained alive for a century and a half shows no sign of producing any single theory able to command general acceptance. Those who attributed authorship of the portolan charts to Marinus of Tyre maintained that it was his cylindrical projection that was involved, even if the lines of longitude and latitude had been discarded.¹³⁵ Fiorini, for his part, believed he could detect the equidistant azimuthal projection; and a more recent Portuguese historian, António Barbosa, asserted, without clarifying the point, that the lines of longitude and latitude were both curved.¹³⁶

The foregoing theories presuppose the existence of an intentional projection according to which the outlines of the earliest charts were laid down. Majority opinion, though, has rejected that view, considering instead that the portolan charts were projectionless or that any projection was accidental. A projection on a terrestrial map will normally be recognized by the way the meridians and parallels have been treated. But in the absence of any evidence beyond what can be derived from the charts themselves, scholars have had to impose a grid of longitude and latitude on examples that survive; yet these charts show no awareness of astronomically determined information of that kind. If, however, a distortion grid is laid over an early chart, by linking places that are known to lie on the same meridian or parallel, this may disclose the underlying projection; but it will also reveal error in the coastal outlines, both of a localized and of a general kind. Unscrambling these two elements presents a circular problem, since the nature and extent of the distortion depend on the projection deemed to be involved.

Most commentators have concluded that both the meridians and the parallels inherent in the early charts were straight lines. Scholars differed, though, on whether the longitude and latitude grid created a pattern of squares or rectangles. Those who favored the former held that the portolan charts were akin to plane charts, although, as a conscious projection, the plane chart (variously termed *plate carrée* and *carta plana quadrada*) is seen as a Portuguese invention of the second half of the fifteenth century.¹³⁷ Seeing the charts as constructed on a basis of observed distance, with directions obtained by means of a magnetic compass, this interpretation denied that any compensation had been made for the sphericity of the earth.

The only way that the habitual network of rhumb lines on the portolan charts could be treated as genuine loxodromes (i.e., lines of constant compass bearing) would be if the charts were drawn on the Mercator projection.¹³⁸ First demonstrated to sailors on Mercator's world map of 1569, this allowed any compass course to appear as a straight line; but the widening gap between latitudes as they moved toward the poles caused distance to be increasingly exaggerated. Following the logic of their contention that the straight rhumb lines on the charts represented compass bearings, some writers have claimed that the portolan charts were drawn, albeit unconsciously, on the Mercator projection, or something closely akin to it. Nordenskiöld had already come to this conclusion by 1897, but it was Clos-Arceuduc who explored the theory more fully, superimposing a modern outline drawn on the Mercator projection

131. Clos-Arceuduc, "Enigme des portulans," 226 (note 129), supposed that the process of compiling the prototype chart would have lasted no more than twenty years and that the magnetic variation incorporated into the finished product, and not changed thereafter, would thus date, on average, from ten years before.

132. Clos-Arceuduc, "Enigme des portulans," 222 (note 129).

133. As suggested by Magnaghi, "Nautiche, carte," 327b (note 4).

134. Heinrich Winter, "Scotland on the Compass Charts," *Imago Mundi* 5 (1948): 74–77, esp. 74 n. 3, found that the European Atlantic coasts did not demonstrate the effects of magnetic variation as did those of the Mediterranean.

135. Laguarda Trías, *Estudios de cartologia*, 25 (note 85).

136. Fiorini, *Projezioni*, 689–96 (note 98); António Barbosa, *Novos subsídios para a história da ciência náutica portuguesa da época dos descobrimentos* (Oporto, 1948), 179 ff. I owe this reference and several other points in this discussion of projections to Luís de Albuquerque. On projections see also Johannes Keuning, "The History of Geographical Map Projections until 1600," *Imago Mundi* 12 (1955): 1–24, esp. 4 and 15–17.

137. Charles Cotter, "Early Tabular, Graphical and Instrumental Methods for Solving Problems of Plane Sailing," *Revista da Universidade de Coimbra* 26 (1978): 105–22.

138. For a definition of loxodromes see David W. Waters, *The Art of Navigation in England in Elizabethan and Early Stuart Times* (London: Hollis and Carter, 1958), 71–72.

over the coastal shapes of the earliest charts.¹³⁹ The surprisingly close match between the two convinced him that the Mediterranean and Black Sea sections of the portolan charts were drawn on the Mercator projection, while the part covering the Atlantic was a plane chart.¹⁴⁰ Clos-Arceud even found that the 1339 Dulcert chart, when treated as if drawn on the Mercator projection, gave more accurate outlines for the Mediterranean than Mercator's own world map of 1569.¹⁴¹

Clos-Arceud does not, however, attempt to explain the mechanism by which the supposed thirteenth-century compilers of the original portolan chart (or of its individual sections) managed to overcome the technical cartographic problems caused by the conflicting demands of straight-line compass directions and converging meridians. A full mathematical solution to this would have to wait to the very end of the sixteenth century. In essence, the Mercator projection hypothesis attempts to embrace two contradictory principles: on the one hand that of intentional and remarkably sophisticated cartographic manipulation, on the other that of pure observation. It is possible that what Clos-Arceud interpreted as a system of unequal parallels reflects instead cartographic error. Certainly, the distortion grid devised for the Catalan atlas by Grosjean¹⁴² shows no obvious signs of the Mercator projection, although the diagram's small scale and the two-degree intervals involved may have led to oversimplification. The element of distortion for the Mediterranean and Black seas on the early charts may, alternatively, be attributable to the inevitable compromise forced on their compilers when attempting to reconcile discrepancies arising from the unsuspected convergence of the meridians.

Although the Portuguese apparently developed a new type of chart about 1485, one graduated with latitudes, no surviving latitude scale has been convincingly dated before the sixteenth century.¹⁴³ There have, however, been a number of claims. Cortesão and Teixeira da Mota dated to about 1500 the unsigned Portuguese chart in Munich that displays a latitude scale. Working from their reproduction, however, it appears that the Spanish flag is placed over Oran and Bougie (Bejaia).¹⁴⁴ Yet these fell to Spain only in 1509 and January 1510, respectively, while Algiers, which was captured in July 1510, still has its Arab flag. Similar comments can be made about another work preserved in Munich (Universitätsbibliothek, 8° Codex MS. 185, sheets 2 and 3), which again displays the Spanish flag over Oran. The latitude scales on its first two sheets appear to have been added later, anyway, as seems to be the case with the supposedly late fifteenth-century chart in the Henry E. Huntington Library (HM 1548) and the 1403 Francesco Beccari chart at Yale.

The earliest chart with a latitude scale is probably one of those undated works assigned to the first decade of

the sixteenth century, for example, the King-Hamy chart of about 1504 (Henry E. Huntington Library, HM 45) or the Caverio chart of about 1505 (Bibliothèque Nationale, Département des Cartes et Plans, S. H. Archives no. 1). A latitude scale also occurs on the unreproduced Gap chart, but this must raise doubts about the pre-1453 date suggested by Charles de La Roncière on the unreliable grounds that Constantinople still flies the Byzantine flag.¹⁴⁵ It is significant that when latitude scales came to be added in the sixteenth century to charts whose Mediterranean outlines were essentially copies of earlier models, the parallels were equidistant.¹⁴⁶

MEDITERRANEAN NAVIGATION BEFORE THE PORTOLAN CHART

Any attempt to assess the likelihood that a chart like the Carte Pisane might have been built up as a composite jigsaw puzzle must consider the navigational techniques of the time.¹⁴⁷ Unfortunately, documentation on the methods practiced in the thirteenth century is as elusive as that for the charts themselves. It is firmly established, however, that the science of astronomical navigation was introduced by the Portuguese in the fifteenth century, specifically in response to problems encountered outside the Mediterranean.¹⁴⁸ Hence it must be assumed that in the period leading up to the first portolan charts navigation depended almost entirely on the pilot's stored experience. Dead reckoning—the estimate of the distance and direction run—would owe little to any instrument, except perhaps to a primitive precursor of the log for gauging speed, a sandglass for reckoning time, a lodestone, and a lead and line.¹⁴⁹ Like other sailors at

139. Nordenskiöld, *Periplus*, 16–17 (note 14); Clos-Arceud, "Enigme des portulans," 217–228 (note 129).

140. Clos-Arceud, "Enigme des portulans," 223 (note 129).

141. Clos-Arceud, "Enigme des portulans," 225 (note 129).

142. Grosjean, *Catalan Atlas*, 16–17 (note 94).

143. See Teixeira da Mota, "Art de naviguer," 134 (note 70).

144. See Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:23–24, pl. 7 (note 29). Munich, Bayerische Staatsbibliothek, Codex Icon. 138/40, fol. 82.

145. See Charles de La Roncière, "Le portulan du XV^e siècle découvert à Gap," *Bulletin du Comité des Travaux Historiques et Scientifiques: Section de Géographie Historique et Descriptive* 26 (1911): 314–18. For the canard that Benincasa introduced latitude scales on his charts of the second half of the fifteenth century, see Alexander von Humboldt, *Examen critique de l'histoire de la géographie du nouveau continent et des progrès de l'astronomie nautique au XV^e et XVI^e siècles*, 5 vols. (Paris: Gide, 1836–39), 1:291.

146. For examples, see Nordenskiöld, *Periplus*, pls. xxviii–xxxii (note 14).

147. For a discussion of the navigational techniques relating to the use rather than origin of the charts, see below, pp. 441–44.

148. Cortesão, *History of Portuguese Cartography*, 2:221 ff. (note 3).

149. Whereas some commentators contend that an experienced seaman could have estimated distances at sea with considerable accuracy,

different times and in different places, these early thirteenth-century Mediterranean pilots presumably carried with them a mental chart of the regions they frequented. This was no doubt adequate for their purposes, just as Geoffrey Chaucer's fourteenth-century "shipman" knew all the havens from the island of Gotland to Finisterre without recourse to a chart.¹⁵⁰

It must be obvious that the navigational abilities of at least some Mediterranean sailors in the mid-thirteenth century would have to have been as sophisticated as the cartographic accuracy of the earliest portolan charts—if a theory of medieval origin is accepted for them. A pilot who was unable to navigate with any confidence, say from Palma to Acre, could have made no contribution to the compilation of the earliest charts, nor would he have had much use for the finished product, at least when the ship was out of sight of land. If early thirteenth-century French statutes could prescribe the death penalty for a pilot whose negligence led to the loss of his ship,¹⁵¹ a considerable degree of navigational expertise must have existed among pilots operating along France's Atlantic coasts. It is only fair to suppose that equivalent skills were available in the Mediterranean, where conditions were easier than in the Atlantic, the North Sea, or the Baltic. Many of the Mediterranean ships, for example, were galleys, and the straight courses they could pursue made it far easier to estimate position.¹⁵² The limited tidal range in the Mediterranean further simplified matters. So too did the normally clear air in the summer months, when almost all voyages took place until the compass-inspired revolution of the late thirteenth century.¹⁵³ All these factors, combined with the frequency with which high land rises up from the coast,¹⁵⁴ increased the chance of a good landfall. Nor can it still be maintained that medieval ships routinely hugged the shore.¹⁵⁵ It is precisely inshore waters, the most likely to conceal rocks and shoals, that are the greatest navigational hazards. Moreover, just as the periplus of Scylax can be cited as evidence that the ancients regularly made direct open-sea sailings, even by night,¹⁵⁶ so descriptions of long passages (*peleggi*) given in *Lo compasso da navigare* indicate that such voyages were actually undertaken, and with considerable navigational accuracy.¹⁵⁷

THE METHOD OF COMPILATION

It does not necessarily follow from an ability to navigate successfully around and across the Mediterranean and Black seas that there was either the inclination or the skill to record the experience in chart form. Nevertheless, a recent writer has proposed that a simple form of triangulation ("resection and intersection") could have been used to control a running survey.¹⁵⁸ The problem with

this interpretation is that however elementary the geometry, and however unsophisticated the "plane table, sextant or similar instrument" involved,¹⁵⁹ there is no evidence that any of these were available until long after the thirteenth century.

The particular nature of the Mediterranean Sea may lead to another theory—yet to be tested—about the origin of the portolan charts.¹⁶⁰ As Braudel has shown in detail, the physical configuration of the Mediterranean is better understood not as one continuous sea, but as a series of basins separated by peninsulas.¹⁶¹ The most clear-cut division—between the western and the eastern portions—runs from Tunisia to Sicily, crossing a strategically important channel (the Strait of Sicily) only ninety miles wide, guarded by the islands of Pantelleria and Malta. The two divisions tended to become distinct geopolitical entities. Within the western portion, there are three basins: the Alboran Sea between Spain and North Africa; the Balearic Sea; and the Tyrrhenian Sea. The eastern portion consists of the Adriatic, Ionian, and Aegean seas, as well as the most easterly basin surrounded by Asia Minor, Syria, the Holy Land, and Egypt. The Black Sea—which routinely appears on the portolan charts—provides yet another self-contained body of water with its own subbasin in the Sea of Azov.

for example, Taylor, *Haven-Finding Art*, 121 (note 7), and Freiesleben, "Catalan Mappamundi," 87 (note 57), others deny this—for instance, Grosjean, *Catalan Atlas*, 17 (note 94).

150. Geoffrey Chaucer, *Prologue to the Canterbury Tales*, lines 401–9; see *The General Prologue to the Canterbury Tales*, ed. James Winny (Cambridge: Cambridge University Press, 1965).

151. David W. Waters, *The Rutters of the Sea: The Sailing Directions of Pierre Garcie—A Study of the First English and French Printed Sailing Directions* (New Haven: Yale University Press, 1967), 36–39, 122, 385. The statutes of Oléron were codified in the thirteenth and fourteenth centuries but are undoubtedly of much earlier date.

152. Pagani, *Vesconte*, 9 (note 47). Since it was known how far the galley traveled with each oar stroke, measurement of the distance run was obtained simply by counting the strokes. Bartolomeo Crescenzo described this method in 1602; see his *Nautica Mediterranea*, 245–53 (note 56).

153. Lane, "Invention of the Compass," 608 (note 124); on atmospheric conditions see Fernand Braudel, *The Mediterranean and the Mediterranean World in the Age of Philip II*, 2 vols., trans. Siân Reynolds (London: Collins, 1972–73), 1: 232–34.

154. Vincenzo Coronelli, *Specchio del mare* (Venice, 1693), chap. 3.

155. Lane, "Invention of the Compass," 607 (note 124).

156. Nordenskiöld, *Periplus*, 8 n. 3 (note 14).

157. Pagani, *Vesconte*, 14 (note 47). Several of the voyages described in *Lo compasso* were 500 *miglia* long (about 600 km), and some were as much as 700 *miglia* (roughly 900 km); the hoped-for landfall was often a cape or a small island.

158. Pelham, "Portolan Charts," 104 (note 56).

159. Pelham, "Portolan Charts," 109 (note 56).

160. The rest of this section on the traverse-trilateration theory (to p. 388) has been written by David Woodward.

161. Braudel, *Mediterranean*, 1:103–38 (note 153).

The cumulative experience of several centuries of coastal and other shipping in each of these basins could have led to the independent recording of traditionally known distances. It is probable that navigators in the Mediterranean during the late medieval and Renaissance periods used both coastal traverses and cross-basin routes. The average distances derived from these sailings between pairs of ports—both along the coast and across the sea—could then have been used in the construction of a series of separate charts of the individual basins. If these routes were plotted to form networks in each of the basins listed above, each network might have assumed the form of a self-correcting closed traverse approximating the shape of each basin. The rigidity of this structure would, however, have depended on the availability of the cross-basin distances, acting as braces to the framework. It is thus postulated that some system of empirical or stepwise graphic method of correcting these frameworks was used to achieve a “least-squares” result. These discrete compilations could then have been amalgamated into charts of the entire Mediterranean.

It must be stressed, however, that this theory does not require that modern methods or instruments of trilateration or triangulation be available in the thirteenth century. Indeed, there is no evidence that such techniques were available until the fifteenth century. The terms are simply used as an analogy for the natural structure that may have underlain the charts.

By using distances only, such a system could have worked independently of the magnetic compass. It might also have given rise to the approximately four- to eleven-degree shift in the axis of the early charts from the parallel of Rhodes. The longitudinal extent of the Mediterranean is such that the curvature of the earth must be taken into account in any accurate cartographic representation. If the charts were constructed piecemeal from different self-correcting compilations of the basins, the natural tendency would thus have been for the whole framework to be skewed farther north as the accretion continued.

Furthermore, this theory might also explain the rapid deterioration of these charts’ structural accuracy in those areas where empirical information was lacking for one or more sides of the basins, as with the Bay of Biscay or the North Sea. In the course of constructing charts by this method, we would also expect to find that some of the individual basins (for example, the Black Sea) could have been tacked on at varying angles to adjacent basins while still maintaining their individual integrity or that land areas between basins could have become constricted. At first sight this appears to have been the case, but empirical studies to test these deformations on selected charts still have to be undertaken.¹⁶² Finally, it is likely that—if this method was used—it was employed

in combination with a number of other techniques. It does not exclude the use of the compass, for example, which would simply add more directional stability, however crude, to the orientation of the individual basins of the Mediterranean Sea.

THE CHARTS’ PLACE OF ORIGIN

Even assuming a thirteenth-century origin, the question remains, Which Mediterranean center should be seen as the cradle of the portolan charts? This is probably the thorniest issue of all. There are not many forces more potent than nationalism, and the upheavals of this century have done little to dampen its effect on the historiography of the subject. Few Italian writers have failed to insist on an Italian origin, and Spanish scholars have tended to react as predictably. Among those neutral by birth, Nordenskiöld and Winter were committed to the Catalan cause, while Fischer and Kretschmer, for example, supported a theory of Italian origin.¹⁶³ The possible involvement of the Portuguese was not ruled out by Kamal;¹⁶⁴ nevertheless, this did not lead to any serious claims for a Lusitanian invention by Cortesão or other Portuguese historians.

Despite its length and intensity, the nationalist debate has thrown up little of lasting value. The writings of the late thirteenth-century Majorcan polymath Ramón Lull are often cited in support of early Catalan chartmaking. Yet there are no indications that the sea charts to which he refers were actually of Catalan workmanship. Nor, on the Italian side, have demonstrations that the Norman kingdom of Sicily acted as a catalyst between the Arab and Christian worlds necessarily brought us any nearer to a solution of the problem.¹⁶⁵ That a climate sympathetic to the creation of portolan charts existed in thirteenth-century Sicily is of itself no proof that they were actually produced.

Two particular features have been harnessed for use in this argument: first, the value of the scale unit; second, the language or dialect thought to predominate in the

162. Such studies are currently the subject of a doctoral dissertation by Scott Loomer, University of Wisconsin–Madison.

163. Nordenskiöld, *Periplus*, 47 (note 14); Heinrich Winter maintained the Catalan position in his numerous writings on the subject; Fischer, *Sammlung*, 81–97 (note 36); Kretschmer, *Die italienischen Portolane*, 103–4 (note 48).

164. Youssouf Kamal, *Quelques éclaircissements éparés sur mes Monumenta cartographica Africae et Aegypti* (Leiden: E. J. Brill, 1935), 188.

165. For example, Grosjean, *Catalan Atlas*, 15 (note 94). A recent article makes the claim that the origin of the portolan charts should be looked for in Sicily during the time of the emperor Frederick II of Hohenstaufen (1194–1250), but no convincing evidence is adduced; see Hans-Christian Freiesleben, “The Origin of Portolan Charts,” *Journal of Navigation* 37 (1984): 194–99.

toponymy of the earliest charts. If the length of the “portolan mile” could be determined, and if it were shown to approximate a known unit of measure, this could be a useful pointer to the charts’ place of origin. Nordenskiöld, for example, believed the charts were drawn according to a scale of Catalan leagues (*legua*), and this fitted conveniently into his general thesis of a Catalan invention.¹⁶⁶ Yet neither his explanation nor Kelley’s has been successful in imposing any kind of order on the numerous different interpretations.¹⁶⁷ While it is known that each of the smaller scale divisions on the portolan charts represented ten *miglia* (sometimes termed *mia* or *milliaria* instead),¹⁶⁸ that is the extent of unanimity. Taking the value of a Catalan league as 5.83 kilometers, Nordenskiöld, having suggested that each ten-*miglia* unit contained two portolan miles, arrived at a figure of 1.16 kilometers for a single *miglio* ($5.83 \div 5$). He then proposed that this was an error resulting from an attempt by Italian draftsmen to “fit the Italian mile-measure with the portolan-scale,” and the more correct value of a *miglio* was 1.457 ($5.83 \div 4$).¹⁶⁹ Nordenskiöld’s successors have variously supported the five-*miglia* and the four-*miglia* portolan mile.¹⁷⁰

With disagreement about fundamentals, and given a general rejection of the supposed relevance of the Catalan league, there has been wide scope for alternative estimates of the length of the portolan mile. Even though majority opinion has settled for an approximate value of 1.25 kilometers, the issue is far from settled. Leaving aside the significant differences of scale involved in the Mediterranean, Black Sea, and Atlantic sections of the charts (see below, p. 414), there remain discrepancies in the various calculations,¹⁷¹ the significance of which may have been overlooked through averaging out. Alternatively, the variation in the figures might be interpreted as evidence of regional differences in the value of the *miglio*, leading to fluctuations in the overall scale. It is hardly possible, anyway, to arrive at a precise estimate of the value of an unstated unit of measurement on charts whose method of construction remains unknown and whose accuracy is clearly uneven. If internal inconsistency was confirmed, this would make irrelevant the task of matching the stated scale divisions to a single portolan mile unit, and it would also confirm the “mosaic” theory of portolan chart origins.

Language also played a significant part in the particular Italian and Catalan controversy that is most associated with the names of Caraci and Winter.¹⁷² If the argument runs, the earliest charts revealed in their toponymy clear traces of one particular language, this would identify their place of origin. Again, the same data have been interpreted differently.¹⁷³ Winter discerned Catalan name forms, which “speak for a Catalan origin,” whereas Guillén y Tato supposed the model was

Cantabrio-Castilian.¹⁷⁴ Although himself a Spaniard, Reparaz detected Italianisms on Catalan charts, even along the Spanish coasts, and Caraci was also convinced that the name forms were Italian.¹⁷⁵ The problem goes beyond the simple Catalan/Italian distinction to embrace the contradictory claims of different Italian cities. Although the Carte Pisane is conventionally considered to be of Genoese construction, at least one writer was more inclined to see it as Venetian.¹⁷⁶ A strong argument in favor of Genoese origin is the fact that the earliest reference to a portolan chart, in 1270, occurred on board a Genoese ship.¹⁷⁷ Conti’s contention that the Carte Pisane’s toponymy embodies a range of languages and dialects may explain why Italian historians have not always been convincing in their interpretations of the dialect showing through in the place-names of the early charts.¹⁷⁸ This very uncertainty adds substance to the view that portolan chart origin should be looked for in terms of separate regional sources.

166. Nordenskiöld, *Periplus*, 24 (note 14). For criticism of this see Salvador García Franco, “The ‘Portolan Mile’ of Nordenskiöld,” *Imago Mundi* 12 (1955): 89–91.

167. Kelley, “Oldest Portolan Chart,” 46–48 (note 58).

168. This is stated in a legend on the Carignano map; see Nordenskiöld, *Periplus*, 22 (note 14), and see note 58.

169. Nordenskiöld, *Periplus*, 22–23 (note 14).

170. Magnaghi, “Nautiche, carte,” 325a (note 4), the five-*miglia*; Kelley, “Oldest Portolan Chart,” 47 (note 58), the four-*miglia*. Armando Cortesão, “The North Atlantic Nautical Chart of 1424,” *Imago Mundi* 10 (1953): 1–13, esp. 2, referred to a league of four miles—a “league” and a “portolan mile” being apparently interchangeable in this context.

171. For example, Nordenskiöld, *Periplus*, 20 (note 14).

172. See note 201.

173. See, for example, the inconclusive discussion about the nationality of a fragment in Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 14207 in Destombes, “Cartes catalanes,” 63 (note 99).

174. Heinrich Winter, “Catalan Portolan Maps and Their Place in the Total View of Cartographic Development,” *Imago Mundi* 11 (1954): 1–12, esp. 5, 7; Julio F. Guillén y Tato, “A propos de l’existence d’une cartographie castillane,” in *Les aspects internationaux de la découverte océanique aux XV^e et XVI^e siècles: Actes du V^eme Colloque Internationale d’Histoire Maritime*, ed. Michel Mollat and Paul Adam (Paris: SEVPEN, 1966), 251–53, esp. 253.

175. Gonçal (Gonzalo) de Reparaz, “Essai sur l’histoire de la géographie de l’Espagne de l’antiquité au XV^e siècle,” *Annales du Midi* 52 (1940): 137–89, 280–341, esp. 303; Giuseppe Caraci, *Italiani e Catalani nella primitiva cartografia nautica medievale* (Rome: Istituto di Scienze Geografiche e Cartografiche, 1959), 83–187, 302–7, English summary on 351–53. See also note 329.

176. Motzo, “Compasso da navigare,” LXIII (note 103). For the Genoese case, see O. Pastine, “Se la più antica carta nautica medioevale sia di autore genovese,” *Bollettino Ligustico* 1 (1949): 79–82.

177. De La Roncière, *Afrique*, 1:39 (note 100).

178. Conti, “Portolano e carta nautica” (note 109); see below, p. 424 and note 364, where Venetian origin is proposed for the Luxoro atlas—a work that has until now been treated as Genoese.

THE ARGUMENTS SUMMARIZED

In the light of this sometimes ambiguous and often conflicting evidence, it is to be doubted if many of the confident claims of the past have much advanced the cause of truth. Lacking any one compelling theory, we must deal instead with a balance of probabilities. Attempts to locate the charts' origin elsewhere than in the thirteenth century run counter to the information available. Following the earliest identified literary reference to a portolan chart and the oldest surviving example of the genre—both roughly contemporary at the end of that century—there are more than 30 charts and atlases attributable to the fourteenth century and almost 150 that probably derive from the fifteenth century. Working backward along this pattern of steady expansion to its beginning, it is hard to see the justification for extending the vanishing point much further. If portolan charts existed before the thirteenth century, they have failed to leave any discernible trace. Those who suggest a great leap backward over a thousand years to the world of ancient Rome must find an explanation for the fact that the most striking error on the Mediterranean portion of the *Carte Pisane*, when compared with its immediate successors, concerns no less a region than Italy. Similarly, since the earliest Catalan chart is preceded by the work of four or possibly five Italian practitioners, there seems to be little substance to claims for a Catalan origin.¹⁷⁹

Even the most plausible of the many proffered explanations—that the *Carte Pisane's* Mediterranean and Black seas represent a mosaic in which are preserved the separate navigational experiences in the various different basins—leaves a number of questions unanswered. Who could have provided the necessary cartographic skill to produce this confident patchwork without leaving any visible joins? How, even if the trilateration thesis is accepted as the charts' constructional basis, could large errors have been avoided in the relationship of one distant shore to another, given that a voyage, say, from Sicily to the Holy Land could take several weeks?¹⁸⁰ Is there evidence of localized distortion and variation of scale between one basin and another, and does this remain hidden behind measurements that have been presented as averages? What can be learned in this context from distortion grids, like those compiled by Grosjean and Romano?¹⁸¹ A general awareness of the vital importance of such questions as these and the development of systematic diagnostic techniques to test these cartometric points remain long overdue.

One day, no doubt, these issues will be conclusively resolved. Until that happens, and as an oblique comment on the whole question of origin, it is worth drawing particular attention to the notable developments that can

be discerned among the earliest surviving charts. These will be discussed in due course. Whether of changes to the shape of Italy, of additions or corrections to the Atlantic coastlines, or of a constant toponymic updating, they all point to a remarkable vitality. If the moment of portolan chart birth cannot be precisely pinpointed, the creative process can be clearly seen at work in the early fourteenth century.

DRAFTING

There are no signs that the basic techniques involved in producing a chart were much different in 1300 and 1500—though no study of portolan chart draftsmanship has yet been made. Unfortunately, since no contemporary account has survived of how a chart was drawn, we are left to infer the procedures from the charts themselves. The vellum on which the chart was to be drawn would have been purchased, fully prepared, from a specialist parchment maker.¹⁸² Scholarly opinion has been almost equally divided about what happened next: whether the rhumb line network or the coastal outline was laid down first.¹⁸³ To test this point, four of the British Library charts (two from the fourteenth century and two from the fifteenth) were therefore examined through a microscope. In three cases the order of superimposition showed definitely that the rhumb lines were under both coastal outlines and place-names, while the fourth instance was ambiguous but pointed the same way.¹⁸⁴

179. The earliest Catalan chart is Dalorto's of 1325/30, when judged by its language and leaving aside the controversy surrounding the author's possible Italian origin. Preceding Italian practitioners include the unknown authors of the *Carte Pisane* and the Cortona chart, Pietro and Perrino Vesconte, and possibly Giovanni da Carignano—see below, pp. 406–7, for comments on the suggestion that only one Vesconte was involved and above, p. 380, for the judgment that Giovanni da Carignano's "map" was not a true portolan chart.

180. Taylor, *Haven-Finding Art*, 109 (note 7).

181. Grosjean, *Catalan Atlas*, 16–17 (note 94); Virginia Romano, "Sulla validità della *Carte Pisana*," *Atti dell'Accademia Pontaniana* 32 (1983): 89–99, esp. 96–97.

182. Daniel V. Thompson, *The Materials of Medieval Painting* (London: G. Allen and Unwin, 1936), 24.

183. Kretschmer, *Die italienischen Portolane*, 39 (note 48), cited sheets that had rhumb lines but no outlines. An example, from the Lyons Vesconte atlas, is illustrated in Mollat du Jourdin and de La Roncière, *Sea Charts*, 12 (note 40). Several commentators, however, were convinced that the outlines were drawn first. Thompson, "Rose of the Winds," 194 (note 56), made the surprising suggestion that while the black and green rhumb lines were laid down first, the red ones were often added after the outlines.

184. London, British Library, Add. MS. 27376* (Vesconte), Add. MS. 25691 (Dulcert-type), and Egerton MS. 2855 (Benincasa, 1473). The doubtful instance was Add. MS. 18665 (attributed to Girolodi). The maps were examined under a low-angled light from a fiber-optic lamp. I owe these comments to the assistance and expertise of A. E. Parker, senior conservation officer of the Department of Manuscripts, British Library.

Speculation remains as to the precise way this rhumb line network was constructed. Most fourteenth- and fifteenth-century charts—but significantly not all—reveal a “hidden circle” scraped into the vellum with a compass point. The sole function of this circle was to define the sixteen intersection points whose subsequent connection created the rhumb line network. Martin Cortés, writing in his *Arte de navegar* of 1551, advocated drawing in the circle with a piece of lead whose marks could later be rubbed out.¹⁸⁵ This may correctly reflect sixteenth-century usage, but there are no signs that chartmakers of the two previous centuries had access to an erasable pencil. There are certainly no traces of it on Benincasa’s work, which dates from the second half of the fifteenth century. A ruler, a pair of dividers, a pen, and various inks seem to have been the standard equipment of the early chartmakers.¹⁸⁶ It was vital that the sixteen intersection points (or double that number when two networks were involved) be precisely located if a symmetrical pattern was to be achieved. From the holes usually visible at each of the intersection points, it is likely that the circle, which was presumably first quartered by single vertical and horizontal lines, was then further subdivided into sixteenths using a pair of dividers.¹⁸⁷ The holes thus formed would afterward be joined to one another by ruled lines.¹⁸⁸

COPYING

That the Mediterranean outlines on portolan charts were copied from one another for four centuries is obvious. But the statement begs the question: How did the early chartmakers actually copy from an existing chart?¹⁸⁹ The Spaniard Cortés, in another passage from the 1551 *Arte de navegar*, described how to use oiled tracing paper in conjunction with smoked carbon paper.¹⁹⁰ Yet the Italian Bartolomeo Crescenzo, writing half a century later, prescribed two quite different alternatives.¹⁹¹ The first involved perforating a sheet of paper with a succession of closely spaced pinholes to define the coastlines. A fine powder (pounce) was then rubbed over the perforated sheet, leaving small deposits on the underlying vellum. Using these as a guide, the coastlines could then be inked in. Crescenzo’s second method was to stretch the model and the fresh vellum together over a frame with a light source behind, then make a freehand copy.

It might reasonably be supposed that one of these three methods had been employed from the outset; yet there is a major drawback to this interpretation. All the described procedures would have produced direct facsimiles, identical in coverage and scale to their model. Yet this is patently not the case. Though Nordenskiöld and Kelley, for example, found that a number of the charts they considered had approximately the same scale,¹⁹²

they manifestly failed to identify any one single scale in general use. In a recent catalog, Pietro Frabetti estimated the representative fraction for eight fourteenth- and fifteenth-century works and found that these ranged from 1:4.5 million to 1:8 million.¹⁹³ Variations of scale are also encountered within an atlas and even on a single sheet.¹⁹⁴

The propensity of vellum to distort and cockle when wet¹⁹⁵ must place a question mark beside the many portolan chart measurements that have been obtained in the face of these difficulties. Nevertheless, this evident fluctuation of scale seems perverse, since it must always

185. Thomas R. Smith, “Manuscript and Printed Sea Charts in Seventeenth-Century London: The Case of the Thames School,” in *The Compleat Plattmaker: Essays on Chart, Map, and Globe Making in the Seventeenth and Eighteenth Centuries*, ed. Norman J. W. Thrower (Berkeley: University of California Press, 1978), 45–100, esp. 90, quoting from Martin Cortés, *The Arte of Navigation*, trans. Richard Eden (London: Richard Jugge, 1561).

186. On this see H. W. Dickinson, “A Brief History of Draughtsmen’s Instruments,” *Transactions of the Newcomen Society* 27 (1949–50 and 1950–51): 73–84; republished in the *Bulletin of the Society of University Cartographers* 2, no. 2 (1968): 37–52.

187. Cortés, *Arte of Navigation*, fol. lvi verso (note 185), gives instructions for the quadrants to be divided “in the midst with a pricke or puncte.”

188. The charts of the British Library’s Cornaro atlas (Egerton MS. 73), which are in many respects unusual for portolan chart work, were constructed by pricking through the intersection points from a master copy. The holes can be made out on one of its sheets that is otherwise cartographically blank.

189. It is as well to dispose here of Nordenskiöld’s unfounded speculation about the 1467 Grazioso Benincasa atlas, “that the inscriptions were partly produced by mechanical means through printing or stamping, a method of production which naturally was ready to the hand of so prolific a portolan manufacturer as Benincasa,” *Periplus*, 126 (note 14). Nordenskiöld may have been misled by the later use of hand stamps for some decorative features. I owe to Christopher Terrell the information that a 1548 Vesconte Maggiolo chart used stamps for tents, animals, monarchs, towns, and a ship (National Maritime Museum, G. 230/10 MS). Stamped town symbols have also been seen on a 1520 Juan Vespucci chart (in private hands), but no fifteenth-century instances have yet been recorded. Alternatively, Nordenskiöld was led down this blind alley by Uzielli and Amat di San Filippo, *Mappamondi*, 92 (note 35), who inexplicably used the word “impressa” (printed) in connection with the Andrea Benincasa chart of 1490. No credence should be given either to Nordenskiöld’s further suggestion that “mechanical means were probably used for the reproduction of the land-outlines on the charts that pass under the names of Sanudo and Vesconte,” *Periplus*, 126 (note 14). On this see also Cortesão, *History of Portuguese Cartography*, 2:94–95 (note 3).

190. See Smith, “Thames School,” 90 (note 185).

191. Crescenzo, *Nautica Mediterranea* (note 56). A translation is provided in Pelham, “Portolan Charts,” 27–28 (note 56).

192. Nordenskiöld, *Periplus*, 24 (note 14); Kelley, “Oldest Portolan Chart,” 38 (note 58).

193. Frabetti, *Carte nautiche italiane*, 1–40 (note 73).

194. Examples of the latter would be the Aegean sheet in the 1313 Vesconte atlas and the Italy and Adriatic sheet in the 1373 Pizigano atlas.

195. Ronald Reed, *Ancient Skins, Parchments and Leathers* (London: Seminar Press, 1972), 123.

be more complicated to enlarge or reduce than to make a copy to the same scale. Perhaps the Grazioso Benincasa corpus provides us with a partial explanation. Comparison of the British Library's holding of his five atlases and a single loose chart, when considered in conjunction with measurements cited for his two atlases in the Bibliothèque Nationale (see the Biographical Index, appendix 19.2, pp. 449–56), reveals that all eight works were apparently drawn at one or the other of two distinct scales. Five of the major scale divisions measure approximately either 52 millimeters or 64 millimeters. While these differences would have enabled Benincasa to offer his customers a choice of atlas size, this apparent use of two specific scales—which extended to the separate chart as well—probably reflects a desire to make 1:1 copies where possible. Further measurements are needed to test this hypothesis and to explain the great variety of scales encountered elsewhere.

A standard way that cartographic scale was altered in the past was the square grid method. Once a grid had been placed over the original, the contents of each square could be copied in turn onto the equivalent square (now enlarged or contracted) on the new vellum. Later the grid lines would be rubbed out. It remains to be explained, though, how a temporary grid could have been drawn before the availability of the graphite pencil.¹⁹⁶ The Carte Pisane is sometimes cited in this connection, but all its small squared sections fall outside the hidden circle—thus having nothing to do with the construction of the chart as a whole—and both grid and circles are indelibly inked in.¹⁹⁷

Another early instance of an underlying grid is to be found in the 1320 Sanudo-Vesconte atlas (Biblioteca Apostolica Vaticana, Pal. Lat. 1362A), but its use on the map of Palestine merely accentuates the non-portolan-chart characteristics of that particular sheet. A more relevant, though equivocal, example is that of the undated and anonymous atlas in the Topkapi Sarayi, Istanbul.¹⁹⁸ Its general chart is covered with a network of small squares but has no rhumb lines. There are too many uncertainties about this work, however, for any conclusions to be drawn.¹⁹⁹ A final possibility, that the rhumb line network itself might have served as a substitute copying grid, is ruled out by inconsistencies in the rhumb line placings on otherwise identical charts.²⁰⁰ No commentator has yet managed to detect traces of the copying method on any early portolan chart. Again, this remains a challenge for future research.

STYLISTIC CONTENT

CATALAN AND ITALIAN DIFFERENCES

Once rhumb lines, coastal outlines, and names had been completed, the chart could then be embellished with

inland detail and decoration. This point is significant both as defining the stage at which geographic fact gave way to artistic expression and also as marking the divide between Italian austerity and Catalan flamboyance. Yet caution is necessary here. Of the many arguments that have surrounded the portolan charts for a century or more, the fiercest have concerned nationality. With full patriotic fervor, Spaniards (or at times their foreign champions) have claimed certain practitioners or innovations as Catalan, only to have Italian scholars lodge a counterclaim.²⁰¹ Nor have the Portuguese stood idly by. The arguments have often been more emotional than substantial; the gain for history has been minimal. The terms “Catalan style” and “Italian style” will therefore be used. This is not simply an evasive compromise; it reflects the degree of overlap between the work of Catalans and Italians—a factor not sufficiently acknowledged by most earlier writers.

Italian-style charts might show part of the Danube; beyond that, their interiors are usually empty. They tend

196. Cortés, *Arte of Navigation* (note 185), described the square grid method, and Smith, “Thames School,” 90 (note 185), detected places on the seventeenth-century English charts “Where a careless hand has left a bit of guideline [for the coast] uncovered.” But all this relates to a later period, when graphite was generally available. Very recently, a commentator detected “an initial dry-point sketch” on the 1409 Virga chart, which the final coastal outlines did not always follow. This intriguing observation invites further study; see Mollat du Jourdin and de La Roncière (i.e., Isabelle Raynaud-Nguyen), *Sea Charts*, 204 (note 40).

197. The circles and grid squares are red, the diagonal lines across the latter are green; see Mollat du Jourdin and de La Roncière, *Sea Charts*, 198 (note 40). This conflicts with the interpretation given by Motzo, “Compasso da navigare,” LXXI (note 103).

198. G. Adolf Deissmann, *Forschungen und Funde im Serai, mit einem Verzeichnis der nichtislamischen Handschriften im Topkapu Serai zu Istanbul* (Berlin and Leipzig: Walter de Gruyter, 1933), no. 47, where the atlas is attributed to Grazioso Benincasa.

199. The chart is reproduced in Marcel Destombes, “A Venetian Nautical Atlas of the Late Fifteenth Century,” *Imago Mundi* 12 (1955): 30. Destombes interpreted the grid on the Istanbul chart as “simply a scale of miles extended throughout the surface of the map,” but see also above, p. 381. A further instance of an underlying square grid is to be found on one sheet of the British Library's Cornaro atlas, but this belongs to a group of sheets on which the draftsman was evidently experimenting with alternatives to the normal rhumb line network.

200. Nordenskiöld, *Periplus* 17 (note 14), and Motzo, “Compasso da navigare,” LXXV (note 103). Yet the claim that the rhumb line network “served as a framework for the plotting of coastlines” has recently been revived in Mollat du Jourdin and de La Roncière, *Sea Charts*, 12 (note 40).

201. Giuseppe Caraci, for example, devoted most of his *Italiani e Catalani* (note 175) to the demolition of Heinrich Winter's claims in favor of the Catalans. See also Alberto Magnaghi, “Alcune osservazioni intorno ad uno studio recente sul mappamondo di Angelino Dalorto (1325),” *Rivista Geografica Italiana* 41 (1934): 1–27, esp. 6–14 on the Dalorto controversy. A rare corrective to the nationalistic arguments was provided by Quaini, “Catalogna e Liguria,” 551 n. 3 and 563–66 (note 60).

to be virtually, if not completely, devoid of everything for which there was no functional necessity (plate 26). By contrast, rivers, mountains, and a host of ornamental features make the standard Catalan chart immediately recognizable (plate 27). Most of these elements appear on the oldest surviving Catalan-style charts: Dalorto's of 1325/30 (on its dating, see below, p. 409), Dulcert's of 1339, and the unsigned British Library example, which is closely related to them.²⁰²

Already stylized, many of these Catalan-style conventions continue throughout our period and beyond, with only minor modifications. Rivers cross the interior, sometimes drawn as elongated corkscrews emerging from almond-shaped lakes. Mountain ranges, picked out in green, are also given distinctive forms. The largest of these, the Atlas chain, seems like a bird's leg, with two, and later three claws at the eastern end²⁰³ and a spur halfway along, while Bohemia is typically enclosed within a horseshoe of green mountains. The Red Sea, appropriately colored, is cut into at its northwest end to mark the miraculous crossing of the Israelites; the sea itself might be covered in parallel wavy lines. Important shrines are represented by a simplified drawing of a church, and the more significant towns are accorded a distinctive sign formed of a circular castle with a red interior, shown in a bird's-eye view. Majorca, often picked out in solid gold, is sometimes striped in the colors of Aragon,²⁰⁴ and Tenerife (Inferno) occasionally displays a white disk in its center, probably a reference to the snow-covered Pico de Teide.

Discursive notes are another hallmark of the Catalan-style charts,²⁰⁵ as are the names of provinces and kingdoms. The many other devices scattered over such charts not only add immeasurably to their beauty but also convey a wide range of further information. Flags flying above a tent or town sign identify, if not always accurately, the ruling dynasty, just as crowned figures represent real kings. The occasional ships and fishes are doubtless intended to convey a specific message too, like the North Atlantic whaling scene on the 1413 Mecia de Viladestes chart and the beautiful vignettes on the 1482 Grazioso Benincasa chart (though the latter appear to have been added later). Around the periphery of these Catalan charts there will usually be disks to locate the eight main wind directions.

It should always be borne in mind that these decorative elements might have been the work of specialist artists. Such was certainly the case with a series of world maps that the chartmaker Francesco Beccari contracted to produce in collaboration with Jefuda Cresques for a Florentine merchant in 1399.²⁰⁶ Beccari, who was responsible for the map's ornamentation, even charged individually for the figures and animals, ships and fishes, flags and trees.

For the most part, the division between charts drawn by Catalans and Italians matches the stylistic differences just described. But there are enough exceptions to demonstrate the ease with which the alternative style could be adopted. Chartmakers give frequent proof of both versatility and a desire for variety. Guillermo Soler, who evidently worked in Majorca, signed two surviving charts. One is undated and typically Catalan; the other of 1385 is in the Italian manner with virtually no inland detail or decoration. Other unsigned and unadorned Catalan charts survive from the late fourteenth century, and only their characteristic town signs distinguish them at a glance from Italian work.²⁰⁷ The Venetian Pizigani brothers ornamented their 1367 chart in the Catalan style; yet the atlas signed by Francesco Pizigano alone six years later is subdued and typically Italian. The prolific Grazioso Benincasa produced at least seventeen atlases in the austere Italian manner; but his latest known production, a chart of 1482, is thoroughly Catalan in style. If these examples demolish the hard-and-fast divisions between the work of Catalans and Italians, others—the 1447 Valseca chart, for example (fig. 19.3)—illustrate a style midway between the two extremes. Thus there was a regular stylistic interchange between the Catalan-speaking chartmakers of Majorca and their Italian counterparts. This is most noticeable in the way Genoese practitioners imitated the decorative devices of the Catalans. It is also corroborated by the borrowing of place-names to be discussed below.

Nevertheless, there was one important way Catalan draftsmen consistently differed from their Italian counterparts. Catalan chartmakers—or their clients—apparently had no use for bound volumes of charts.²⁰⁸ Conversely, the Italians of the fourteenth and fifteenth centuries seem never to have decorated their atlases in the Catalan style (though they may have added corner-pieces to otherwise unadorned charts), reserving these

202. London, British Library, Add. MS. 25691; Heinrich Winter, "Das katalanische Problem in der älteren Kartographie," *Ibero-Amerikanisches Archiv* 14 (1940/41): 89–126, esp. 89.

203. Youssouf Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51), 4.4:1469.

204. This convention is found for the first time on the Catalan atlas of 1375.

205. Those relating to Africa have been transcribed, translated, and analyzed by Kamal, *Monumenta cartographica*, 4.4:1472–77 (note 203).

206. R. A. Skelton, "A Contract for World Maps at Barcelona, 1399–1400," *Imago Mundi* 22 (1968): 107–13, esp. 107–9.

207. Florence, Biblioteca Nazionale Centrale, Port. 22; Venice, Biblioteca Nazionale Marciana, It. IV, 1912.

208. The so-called Catalan atlas is not an exception to this, since it was originally mounted on six wooden panels; see Grosjean, *Catalan Atlas*, 10 (note 94). However, two lost fourteenth-century productions seem to have been Catalan atlases; see Rey Pastor and García Camarero, *Cartografía mallorquina*, 66 (note 28).

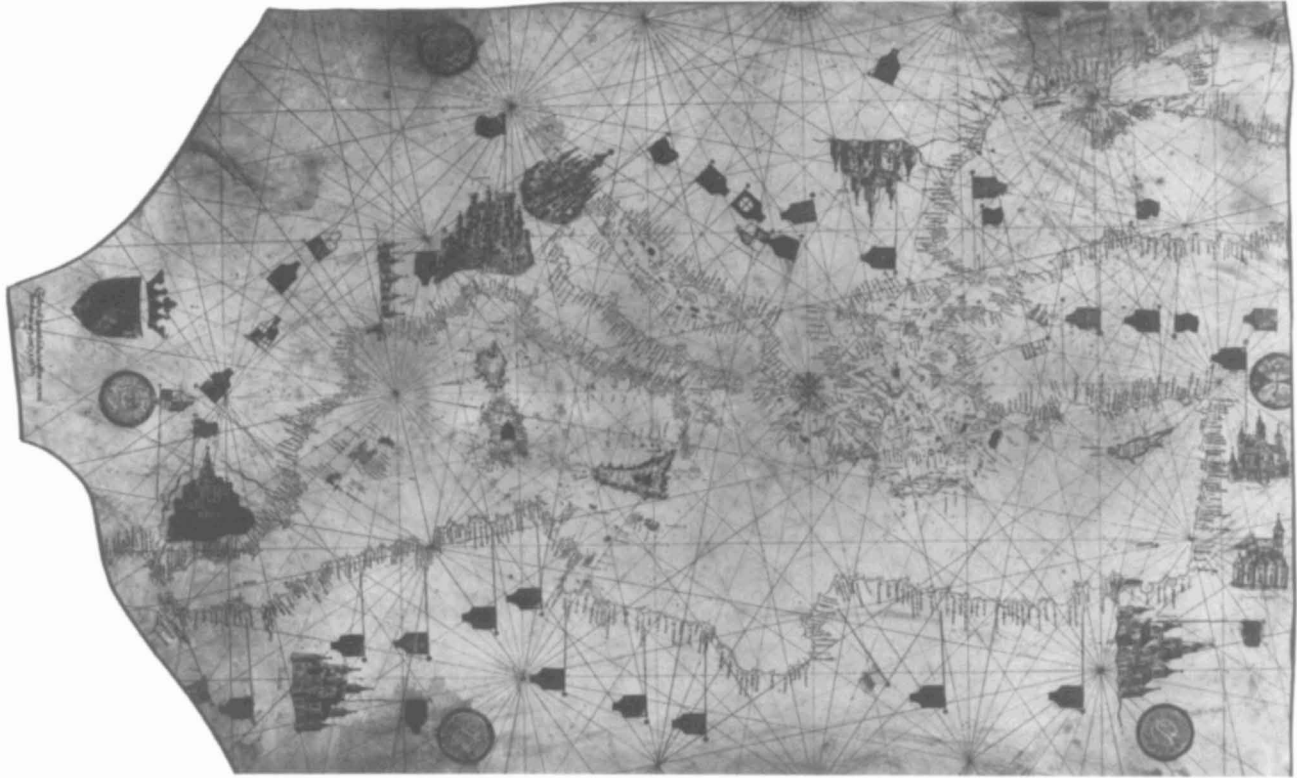


FIG. 19.3. A CHART IN AN INTERMEDIATE STYLE. Drawn by the Majorcan Gabriel de Valseca in 1447, this style is midway between the two extremes of Catalan flamboyance and Italian austerity. Flags, town vignettes, and wind disks are typically Catalan, the lack of inland detail typically Italian. Note the compass roses at the center and top of the rhumb line network. Valseca apparently revived this convention, first

found in the Catalan atlas (see fig. 19.5). The coat of arms at the neck of the chart belongs to the Lauria family, perhaps denoting the Francesco de Lauria whose name occurs in the Aragonese archives in the 1440s. Size of the original: 59 × 94 cm. Photograph from the Bibliothèque Nationale, Paris (Rés. Ge. C 4607).

flourishes for those drawn on a single skin. Here, at least, the distinctions are valid.

With their concern to reveal the nature of the interior, Catalan-style charts are simultaneously terrestrial maps. It is not surprising, therefore, that some Catalan draftsmen should have continued their work eastward to take in regions whose coastlines and hinterland were both little known. This effectively meant the countries beyond the Caspian Sea and Persian Gulf. The former, realistically treated in the Medici atlas, was well known to the Italians; as Marco Polo tells us, they had even launched their own ships there. Some of those Catalan productions that ventured east of the Caspian blend into *map-paemundi*.²⁰⁹ The farther they go, the more unreliable the coastal information becomes, as greater weight is given in Asia to interior details and less to navigational information. It is hard to see how an Italian-style portolan chart, with its bold statement of factual coastal outlines, could have expanded in this speculative way.

Italian world maps might borrow their Mediterranean outlines from the charts, but in other respects they belong to a separate tradition.²¹⁰ The overall stylistic con-

209. It was strongly argued by Reparaz, "Essai," 300 (note 175), that the two-sheet Dulcert chart of 1339 had originally had a further eastern section. Although this possibility was denied by Destombes, "Cartes catalanes," 51 (note 99), Cortesão, *History of Portuguese Cartography*, 2:40 (note 3), more recently proposed that, when constructed, the Dulcert map would have had *two* further sheets to the east, providing a total coverage similar to that of the Catalan atlas. Hinks, *Dalorto*, 9 (note 76), supposed there had been a similar eastern section for the Catalan chart in Florence, Biblioteca Nazionale Centrale, Port. 16.

210. Rome, Biblioteca Apostolica Vaticana, Borgiano V (once attributed to Fra Mauro), does extend some way east of the Caspian, but it is far from being a simplified Italian chart, having its interior packed with notes and details. So too is the Italian fragment in Istanbul; see Marcel Destombes, "Fragments of Two Medieval World Maps at the Topkapu Saray Library," *Imago Mundi* 12 (1955): 150–52, esp. plate facing p. 150, where it is incorrectly captioned as "Catalan"; see *Imago Mundi* 13 (1956): 193.

sistency of the Catalan examples may serve to disguise the joins between those regions based on portolan chart information and those derived from travelers' accounts or theoretical cartography, but it must be emphasized that the eastern extension has little to do with the portolan charts. Catalan world maps of this sort are properly discussed in the chapter on medieval *mappaemundi* and belong rather to an account of European discovery and knowledge of the Orient.

STYLISTIC DEVELOPMENT

It is to be regretted that no attempt has yet been made to provide a generalized index—preferably a visual one—of the common and distinguishing characteristics of portolan charts. Style obviously has great potential for assigning an anonymous work to its correct author or, failing that, to its most logical “school.” Yet the limited use so far made of this method has been highly selective. Heinrich Winter, who, more than anyone else, concerned himself with the ornamentation and design of portolan charts, appreciated that perceived changes in stylistic content could be a useful dating aid. Certain characteristics, for instance, are peculiar to the earliest charts. The scale is placed inside a circle on the *Carte Pisane*, the Cortona chart, Pietro Vesconte's chart of 1311, and the latter's 1313 atlas (fig. 19.4). These are probably the four earliest survivors, and this circle device is not found later. Then again, as Kelley appreciated, borders made up of a recurring chevron pattern are found only on charts that can be ascribed to the first half of the fourteenth century.²¹¹

It was the compass rose that Winter considered “one of the most important elements which make it possible, in the case of anonymous charts, to determine their national origin and to some extent also their date.”²¹² Unfortunately, his investigation was marred by its reliance on undated charts, whose ascription to a particular period can be challenged. That compass rose design is indicative of both the place and the time of construction seems clear, but we can only hint here at what seem to be the major developments.

The terminology first needs unscrambling. Many writers confuse the terms “wind rose” and “compass rose.”²¹³ If “wind rose” is to be used at all it should apply only to the unembellished intersection point at which the rhumb lines meet, while “compass rose” should denote the circular compass design into which the intersection point was sometimes elaborated (fig. 19.5). All portolan charts have wind roses, though not necessarily complete with the full thirty-two points; the compass rose, however, seems to have been a Catalan innovation. Whereas the Italian charts from the *Carte Pisane* onward often indicated the eight main wind di-

rections,²¹⁴ the Catalan chartmakers preferred to place disks around the perimeter. Among the symbols they used was an eight-pointed Pole Star indicating north. It needed only a small additional step to remove the star from its enclosing disk, enlarge it, and place it in a prominent part of the chart. The earliest instance of this occurs on the Catalan atlas of 1375 (see fig. 19.5). In this case, and this alone, the compass rose has been imposed on the rhumb line system rather than growing naturally out of a preexisting intersection point. As a result, only four of the rhumb lines, those for the cardinal points, pass through the heart of its compass rose. This awkwardness strongly suggests that the Catalan atlas instance was a first, or at least a very early, attempt. Thereafter the compass roses would be fully integrated with the rhumb

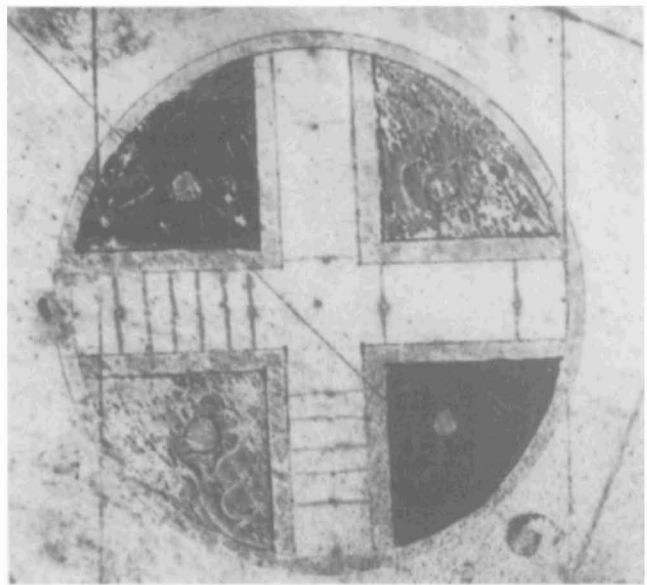


FIG. 19.4. SCALE BAR ON AN EARLY PORTOLAN CHART. A scale found within a circle occurs only on the earliest datable charts. This example from the 1313 atlas of Pietro Vesconte is the latest of four known examples of this convention.

Diameter of the original detail: 6.3 cm. Photograph from the Bibliothèque Nationale, Paris (Rés. Ge. DD 687, pl. 5).

211. The Carignano map, some of the Vesconte work, the Dalorto and Dulcert charts, and three incomplete anonymous charts: Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 14207; Washington, D.C., Library of Congress; and that acquired by Nico Israel of Amsterdam in 1980 (see note 67). See Kelley, “Oldest Portolan Chart,” 32 (note 58).

212. Winter, “Late Portolan Charts,” 37 (note 129); page 38 illustrates different compass rose types, as does Thompson, “Rose of the Winds,” pls. I–V (note 56).

213. See, for example, Nordenskiöld, *Periplus*, 47 (note 14) and the footnote.

214. By name, initial, or in the case of the 1327 Perrino Vesconte chart, by wind heads.

line system, although it was not until the second half of the fifteenth century that compass roses became commonplace, subsequently increasing in both number and intricacy.²¹⁵ A further development, the addition of a north-pointing fleur-de-lis outside the compass disk itself, is first found on Portuguese work, specifically on the Jorge de Aguiar chart of 1492 (fig. 19.6).²¹⁶

The later part of our period demonstrates a second way the rhumb line network could be elaborated. On the earlier charts there are just sixteen lines running out from the center of the hidden circle (the core of the system), connecting it with each of the secondary centers on its circumference. It seems to have been Petrus Roselli who decided to double the number of spokes radiating from the main center by adding a further sixteen red lines between the existing ones. These run out to the edge of the chart, avoiding all the secondary centers. Roselli's three earliest charts, two of 1447 and one of 1449, have the basic form; his six later works (1456–68) display the expanded network (fig. 19.7).²¹⁷ This feature is considered here under “stylistic development” since, in duplicating existing compass directions, the added lines serve no obvious practical function.²¹⁸ Later, however, as the anonymous chart of 1487 and Aguiar's chart of 1492 demonstrate, this enlarged center could

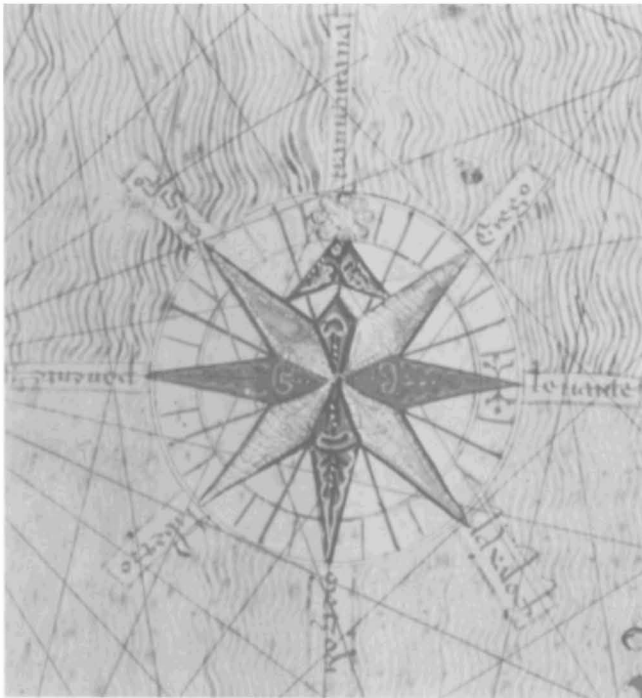


FIG. 19.5. COMPASS ROSE FROM THE CATALAN ATLAS. The Catalan atlas [1375] provides the earliest example of a compass rose, although it is unique in being positioned away from any of the intersection points. Diameter of the original detail: 5.6 cm. Photograph from the Bibliothèque Nationale, Paris (MS. Esp. 30).

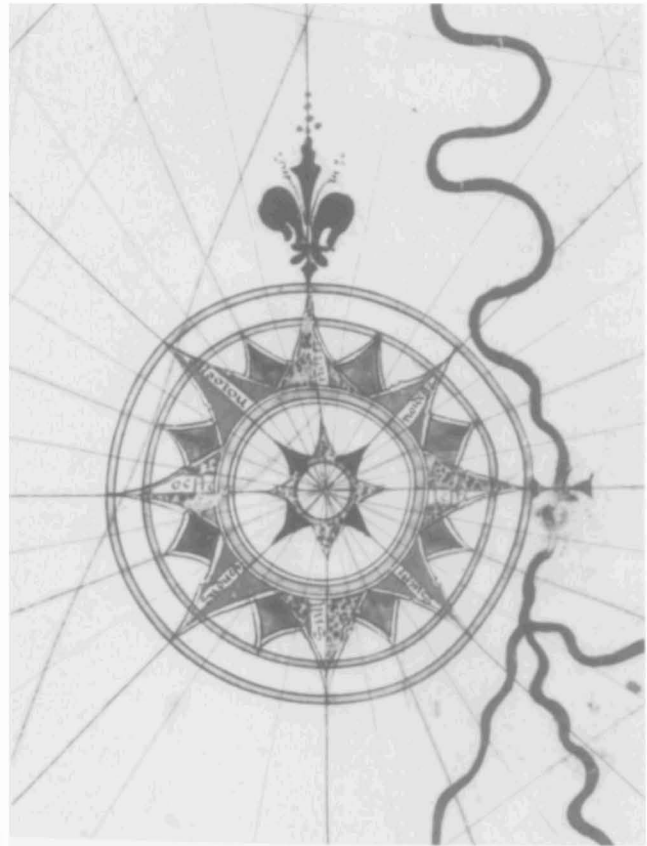


FIG. 19.6. COMPASS ROSE FROM THE 1492 CHART OF JORGE DE AGUIAR. This compass rose is apparently the earliest to include a north-pointing fleur-de-lis outside the compass disk itself.

Diameter of the original detail: 6.5 cm. By permission of the Beinecke Rare Book and Manuscript Library, Yale University, New Haven.

215. The Combitis and Pinelli-Walckenaer atlases, which have in the past been treated as roughly contemporary with the Catalan atlas, display simplified compass roses, but they have been reassigned in this chapter to the early fifteenth century (see table 19.3, pp. 416–20). The second dated appearance of a compass rose occurs on the unlocatable Sentuzo Pongeto chart of 1404. See the reproduction in Weiss und Co., *Antiquariat, Codices manuscriptorum incunabula typographica, catalogus primus* (Munich: Weiss, 1926), no. 55. (I am grateful to Peter Barber for bringing to my attention the copy of this now scarce catalog in the reference library of the Department of Manuscripts, British Library.) It should be pointed out, however, that Giuseppe Caraci, working only from the Weiss description and partial reproduction, expressed doubt about the Pongeto chart's authenticity; see Giuseppe Caraci, “Carte nautiche in vendita all'estero,” *Rivista Geografica Italiana* 34 (1927): 135–36, esp. 135. The Albertin de Virga chart of 1409 introduced a cloverleaf device at a number of the intersection points, but the compass rose proper does not reappear until the Gabriel de Valseca charts of 1439 and later.

216. Cortesão, *History of Portuguese Cartography*, vol. 1, frontispiece (note 3).

217. See appendix 19.2. This point could not be determined for the 1469 chart, known to have been in the possession of Otto H. F. Vollbehr in 1935.

218. N. H. de Vaudrey Heathcote, “Early Nautical Charts,” *Annals*



(a)



(b)

FIG. 19.7. RHUMB LINE CENTERS. In the mid-fifteenth century, the number of lines radiating from the main center of the portolan chart was increased from sixteen to thirty-two. Petrus Roselli appears to have been the first chartmaker to do this, as is shown by these details from his charts of 1449 (a) and 1456 (b).

The 1449 chart by permission of the Badische Landesbibliothek, Karlsruhe (MS. S6); the 1456 chart courtesy of the Edward E. Ayer Collection, The Newberry Library, Chicago (MS. Map 3).

be more readily elaborated into a thirty-two-point compass rose. Roselli's innovation was repeated on other fifteenth-century charts but has not been observed on Italian work before 1500. This can thus contribute to the determination of date.²¹⁹

Realistic town views appear on portolan charts at about the same time as the compass rose. Though rudimentary urban symbols had already been a feature of the 1327 Perrino Vesconte chart and of the earliest Catalan productions, the first drawings to betray actual observation are Italian towns on Italian charts.²²⁰ The 1367 chart by the Venetian Pizigani brothers includes an unmistakable Campanile in its Venice vignette, as does the little-known Sentuzo Pongeto chart of 1404. What may be the first attempt in a portolan atlas to depict Genoa is found in the calendar of the Francesco Pizigano atlas of 1373. Like the Venice scene with which it is paired, this is a mixture of the true and the fanciful (fig. 19.8).²²¹ The 1403 chart drawn by the Genoese Francesco Beccari includes a vignette that unquestionably depicts the crescent-shaped harbor of his native city, with the lighthouse at the end of the western arm.²²² The models for these simplified sailor's-eye views have yet to be identified, and it is possible they may be the work of the chartmakers themselves.²²³ Notwithstand-

of Science 1 (1936): 1–28, esp. 21, was under the impression that all mid-fifteenth-century charts had thirty-two point centers. He also made the strange assertion that this expanded network was essential to the charts' use.

219. It adds, for example, further doubts to the dates suggested by Nordenskiöld for his own chart and that in Uppsala; see *Periplus*, pls. XIX and XXIII (note 14), see note 357. It must also place a question mark beside the Bibliothèque Nationale's fragments (Rév. Ge. D 3005); see Foncin, Destombes, and de La Roncière, *Catalogue des cartes nautiques*, 18 (note 52), even though their suggested early fifteenth-century date is corroborated by the toponymic evidence; see table 19.3 (pp. 416–20).

220. The urban sign was already used on the Dalorto chart to distinguish Christian towns with a cross, and the Catalan atlas added domes to the Muslim centers. Early Catalan charts emphasized shrines rather than commercial centers. Simplified town signs had already occurred on Roman maps and early medieval *mappaemundi*.

221. Reproduced in Nordenskiöld, *Periplus*, 51 (note 14). Paolo Revelli, *La partecipazione italiana alla Mostra Oceanografica Internazionale di Siviglia (1929)* (Genoa: Stabilimenti Italiani Arti Grafiche, 1937), 183, identified the cathedral of San Lorenzo in the view. Carlo Errera, "Atlanti e carte nautiche dal secolo XIV al XVII conservate nelle biblioteche pubbliche e private di Milano," *Rivista Geografica Italiana* 3 (1896): 91–96, reprinted in *Acta Cartographica* 8 (1970): 225–52, pointed out that the outlines in question were drawn on the back of the original charts no earlier than 1381. Examination of the toponymic content of the charts that belong to this same intercalated supplement has not, however, detected any later names. The two elements of this atlas may thus be very close in date.

222. The lighthouse had already been referred to in the mid-thirteenth-century *Lo compasso da navigare*; see Taylor, *Haven-Finding Art*, 107 (note 7).

223. Although comparable views of Genoa were included about 1400 in Giovanni Sercebi's "Chronicles," see the reproductions in

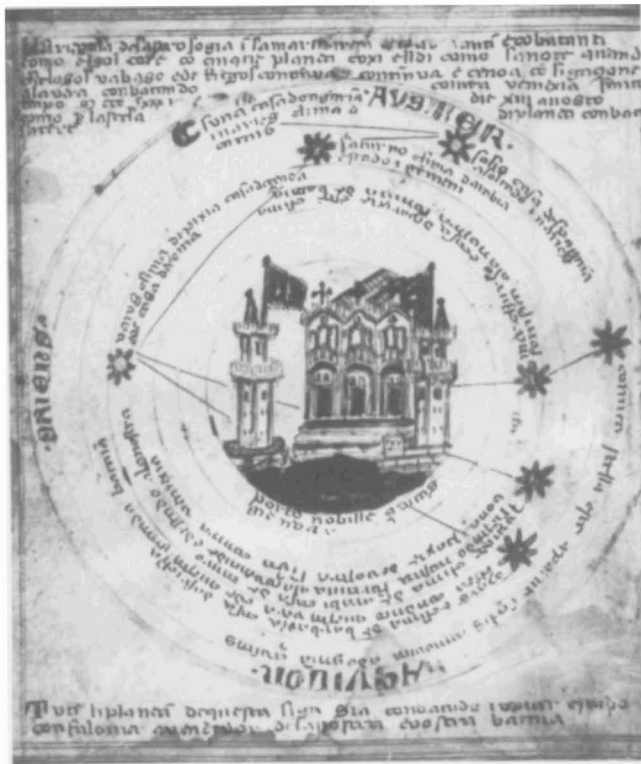


FIG. 19.8. GENOA AND VENICE IN A FOURTEENTH-CENTURY CALENDAR DIAGRAM. Two vignettes from the 1373 Francesco Pizigano atlas. On the left are the lighthouse and cathedral at Genoa, and on the right are the Campanile and church of Saint Mark in Venice.



By permission of the Biblioteca Ambrosiana, Milan (S.P., 10, 29).

ing this increasing tendency for Genoa and Venice to be realistically portrayed, a number of fifteenth- and sixteenth-century chartmakers persisted with fictitious town views.

The 1426 Batista Beccari chart was, in Winter's opinion, the first to emphasize the coasts by color.²²⁴ The same article drew attention to another datable development: the placing of a Madonna and Child vignette on the neck of the chart.²²⁵ The earliest instance of this known to Winter was by Roselli in 1464 (plate 28), although the Nicolo Florino chart of two years earlier had included the IHS monogram. Neither of these chartmakers, however, was the first to make a public gesture of piety. On four of their early fourteenth-century atlases, Pietro and Perrino Vesconte had filled the corners of the sheets with portraits of various saints.²²⁶ These cornerpieces were to recur in the other (anonymous) Lyons atlas (dated by its place-names to the beginning of the fifteenth century), in atlases of the Giacomo Girolodi type, and in the Cornaro atlas. This practice of adding corner portraits to portolan atlases seems to have been a Venetian hallmark. Certainly Vesconte worked

there, Girolodi was a native of Venice, and the Cornaro atlas was produced in that city.

FLAGS

If a systematic study of portolan chart style and embellishment would pay dividends, present indications are that a comparable investigation of the flags arrayed on

Luigi Volpicella, "Genova nel secolo XV: Note d'iconografia panoramica," *Atti della Società Ligure di Storia Patria* 52 (1924): 255–58. Volpicella identifies the oldest recorded view of Genoa as one dating from 1365 (p. 254).

224. Heinrich Winter, "Petrus Roselli," *Imago Mundi* 9 (1952): 1–11, esp. 4.

225. Winter, "Roselli," 6 (note 224).

226. Both Pietro's 1318 atlases and the undated volume in Lyons, as well as Perrino's 1321 Zurich atlas. For an art-historical interpretation of these miniatures see Bernhard Degenhart and Annegrit Schmitt, "Marino Sanudo und Paolino Veneto," *Römisches Jahrbuch für Kunstgeschichte* 14 (1973): 1–137.

about a third of the surviving fourteenth- and fifteenth-century charts might prove disappointing.²²⁷ This paradox needs explaining, because the political statement embodied in a city banner or a nation's arms is precisely the kind to raise expectations of accuracy and contemporaneity. There are countless instances in the extensive literature where an unsigned chart has been given a definite terminus ad quem on the grounds that it omits any reference to a change that took place in that particular year or because it displays a flag that was superseded at that time. Yet no methodical check was made to see whether dated charts were accurate in that respect. When considering the Dalorto chart, whose date has been variously read as 1325 or 1330 (see below, p. 409), Gerola argued in favor of the latter year on the grounds that Cagliari was flying the Aragonese colors—a reference to the subjugation of Sardinia in 1326. This verdict rested, however, on the further, and questionable, assumption that chartmakers recognized only de facto and not de jure rule, since Sardinia had been nominally Aragonese since 1297.²²⁸

Suppositions such as these need to be tested against the overall pattern of portolan chart flags. Unfortunately, though a highly visible element of a chart, the boldly colored flags tend to blur to unrecognizability in reproduction. A further problem is the extent to which the development of distinctive flags for particular places roughly parallels that of the charts themselves.²²⁹ Standardization in the design of flags had not yet taken place; hence it is not surprising that a great variety of forms were adopted by the different early chartmakers. Designs would be simplified or altered at will, and colors switched.²³⁰ The crescent, for example, was frequently used as a convenient shorthand for the Muslim cities of North Africa, even though several fourteenth-century charts already accorded these their own distinctive banners. It is also difficult for the researcher to be sure which place was intended, because the flag-bearing standard, pointing to the relevant place-name, was often located imprecisely. Where banners flew over unnamed town vignettes, this problem increased.

Flags are found on four of the Vesconte works (plate 29), on the Carignano map (though in the form of atypical, simplified disks), on the three Dalorto/Dulcert charts, on the mid-fourteenth-century *Libro del conocimiento*, and on a number of later works.²³¹ Of those atlases and charts attributable to the fourteenth and fifteenth centuries, probably upward of seventy (or about 40 percent) are involved, with more than sixty flags found at times on a single work. A comprehensive study of these is awaited; meanwhile some provisional observations can be made. In the first place, although certain flags recurred regularly, there were numerous variations in the selection of featured places, even within the work

of a single practitioner. In some cases an apparently superseded form reappeared much later.²³² Such inconsistency limits the generalizations that can usefully be made at present. Nevertheless, the selected instances presented in table 19.1, p. 400, are probably the most instructive.

What emerges most clearly from these examples is the difference in the chartmakers' attitudes toward victory and defeat. Whatever their nationality, none begrudged the Portuguese their success at Ceuta, for this was a Christian triumph over Islam. Yet the Ottoman expansion through Asia Minor (culminating in the capture of Constantinople) and around the Black Sea into Europe was ignored. Instead, the chartmakers used their flags to deny an unpleasant reality. This tells us about psy-

227. The main studies devoted to this subject are as follows. First, two by Giuseppe Gerola: "L'elemento araldico nel portolano di Angelino dall'Orto," *Atti del Reale Istituto Veneto di Scienze, Lettere ed Arti* 93, pt. 1 (1933–34): 407–43; and "Le carte nautiche di Pietro Vesconte dal punto di vista araldico," in *Atti del Secondo Congresso di Studi Coloniali, Napoli, 1–3 October 1934*, 7 vols. (Florence: Leo S. Olschki, 1935), 2:102–23. Second, three by Georges Pasch in *Vexillologia: Bulletin de l'Association Française d'Etudes Internationales de Vexillologie*: "Les drapeaux des cartes-portulans: L'atlas dit de Charles V (1375)," 1, nos. 2–3 (1967): 38–60; "Les drapeaux des cartes-portulans: Drapeaux du 'Libro del Conoscimiento,'" 2, nos. 1–2 (1969): 8–32; "Les drapeaux des cartes-portulans [portulans du groupe Vesconte]," 3, no. 2 (1973): 52–62. Finally, Anna-Dorothee von den Brincken, "Portolane als Quellen der Vexillologie," *Archiv für Diplomatik: Schriftgeschichte Siegel- und Wappenkunde* 24 (1978): 408–26.

228. Gerola, "Dall'Orto," 423 (note 227). But see Magnaghi, "Alcune osservazioni," 23–27 (note 201), where many objections are raised to Gerola's theory and it is argued, in support of the 1325 date, that the flag was intended to refer to the entire island, not just to Cagliari.

229. Flags developed out of the gonfanon (a war pennant carried on a lance) and the streamers flown at a ship's masthead. The general adoption of heraldic symbols has been dated to the mid-thirteenth century; see von den Brincken, "Vexillologie," 409–10 (note 227). See also E. M. C. Barraclough and W. G. Crampton, *Flags of the World* (London: Warne, 1978), 12–14.

230. Pasch, "Libro del Conoscimiento," 10 (note 227), and Pasch, "Atlas de Charles V," 44 (note 227), where he talks of the "psychophysiology of color."

231. The Vesconte works are the Vatican atlases of [1320] and [1321], the British Library's atlas of about 1325, and the Perrino Vesconte chart of 1327; the Dalorto/Dulcert charts are Dalorto (1325/30), Dulcert (1339), and British Library, Add. MS. 25691; the *Libro del Conoscimiento* was compiled by a Spanish Franciscan friar (born 1304). His written survey was apparently composed with the aid of a Catalan world map. Between them, the three surviving manuscript recensions illustrate about 110 different flags. The text refers to a battle that took place in 1348, but attempts to narrow further the date of its construction are not convincing. See Clements R. Markham, ed. and trans., *Libro del Conoscimiento: Book of the Knowledge of All Kingdoms* (London: Hakluyt Society, 1912), 2d ser., 29, and Pasch, "Libro del Conoscimiento" (note 227), both of whom reproduce the flags.

232. For example, the 1421 Francesco de Cesanis chart has several forms associated with the Vescontes a century earlier.

TABLE 19.1 Flags and Chartmakers' Response to Political Change

Place	Historical Event	Chartmakers' Response
England	From 1340 the fleur-de-lis was quartered with the three lions when Edward III claimed the French throne.	This form appeared in the <i>Libro del conocimiento</i> (mid-fourteenth century), on the Soler chart (ca. 1385) in Paris, and on most charts thereafter. Portuguese charts at the end of the fifteenth century replaced the quarterings with the cross of Saint George.
Seville (or Spain)	United under Ferdinand and Isabella in 1479.	Where previously the arms of Spain had been the quartered lion and castle, most late fifteenth-century charts seem to have incorporated the alternating bands of Aragon. ^a
Granada	Taken from the Moors in 1492.	Probably recognized immediately.
Valencia	Acquired by Aragon in 1238; toward the end of the fifteenth century transferred to Castile.	Fourteenth-century charts have the alternating bands of Aragon; fifteenth-century charts tend to include a crown as well. ^b
Montpellier	Passed from Aragon to France in 1349.	The bands of Aragon, forming half the flag, are replaced by fleur-de-lis. The 1426 Beccari chart was the first instance noted of the later form.
Marseilles	Transferred from Provence to France in 1486.	Instead of the normal blue cross there is a fleur-de-lis on the [1483?] Reinel chart—see p. 374.
Rome	Republican at various times, e.g., under Cola di Rienzo (1347 and 1353–54).	SPQR is found in place of the usual crossed keys on the anonymous Corsini chart ^c and in the <i>Libro del conocimiento</i> . The 1473 Benincasa atlas in Bologna includes both forms. ^d
Salonika (Thessalonica)	Changed hands several times between the Byzantine Empire, Venice, and the Ottoman Turks, until finally passing to the Turks in 1430.	The Paleologue arms of the Byzantine emperors (4 Bs on their sides) were apparently retained throughout the fifteenth century.
Constantinople	Fell to the Ottoman Turks in 1453.	Subsequent charts either retained the Paleologue form or omitted a flag altogether.
Curcho (in Armenia Minor)	Overrun by the Ottomans in 1375.	Its flag—white crosses on a blue ground—continued for at least a century.
Ceuta	Taken by Portugal in 1415.	No post-1415 instance has been found showing the preconquest device (twin keys) apart from the 1421 Cesanis chart.

^aIt is likely that the rulers depicted on some charts will also indicate changing political realities. However, the attempt by one commentator to use in this way the Spanish sovereigns on two Bertran charts is unconvincing, since neither the unification of Spain nor the conquest of Granada—both of which were supposed to be reflected—occurred during the period in question (1482–89). See Niccolò Rodolico, “Di una carta nautica di Giacomo Bertran, maiorchino,” in *Atti del III Congresso Geografico Italiano, Florence, 1898*, 2 vols. (1899), 2:544–50, esp. 545.

^bGeorges Pasch noted that the bands were horizontal in the fifteenth century and then vertical in the sixteenth and seventeenth centuries;

see *Vexillologia: Bulletin de l'Association Française d'Etudes Internationales de Vexillologie* 2, no. 6 (1972): 19. Confusingly, late fifteenth-century Portuguese charts reverted to the earlier form.

^cFor which reason a mid-fourteenth-century date was suggested for it; see Pietro Amat di San Filippo, “Recenti ritrovamenti di carte nautiche in Parigi, in Londra ed in Firenze,” *Bollettino della Società Geografica Italiana*, 3d ser., 1 (1888): 268–78, esp. 273; reprinted in *Acta Cartographica* 9 (1970): 1–11.

^dMarina Emiliani (later Marina Salinari), “Le carte nautiche dei Benincasa, cartografi anconetani,” *Bollettino della Reale Società Geografica Italiana* 73 (1936): 485–510, esp. 498–99.

chological attitudes, not about historical events. Hence bizarre results are produced when attempts are made to draw dating inferences from flags flying over towns that were to be overrun by the Ottoman Turks.²³³ Errors of at least a century can be produced in this way. On the other hand, the rapidity with which the capture of Ceuta was generally acknowledged gives some justification for treating the earlier Arab insignia as a terminus ad quem of 1415. In the same way, the Spanish flag seems to have been speedily inserted over Granada after 1492 and beside Oran, Bougie (Bejaia), and Tripoli in Libya after those towns were subdued in 1509–10.²³⁴ If the presence of these flags has caused some charts to be moved out of the fifteenth century,²³⁵ their absence provides reasonable (though inconclusive) grounds for a date before 1510.²³⁶

Once an element of selective truth is admitted, it is no longer possible to see the flags as giving “valuable information to a visiting ship.”²³⁷ Many a Christian sailor would have ended up a galley slave had he relied on his chart to distinguish friend from foe. It is surely fair to assume anyway that medieval mariners would have been aware of those political developments taking place in Mediterranean or Black Sea ports that carried implications for them.

Even if we agree with Georges Pasch, the most assiduous modern commentator on this subject, that the portolan chart vexillology was no better or worse than that of other documents of the period,²³⁸ it is as well to underline its limited value to historians of cartography. The flags have often been interpreted as a straightforward account of shifting political reality. Yet they made a very limited response to the turmoil of the centuries concerned as the fortunes of the Genoese and Venetian colonies fluctuated in the face of the military expansion of the Ottoman Turks. Many towns continued to display an unaltered flag despite changes of overlord, presumably because the design belonged exclusively to the town rather than to the imperial power that dominated it. Other factors may sometimes have overridden considerations of political accuracy: aesthetic or practical judgments must have played their part in the choice of flags. If the place-names left limited space, eastern Adriatic flags and those for Rome and Florence might be omitted to avoid a cramped appearance.²³⁹ Sometimes more positive reasons were involved, as when a chartmaker turned the flags to his own political purpose. There is probably no better example of this than the dozen Genoese flags the chartmaker of that city, Albino da Canepa, placed around the Black Sea on his chart of 1489. This exercise in medieval flag-waving turned the Black Sea into a Genoese lake as much as fifteen years after a process of contraction had culminated in the fall of its final stronghold, Caffa (Feodosiya).²⁴⁰

PALEOGRAPHIC EVIDENCE

Calligraphy is less obvious as an indicator of style, but this ever-present element must represent one of the most important pointers to the place and date of a chart's production. A faithful copy reproducing an archaic hand could be made a long time afterward, though, with the result that on occasion there may be considerable disparity between the dates of a chart's compilation and its execution. One well-known instance—the British Library's Cornaro atlas (Egerton MS. 73)—makes no attempt to disguise its use of obsolete charts. Though its thirty-four sheets of charts are apparently drawn in the same hand throughout²⁴¹ (and one of them is dated 1489), most are acknowledged copies of the work of earlier chartmakers. Among the authors cited are Francesco Beccari and Nicolo de Pasqualini, for whom single signed works are known, dated respectively 1403 and 1408. The same intentional reproduction of out-of-date charts might help explain the conflicting drafts of the

233. Despite the warning given in 1882 by Amat di San Filippo in the preface to Uzielli and Amat di San Filippo, *Mappamondi*, iv (note 35). For example, Gaffarel, “Dijon,” 166 (note 37), argued from the absence of a crescent over Salonika that the Dijon chart must have been drawn before 1429; yet the Spanish flags attached to Granada (taken from the Moors in 1492) and the Canaries (conquered 1493–96) point to the very end of the fifteenth century at the earliest. On this, see also Raynaud-Nguyen, “Hydrographie” (note 37). Rhodes, occupied by the Knights Hospitalers until 1523, retained its red cross on some charts drawn more than a century afterward, for instance, the Caloiro chart of 1665; see Frabetti, *Carte nautiche italiane*, pl. xxxvii (note 73).

234. For example, on the 1512 Maggiolo atlas, see Georges Grosjean, ed., *Vesconte Maggiolo, “Atlante nautico del 1512”*: *Seeatlas vom Jahre 1512* (Dietikon-Zurich: Urs Graf, 1979).

235. See p. 386.

236. For example, the chart reproduced in Edward Luther Stevenson, *Facsimiles of Portolan Charts Belonging to the Hispanic Society of America*, Publications of the Hispanic Society of America, no. 104 (New York, 1916), pl. V, and that described successively in E. P. Goldschmidt, Booksellers, *Manuscripts and Early Printed Books (1463–1600)*, catalog 4 (London: E. P. Goldschmidt, [1924–25]), no. 125, and Ludwig Rosenthal, *Antiquariat*, catalog 163, no. 1237. On the latter, see also Caraci, “Estero,” 136 (note 215).

237. Taylor, *Haven-Finding Art*, 113 (note 7). Nor should the opposite view, that the portolan chart flags are usually of no more than secondary and ornamental significance, be accepted; see Magnaghi, “Alcune osservazioni,” 19 (note 201).

238. Pasch, “Vesconte,” 56 (note 227).

239. Aesthetic values must have been involved when Francesco Beccari inserted 340 flags on his large world map. Since this was three times the total available on the model from which he worked, the additions must simply have been repeats of existing flags or imaginary flags; see Skelton, “Contract,” 108 (note 206).

240. Magnaghi, “Alcune osservazioni,” 3 (note 201), cites several mid-sixteenth-century examples of the Genoese flag being retained for Black Sea ports.

241. But see Cortesão, *History of Portuguese Cartography*, 2:196 (note 3), for a note on contrary opinions.

Adriatic in the Medici atlas (see appendix 19.1 and fig. 19.19).

Nordenskiöld was too dismissive of the use of paleography in dating charts when he declared that “it is perfectly impossible to decide the age of portolanos [i.e., charts] by their style, for even the hand-writing is slavishly copied.”²⁴² Yet it must be accepted that dating based on script can only be approximate. Moreover, the style of the compressed calligraphy forced on the chart-makers by limitations of space was probably slow to change. The combined outlines, toponymy, and style of the Cortona chart all consistently suggest that it antedates the 1311 Pietro Vesconte chart. Should we then follow Armignacco in assigning the chart to about 1350, purely on paleographic grounds?²⁴³ A different kind of conflict between writing and content was reported by Cortesão and Teixeira da Mota. They dated a Portuguese chart in the Arquivo Nacional, Lisbon, to the very end of the fifteenth century from internal evidence but admitted that “the hand-writing of the place-names might suggest an earlier date.”²⁴⁴

A systematic examination by appropriate specialists of the script on all supposed fourteenth- and fifteenth-century portolan charts is clearly long overdue. If the peculiarities of known chartmakers were codified, it might prove possible to test the numerous, and frequently conflicting, attributions of unsigned work that have been casually put forward on supposed paleographic grounds alone. Until a thorough survey has been made of this type of evidence it must be handled with considerable caution (figs. 19.9 and 19.10 show how paleography can corroborate the toponymic analysis—see also p. 424).

HYDROGRAPHIC DEVELOPMENT

It has been natural to emphasize the very obvious visual differences between (usually Italian) austerity and (usually Catalan) exuberance. Indeed, the dissimilarity between the two types might raise doubts that they really belong to the same family. Yet if the Catalan ornamentation is disregarded, it is apparent that the underlying hydrographic content is essentially the same on charts of equivalent age, wherever they were made. While regional variations might lead to differences in the form in which the charts were presented, these differences were softened (in the early stages at least) by the unifying effect of a shared hydrographic development.

It has always been assumed, no doubt correctly, that portolan chartmakers were accomplished copyists. What is not justified, however, is the commonly expressed extension of this: that they slavishly imitated unchanging models. As we shall show, the portolan charts of the fourteenth and fifteenth centuries display a continuous and wide-ranging development. It is convenient to dis-

cuss this under three headings: changes in the outlines of existing coastlines; the addition of new information beyond the Mediterranean; and the evolving toponymy of the areas that lie at the heart of the portolan charts.

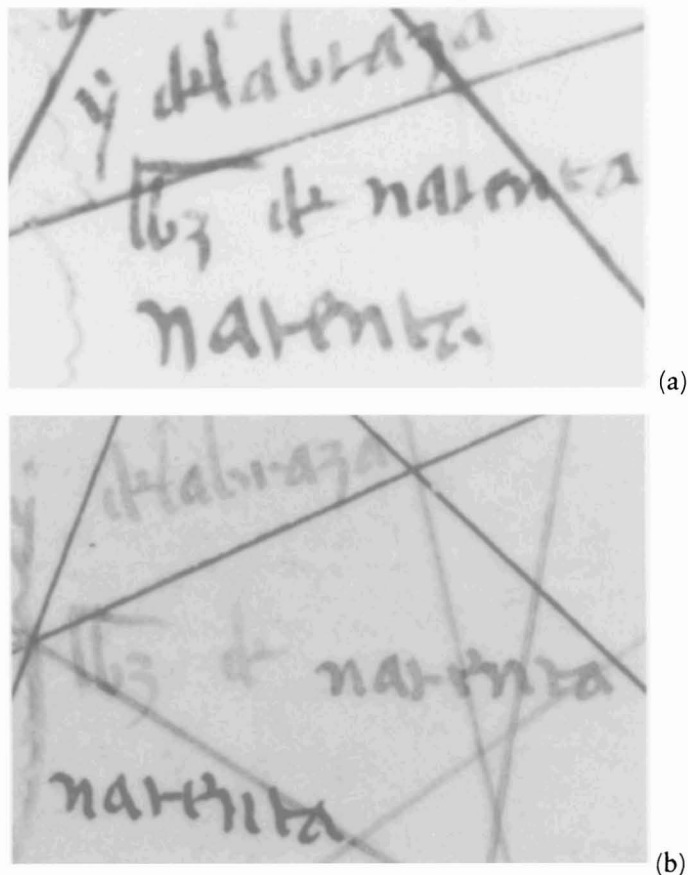


FIG. 19.9. PALEOGRAPHIC COMPARISON (1). The use of the otherwise rare abbreviation *lbz* for “gulf” on both the Combitis (a) and the Pinelli-Walckenaer (b) atlases is one of the pieces of evidence pointing to their common authorship. The portion of the two atlases illustrated is the *lbz de Narenta*, on the Dalmatian coast.

By permission of (a) the Biblioteca Nazionale Marciana, Venice (It. VI, 213 [MS. 5982]), and (b), the British Library, London (Add. MS. 19510, fol. 5r).

242. Nordenskiöld, *Periplus*, 58 (note 14).

243. Vera Armignacco, “Una carta nautica della Biblioteca dell’Accademia Etrusca di Cortona,” *Rivista Geografica Italiana* 64 (1957): 185–223, esp. 192. Armignacco and others have argued that the Cortona chart might be a copy of one that antedated the Carte Pisane. The absence of Manfredonia, founded in 1258 and present on the Carte Pisane, has been cited in support of this. The dating of this important chart was also discussed, though not resolved, in Caraci, *Italiani e Catalani*, 275–79, esp. 278 (note 175). Caraci suggested that remarks about Palestine, written in an old hand on the reverse of the chart, were reminiscent of proposals for a crusade made at the Council of Lyons in 1274. If verified, this could have important implications for the dating of the Cortona chart and, by extension, of the Carte Pisane.

244. Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:5 (note 29).

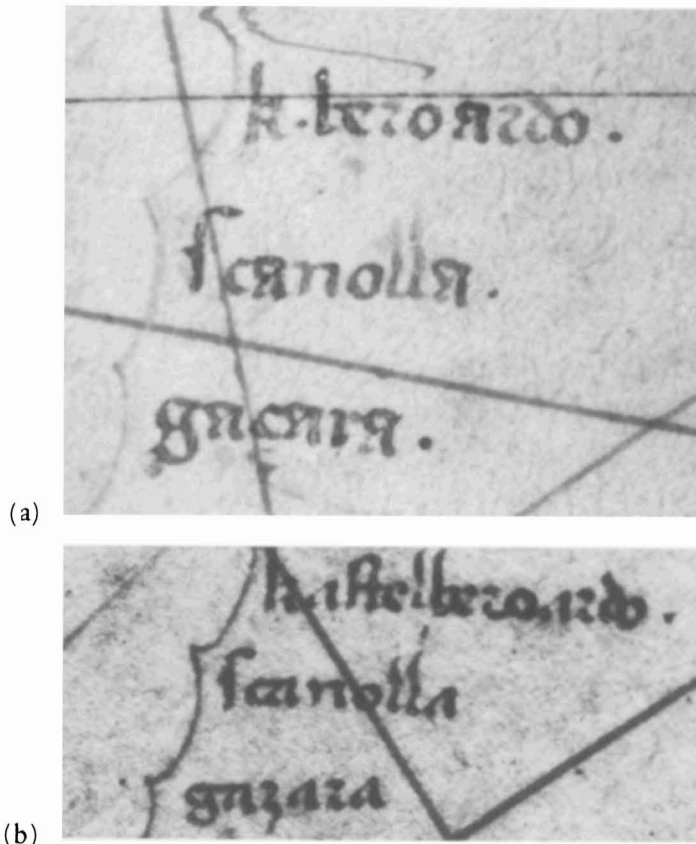


FIG. 19.10. PALEOGRAPHIC COMPARISON (2). As a draftsman, Francesco de Cesanis was distinctive in using a period after most place-names as well as a wavy *l*. This illustration compares the names *scanolla* and *kastelberoardo* along the Palestine coast taken from the 1421 chart of Cesanis (a) with their forms in the Luxoro atlas (b). Other shared characteristics, particularly patterns of place-names, make it likely that both are by the same hand. The Luxoro atlas would thus be a Venetian work of the early fifteenth century, rather than a Genoese production of the early fourteenth century, as generally supposed.

By permission of (a) the Civico Museo Correr, Venice (Collezione Correr, Port. 13), and (b) the Biblioteca Civica Berio, Genoa.

CHANGING COASTAL OUTLINES

It has been generally accepted that alterations to the presented shape of coastal features on portolan charts demonstrate hydrographic progress. However, the unwarranted evolutionary assumptions on which this depends, and the part presumably played by the chance effects of copying in molding particular features, have been insufficiently considered. The more rigorous methods of plotting shape—whether with the aid of a computer, with a camera, or by means of multiple measurements²⁴⁵—are of recent development and have yet to be systematically applied to the early charts. Instead, we have been offered selected tracings of particular features for comparison and have been invited to

detect supposed similarities and stages of development. Yet this method is innately subjective and has proved of only limited value. The differences are evident; their significance is a matter of conjecture. R. A. Skelton warned of the dangers of basing a “heavy load of theory . . . on a visual impression.”²⁴⁶

A few of the many specific coastal outlines that have been considered in this way can be mentioned: the Rhône and Danube deltas, and the Syrtes (by Kelley); the Crimean peninsula, mouth of the Nile, Majorca, and the Straits of Gibraltar (by Nordenskiöld and Caraci), Rathlin Island, off the coast of Northern Ireland (by M. C. Andrews), and France (by Numa Broc).²⁴⁷ Besides these, Rey Pastor and García Camarero offered comparative sketches of various mountain ranges and rivers as they occurred on Catalan charts.²⁴⁸ The most thorough investigation of this kind was carried out by Andrews, who analyzed the shape of the British Isles in three important articles.²⁴⁹ He classified the charts of the three centuries according to which “type” they exhibited and was able to identify thirteen variant shapes for Scotland, twelve for England, and seven for Ireland.²⁵⁰ Andrews taught us much about the influence of one chartmaker on another, but the method suffers from a basic weakness: in assigning charts to one or another of the identified types, the countless (and possibly significant) mi-

245. For computer-aided methods see Joan M. Murphy, “Measures of Map Accuracy Assessment and Some Early Ulster Maps,” *Irish Geography* 11 (1978): 88–101, and Jeffrey C. Stone, “Techniques of Scale Assessment on Historical Maps,” in *International Geography* 1972, ed. W. P. Adams and F. M. Helleiner (Toronto: University of Toronto Press, 1972), 452–54; on camera method see Harry Margary, “A Proposed Photographic Method of Assessing the Accuracy of Old Maps,” *Imago Mundi* 29 (1977): 78–79; and for multiple measures see Elizabeth Clutton, “Some Seventeenth Century Images of Crete: A Comparative Analysis of the Manuscript Maps by Francesco Basilicata and the Printed Maps by Marco Boschini,” *Imago Mundi* 34 (1982): 51–57.

246. R. A. Skelton, *Looking at an Early Map* (Lawrence: University of Kansas Libraries, 1965), 6.

247. Kelley, “Oldest Portolan Chart,” figs. 2–4 (note 58); see also Oldham, “Rhône Delta,” 403–28 (note 81); Nordenskiöld, *Periplus*, 23 (note 14); Giuseppe Caraci, “The Italian Cartographers of the Benincasa and Freducci Families and the So-Called Borgiana Map of the Vatican Library,” *Imago Mundi* 10 (1953): 23–49, esp. 41; Michael Corbet Andrews, “Rathlin Island in the Portolan Charts,” *Journal of the Royal Society of Antiquaries of Ireland* 55 (1925): 30–35, esp. 30; Numa Broc, “Visions Médiévales de la France,” *Imago Mundi* 36 (1984): 32–47, esp. 40, 42.

248. Rey Pastor and García Camarero, *Cartografía mallorquina*, 26–28 (note 28).

249. Michael Corbet Andrews, “The Boundary between Scotland and England in the Portolan Charts,” *Proceedings of the Society of Antiquaries of Scotland* 60 (1925–26): 36–66; idem, “The British Isles in the Nautical Charts of the XIVth and XVth Centuries,” *Geographical Journal* 68 (1926): 474–81; idem, “Scotland in the Portolan Charts,” *Scottish Geographical Magazine* 42 (1926): 129–53, 193–213, 293–306.

250. Andrews, “Scotland in the Portolan Charts,” 132 (note 249).

nor variations have to be ignored. Although Andrews was able to document frequent change, he stressed that it seldom involved improvement in content. Some of his types were in use for a century or more, and several were found to coexist. His analysis was thus more a guide to lineage than to date. Yet despite the imperfections of this method, some infusions of new information can nevertheless be discerned for the earliest period. The areas involved are large enough and the changes sufficiently marked for there to be little danger of subjectivity in their interpretation.

Ideally, the next step would be to parade the earliest charts in their chronological sequence, examining them for these changes in content. Before this is attempted, however, it is necessary to clarify some basic issues. In the first place, we must establish which charts belong to this crucial formative period of the early fourteenth century. Second, we have to clarify which works can be attributed to the period's most prolific practitioners (or practitioner), Pietro and Perrino Vesconte. Unfortunately, many of the supposedly earliest charts are the objects of controversy precisely about their date, and since a number remain unpublished, it is difficult to test earlier judgments on this point. Furthermore, the 1311 Vesconte chart and that in the Library of Congress portray only the eastern half of the Mediterranean,²⁵¹ the Cortona chart is trimmed at its western edge, and some of the others are even more incomplete.²⁵² All of this makes it more difficult to set within a chronological framework the first major improvements to be found on the portolan charts.

The Carte Pisane (plate 30) is accepted as being the oldest surviving portolan chart. It owes its title to Jomard, who believed it came from a Pisan family. Nevertheless, the chart is often considered to be Genoese in workmanship and to date from the late thirteenth century.²⁵³ The first step is to compare its outlines with those of its presumed closest successors: the little-known Cortona chart (fig. 19.11), the Carignano map, and the plentiful productions of Pietro Vesconte from 1311 onward. None of these repeats the Carte Pisane's very apparent broadening of Italy, nor do they imitate its distortion of Spain's Mediterranean outline. The thoroughly unreal outline of the Atlantic coasts of southwestern Europe was possibly repeated on the Cortona chart. Although its Spain has been trimmed away, the small extant section of the Belgian and French coasts imitates very closely that found on the Carte Pisane. As apparently the second earliest surviving chart (in terms of compilation, though not necessarily in terms of drafting), it deserves further study.²⁵⁴

A work that has featured prominently in almost all previous discussions on the earliest charts is the Giovanni da Carignano map. Since it was destroyed in 1943,

it must now be approached through reproductions, none of which is particularly clear.²⁵⁵ All that can be said with certainty is what is stated in its author's legend, namely that it was drawn by Giovanni the priest, rector of Saint Mark's in the port of Genoa.²⁵⁶ Beyond that we move off firm ground. A variety of dates have been proposed for it, ranging from 1291 to 1400,²⁵⁷ although Ferretto reduced the possibilities by showing that Carignano died between September 1329 and May 1330.²⁵⁸ The forty-year tolerance thus allowed still left open the possibilities that the Carignano map might antedate the Carte Pisane or belong to a period later than the Dalorto chart and the entire Vesconte output.

Although Carignano's name features fairly frequently in the Genoese archives, there are no mentions of his mapmaking interests.²⁵⁹ We learn of these instead from a later chronicler, Jacopo Filippo Foresti of Bergamo (known as Bergomensis). In 1306 an Ethiopian embassy on its way back from Avignon and Rome stopped off in Genoa.²⁶⁰ There they met and were interviewed by

251. For the 1311 Vesconte chart see Nordenskiöld, *Periplus*, pl. V (note 14). The Library of Congress chart is reproduced in Kelley, "Oldest Portolan Chart," 22 (note 58), and in color in Charles A. Goodrum, *Treasures of the Library of Congress* (New York: H. N. Abrams, 1980), 93.

252. Like Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 14207, and the chart acquired by Nico Israel in 1980 (see note 67).

253. The approximations "ca. 1275" and "ca. 1300" are often given to it. The more precise "ca. 1290" makes the unwarranted assumption that a cross would not have been placed beside Acre after that town fell to the Turks in 1291. The even more exact "ca. 1284" (applied to the Carte Pisane during an exhibition in Paris in 1931) seems to derive from a careless reading of a passage in de La Roncière, *Afrique*, 1:41 (note 100). I owe this last suggestion to Mireille Pastoureau. One recent commentator misinterpreted the toponymic evidence to reach the unwarranted conclusion that the Carte Pisane was drawn about 1265; see Romano, "Carte Pisana," 89–90 (note 181). Another concluded that it could not have been drawn before 1275, a statement not supported by the cited evidence; see Mollat du Jourdin and de La Roncière, *Sea Charts*, 16 (note 40). For a bibliographical note on the various opinions about the Carte Pisane's date see Revelli, *Partecipazione italiana*, lxxix–lxxx (note 221). Not all Italian scholars are convinced about the Carte Pisane's supposed Genoese authorship; see above p. 389 and note 176.

254. See above, p. 402 and note 243.

255. Ferdinando Ongania, *Raccolta di mappamondi e carte nautiche del XIII al XVI secolo* (Venice, 1875–81), pt. 3; Nordenskiöld, *Periplus*, pl. V (note 14); Kamal, *Monumenta cartographica*, 4.1:1138 (note 203).

256. "Johannes presbyter, rector Sancti Marci de portu Janue me fecit."

257. Revelli, *Partecipazione italiana*, lxx, lxxviii–lxxx (note 221).

258. Ferretto, "Carignano," 45 (note 76). This corrected an earlier belief that he had died in 1344.

259. Ferretto, "Carignano," 36–45 (note 76).

260. R. A. Skelton, "An Ethiopian Embassy to Western Europe in 1306," in *Ethiopian Itineraries circa 1400–1524, Including Those Collected by Alessandro Zorzi at Venice in the Years 1519–24*, ed. Osbert G. S. Crawford, Hakluyt Society, ser. 2, 109 (Cambridge:

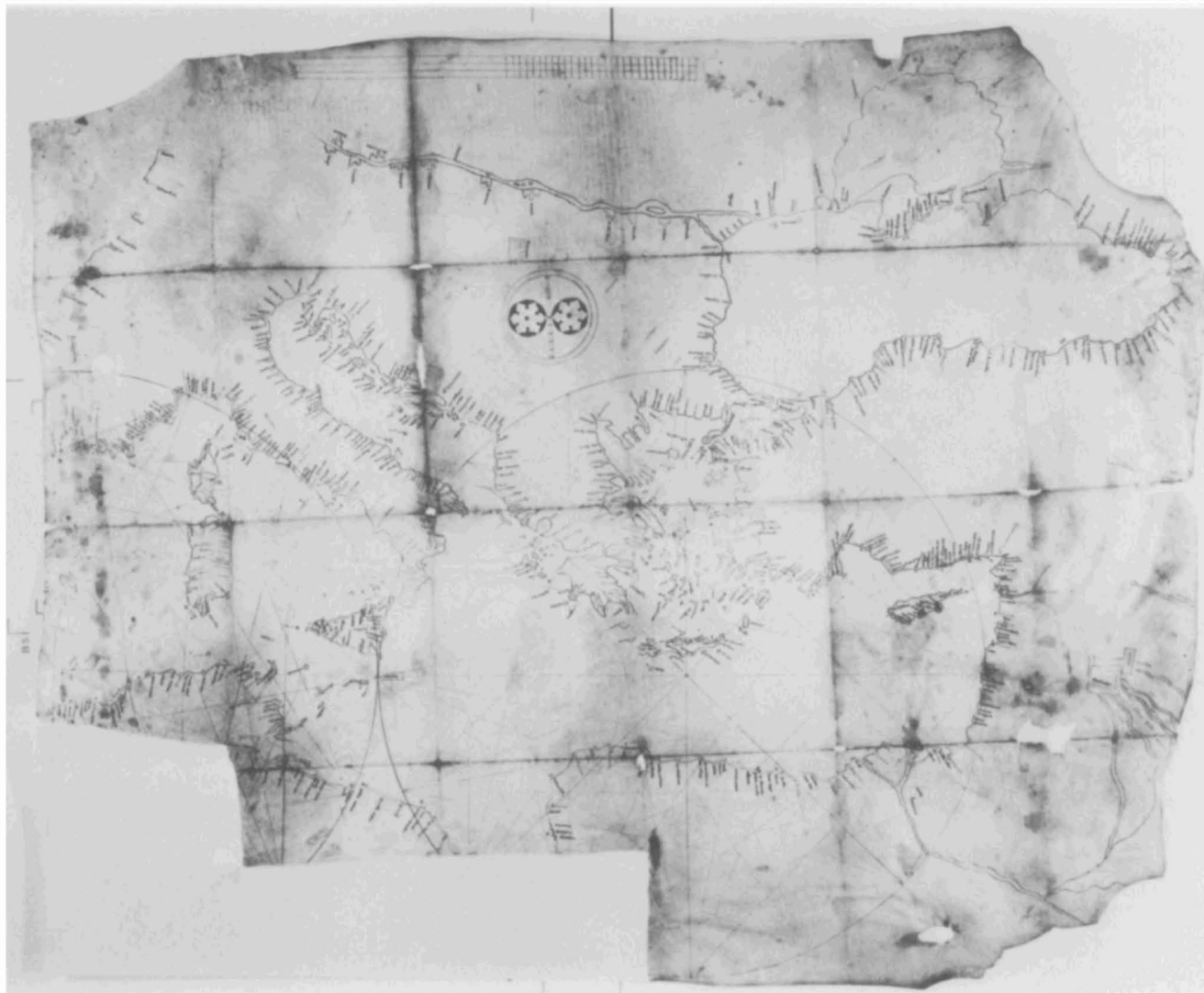


FIG. 19.11. THE CORTONA CHART. It is likely that this little-known portolan chart is in fact the second oldest extant example. Unfortunately, much of the western portion has been trimmed away, but what remains of the Belgian and French coasts shows close similarities with the outlines of the *Carte Pisane*.

Size of the original: 47 × 60 cm. By permission of the *Pubblica Biblioteca Comunale e dell'Accademia Etrusca*, Cortona (Portolano).

the unnamed rector of Saint Mark's, who made both a written record of what he had heard and a *mappamundi*.²⁶¹ Since it is not generally believed that the recently destroyed Florence map should be identified with this *mappamundi*, which was apparently drawn close to 1306,²⁶² the Bergomensis account does not help with the dating of the former. Authorities can be cited to narrow the date of construction of the Florence map to the period 1321–26, but these do not inspire total confidence. Baldacci's assertion that the map could not have been drawn before 1321 because of the presence of Aragonese stripes over Sardinia relies on a type of evidence

Cambridge University Press for the Hakluyt Society, 1958), 212–16, esp. 212.

261. Skelton, "Ethiopian Embassy," 214 (note 260), points out that the first edition of Forestri's text included the strange statement (translated from Latin) that the rector of Saint Mark's had "published a treatise, which he also called a map."

262. Though some commentators have expressed this view and Cortesão, *History of Portuguese Cartography*, 1:220 (note 3), dated the surviving map ca. 1307. Paolo Revelli, "Cimeli cartografici di Archivi di Stato italiani distrutti dalla guerra," *Notizie degli Archivi di Stato* 9 (1949): 1–3, esp. 1, was one of those who argued that the map's construction seemed to antedate the papal move to Avignon in 1307 because the flag of Rome still displayed the papal keys. This argument is invalid, however, since the papal standard remained over Rome on portolan charts throughout the fourteenth century.

that has already been questioned.²⁶³ Similarly, Fischer's view that the map must have been drawn before 1326, since Bursa is not tinted black like other towns in northwestern Turkey that had fallen to the Ottomans, depends on absent features—a notoriously suspect line of argument.²⁶⁴

It must be concluded that the dates so far suggested for the Carignano map's construction, on biographical or historical grounds, carry little conviction. Instead, therefore, of making an arbitrary assumption about its date and then weaving an account of portolan chart evolution around that, we will attempt to compare the maturity of the Carignano map's geographical content with whatever development can be discerned in the reliably dated charts of the early fourteenth century.

Those who have attempted to date the Carignano map to the very beginning of the fourteenth century²⁶⁵ would have to explain how a priest, using secondhand information from nautical charts, could present outlines that were not achieved on datable charts for a further two or three decades. Although the earliest of the visible changes through which the charts passed included, *inter alia*, improvements to the shape of Italy as it had been portrayed on the *Carte Pisane*, all subsequent developments of this kind—some of which are already reflected on the Carignano map—occurred beyond the Pillars of Hercules. The first region to be affected was the British Isles, and we can actually observe the gradual emergence of outlines as mature as Carignano's in the successive productions of the Vescontes.

Without knowing the mechanism by which a steadily more plausible picture of the British Isles reached Mediterranean chartmakers, we cannot be sure of the relationship, if any, between the Vesconte charts and the Carignano map. Nevertheless, the latter's inclusion of Ireland, albeit sketchily, and the Bristol Channel is broadly equivalent to the stage reached on the steadily evolving Vesconte charts about 1325. The early dates suggested for the Carignano map, like Nordenskiöld's "about 1300,"²⁶⁶ should surely be abandoned. On the evidence of the British Isles, the Carignano map needs to be set in the shadow of the Vescontes' work and placed in the closing stages of the priest's life, which ended in 1329 or 1330.²⁶⁷

The first medieval chartmaker whose name is known to us, Pietro Vesconte, declared himself to be Genoese, like Carignano, but was working in Venice on the two occasions when his author's legend mentioned the place of production.²⁶⁸ A measure of scholarly disagreement notwithstanding, it seems clear which works can be reliably attributed to him. The chart of 1311, the atlas of 1313, both those of 1318, the 1320 atlas in the Vatican (Pal. Lat. 1362A), and that at Lyons all bear his signature. The other Vatican atlas (Vat. Lat. 2972) is un-

signed but has enough shared features to substantiate earlier opinions that it too is Vesconte's work—at least as far as its strictly nautical charts are concerned.²⁶⁹ In both the Vatican works the Mediterranean charts form part of a cartographic supplement to a manuscript by Marino Sanudo entitled *Liber secretorum fidelium crucis*. Vat. Lat. 2972 is accepted as being one of the two copies of Sanudo's treatise urging a further crusade that the author presented to the pope in September 1321.²⁷⁰ This date makes it more probable that the slightly less developed Pal. Lat. 1362A really belongs to 1320, and not some later year—a possibility left open by the closely trimmed roman date, MCCCXX.²⁷¹ Also unsigned are the nautical charts attached to the British Library's copy of Sanudo's *Liber* (Add. MS. 27376*), but these can be confidently ascribed to Vesconte.²⁷²

Pietro Vesconte's work evidently consists, therefore, of one chart of the eastern half of the Mediterranean and seven atlases.²⁷³ It has been suggested that Perrino

263. Osvaldo Baldacci, "La cartonautica medioevale precolombiana," in *Atti del Convegno Internazionale di Studi Colombiani 13 e 14 ottobre 1973* (Genoa: Civico Istituto Colombiano, 1974), 123–36, esp. 125. On the early fourteenth-century Sardinian arms, see Gerola, "Dall'Orto," 423 (note 227), and above, p. 399.

264. Fischer, *Sammlung*, 119 (note 36). Kamal, *Monumenta cartographica*, 4.1:1139 (note 203), transcribed and translated into French Carignano's Latin note about the coloring of non-Christian towns.

265. For example, Nordenskiöld, *Periplus*, 20 (note 14).

266. Nordenskiöld, *Periplus*, 20 (note 14).

267. See note 258. It is also worth noting that Carignano cites four extra features below Cape Bojador, the Vescontes' invariable western African terminus.

268. The 1318 atlas in Venice and the undated atlas in Lyons. He invariably included the words *de janua* in his author's legends. The two autograph productions of Perrino Vesconte, who might be the same as Pietro, were also signed from Venice.

269. Almagià, *Vaticana*, 1:18b (note 35); Degenhart and Schmitt, "Sanudo und Veneto," 66–67 (note 226).

270. Almagià, *Vaticana*, 1:17a (note 35).

271. Almagià, *Vaticana*, 1:14b (note 35). See the reproduction in Kamal, *Monumenta cartographica*, 4.1:1161 (note 203). Nevertheless, Revelli, *Partecipazione italiana*, lxxxii–lxxxiii (note 221), detected re-touching to the world map, which he considered to be in Vesconte's hand and to date from 1321.

272. Degenhart and Schmitt, "Sanudo und Veneto," 24 (note 226). Andrews, "Scotland in the Portolan Charts," 136 (note 249), proposed, equally plausibly, that its charts might be the work of Perrino Vesconte.

273. The attribution to Vesconte of the Luxoro atlas (Genoa, Biblioteca Civica Berio) by Revelli, *Colombo*, 80, 235–36, 250–51 (note 22), is clearly unfounded. A quite different hand is involved, and in any case the Luxoro atlas should be assigned to the first half of the fifteenth century on the basis of its names (see table 19.3, pp. 416–20), and probably to Francesco de Cesanis; see p. 424. Almagià, *Vaticana*, 1:20b (note 35), disputes the further attribution to Vesconte by Revelli, *Colombo*, 241 (note 22), of the maps in another Sanudo manuscript (Rome, Biblioteca Apostolica Vaticana, Reg. Lat. 548). Nor should any credence be given to the suggestion that the Combitis atlas (Venice, Biblioteca Nazionale Marciana, It. VI, 213) is similar

Vesconte, who signed the Zurich atlas of 1321 and the 1327 chart in Venice, was the same person as Pietro—Perrino being a diminutive form of Pietro.²⁷⁴ Comparison of the writing on all the signed or attributed Vesconte works reveals strong similarities, but it is dangerous to draw conclusions from this, since a formal book hand of that kind would have been in common use at the time. Weighing against the theory that Pietro latterly signed himself Perrino is the fact that the illegibly dated Pietro atlas in Lyons can be placed on developmental grounds between the two signed Perrino works. Nevertheless, whether one man or two collaborating members of the same family are involved, the charts and atlases concerned exhibit improvements over their predecessors and a steady growth in geographical knowledge thereafter. This can be best demonstrated in the context of the British Isles.

THE BRITISH ISLES

Neither the Cortona chart nor Vesconte's chart of 1311 extends far enough west to take in the British Isles; hence Vesconte's atlas of 1313 invites direct comparison with the Carte Pisane. The latter had presented Britain as a misshapen rectangle lying on an east-west axis, with London (one of only six names) set into the middle of the south coast (fig. 19.12). Vesconte, in 1313, was able to align the British Isles more correctly north-south. Certain features are clearly recognizable: for example, the Cornish peninsula and South Wales (fig. 19.13).²⁷⁵ There are now thirty-six names. By 1320, the date of Pal. Lat. 1362A, this figure has been increased to forty-six, and Ireland has made its first appearance on a dated portolan chart (fig. 19.14).²⁷⁶ This presumably indicates either information received by Vesconte after 1318 or a new appreciation of the island's commercial importance.²⁷⁷

By the following year, as can be made out on Vat. Lat. 2972 and the Zurich atlas signed by Perrino Vesconte, Ireland has been radically redrawn. At the same time, it has been fitted out with up to forty names, where none had been included before.²⁷⁸ Further refinements, this time to the east coast of Ireland, can be seen on the British Library's undated Sanudo atlas and on the 1327 Perrino Vesconte chart (fig. 19.15). The hollow of Dundalk Bay, for example, and the southeastern promontory of Carnsore Point are now clearly defined.

The increasing sophistication of the British Isles in the work of the Vescontes thus allows us to arrange their dated and undated productions in one assured chronological sequence. Besides other innovations, the 1321 Vatican and Zurich atlases introduce an unnamed Isle of Man, absent from the atlas of 1320. This and the 1321 form of Ireland are repeated on the illegibly dated

Lyons atlas, which can thus be assigned to 1321 at the earliest.²⁷⁹ The final Vesconte contribution to the cartography of the British Isles occurs in almost identical fashion on the British Library atlas and the 1327 Perrino chart. The Isle of Man is now named, as are several Irish islands, and the Bristol Channel is shown for the first time. The named features around the coasts of Britain have also increased from the forty-nine found on the Lyons atlas to more than sixty. Ireland shows a similar increase from forty to fifty-four.

It is easy to document successive improvements to the outline and toponymy of the British Isles made by the Vescontes in 1320, 1321, and 1327; but it is another matter to identify the mechanism by which this information reached them, presumably in Venice. Since this process seems to owe nothing to earlier maps of Britain

to Vesconte's of 1318; see Guglielmo Berchet, "Portolani esistenti nelle principali biblioteche di Venezia," *Giornale Militare per la Marina* 10 (1865): 1–11, esp. 5. The Combitis atlas is probably fifteenth century; see table 19.3, pp. 416–20.

274. Nordenskiöld, *Periplus*, 58 (note 14). However, Revelli, *Colombo*, 268 (note 22), surmised that Perrino was probably a son or nephew of Pietro. On this reading Perrino might be a way of saying "Pietro the younger." The partial chart acquired by Nico Israel in 1980 (see note 67) has also been attributed to Perrino, but it has some un-Vesconte features. The white cross over a green Rhodes, a scale bar whose alternate divisions are subdivided, and the additional name *cauo ferro* beneath Mogador in western Africa are examples of these. Its names are also not typical of Vesconte's work, as can be seen in table 19.3, pp. 416–20.

275. Crone, *Maps and Their Makers*, 17 (note 11), pointed out, in the context of the 1327 Perrino Vesconte chart, that "as southern England is too small compared with the rest of the country, it is plain that a piece of relatively accurate survey has been fitted to an older, highly generalised outline of the whole island."

276. It has been argued that there was insufficient space on the relevant sheets in the earlier atlases for Ireland to have been accommodated. It seems safe to assume, though, that the cartographer would have planned his sheet arrangement carefully to leave room for what he wished to show.

277. See two articles by Thomas Johnson Westropp in *Proceedings of the Royal Irish Academy*, vol. 30, sect. C (1912–13): "Brasil and the Legendary Islands of the North Atlantic: Their History and Fable. A Contribution to the 'Atlantis' Problem," 223–60; idem, "Early Italian Maps of Ireland from 1300 to 1600 with Notes on Foreign Settlers and Trade," 361–428. Both are reprinted in *Acta Cartographica* 19 (1974): 405–45, 446–513.

278. The most pronounced feature of this second type is the large island-crowded bay set into the west coast. Plausibly identified as Clew Bay, this has above it a westward-projecting island, presumably Achill; see Michael Corbet Andrews, "The Map of Ireland: A.D. 1300–1700," *Proceedings and Reports of the Belfast Natural History and Philological Society for the Session 1922–23* (1924): 9–33, esp. 17 and pl. II, 1. Andrews's analysis of Ireland's shape on the portolan charts emphasizes Vesconte's importance in this respect, since the outline he introduced in 1321 was still being repeated by Grazioso Benincasa a century and a half later.

279. Almagià, *Vaticana*, 1:15 (note 35), and Mollat du Jourdin and de La Roncière (i.e., Isabelle Raynaud-Nguyen), *Sea Charts*, 199 (note 40), support this reasoning. However, de La Roncière, *Lyon*, 8 (note 34) had dated it 1319(?).

(though the final Vesconte form with the Bristol Channel reveals similarities to the Gough map of Great Britain, ca. 1350), it might reasonably be attributed to crew members of trading vessels returning to Venice. True, the state-controlled Venetian fleets, the so-called Flanders galleys, made regular visits to the Flemish ports from 1314 onward, but this proves to be a disappointing lead.²⁸⁰ The earliest occasion on which this fleet is known to have been directed to England was in 1319, and a violent affray at Southampton led to the postponement of further visits by the Venetians for another twenty years.²⁸¹ Thus the Flanders galleys could have contributed neither to the improvement of the 1313 Vesconte atlas over the *Carte Pisane* nor to further updating in the 1320s.²⁸²

The quantity of surviving Vesconte works, the confidence with which they can be dated, and the narrow time band involved (ten works spread over a mere fifteen years) permit a fairly full account of the Vescontes' increasing knowledge about the British Isles. While there



FIG. 19.12. THE CHANGING CONFIGURATION OF THE BRITISH ISLES (1). On the *Carte Pisane*, Great Britain is represented by a single misshapen rectangle with only six places marked, including *civitate londra* (London), which is placed in the middle of the south coast.

Photograph from the Bibliothèque Nationale, Paris (Rés. Ge. B 1118).

280. Alwyn A. Ruddock, *Italian Merchants and Shipping in Southampton, 1270–1600* (Southampton: University College, 1951), 22.

281. Ruddock, *Italian Merchants*, 25–27 (note 280).

282. Nor does the fact that Vesconte acted as adviser to the first Flanders fleet appear to be relevant. If the channel of communication by which geographical information about the British Isles reached Mediterranean chartmakers was not Venetian, it was presumably Genoese or Majorcan. Genoese galleys had been visiting England since at least 1278, and a Majorcan galley is recorded at London three years later; see Ruddock, *Italian Merchants*, 19, 21 (note 280). The cartographic contribution of such ventures must remain a matter for speculation, given the individually organized and haphazardly documented nature of Genoese and Catalan operations.

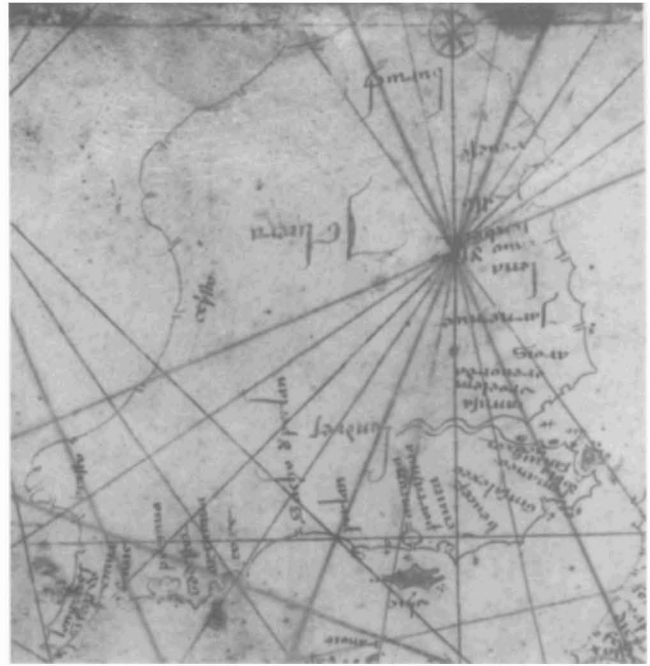


FIG. 19.13. THE CHANGING CONFIGURATION OF THE BRITISH ISLES (2). By the time of the 1313 Pietro Vesconte chart, Great Britain has developed into a more correctly aligned island, with some identifiable features, such as the Cornish peninsula. Instead of the *Carte Pisane*'s mere six names, this chart lists thirty-six.

Photograph from the Bibliothèque Nationale, Paris (Rés. Ge. DD 687, pl. 5).

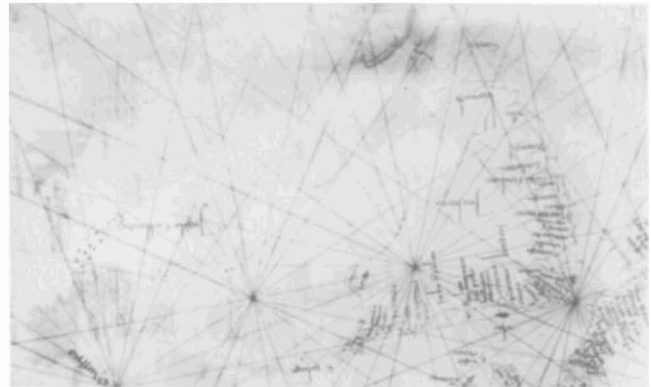


FIG. 19.14. THE CHANGING CONFIGURATION OF THE BRITISH ISLES (3). The first appearance of Ireland on a dated portolan chart is on the 1320 chart by Pietro Vesconte. Although Ireland has no place-names, the total for Great Britain has increased to forty-six.

Photograph from the Biblioteca Apostolica Vaticana, Rome (Pal. Lat. 1362A, fol. 7r).

is insufficient space in this essay to analyze every other change to the content of fourteenth- and fifteenth-century portolan charts, it is possible to sketch in the broad lines of subsequent expansion beyond the Mediterranean. The areas affected were the Baltic, the island groups of the central Atlantic, the western coastline of Africa, and the islands of the North Atlantic.



FIG. 19.15. THE CHANGING CONFIGURATION OF THE BRITISH ISLES (4). The chart in the atlas attributed to Pietro Vesconte and datable to about 1325 reveals greater knowledge of the Irish coastline. Dundalk Bay, for example, is now clearly defined.

By permission of the British Library, London (Add. MS. 27376*, fol. 181r).

THE BALTIC

The extension of the portolan charts to include the North Sea and Baltic marks the next major step in their development. The Carignano map is certainly an important witness in this respect, but it is impossible to state with any confidence whether it or a chart signed by Angelino de Dalorto should be considered the first to include Scandinavia (fig. 19.16). To the controversy about the dating of the Carignano map should now be added variant readings of the date on Dalorto's chart. Preserved in the private library of Prince Corsini in Florence, this has an indistinct roman date that has been read as MCCCXXII, MCCCXXV and MCCCXXX. The earliest possibility, 1322, has found few supporters, but opinions have been strongly divided between the other two.²⁸³ To emphasize this continuing uncertainty, the Dalorto chart will be described hereafter as "1325/30."

By 1330 at the latest, therefore, portolan charts were being extended northward beyond the west coast of Jutland to recognize, if imperfectly, the existence of the Baltic and the lands to the north of it. A version of the Marino Sanudo world map of about 1320 has been shown to be a precursor of the portolan chart outlines, as has its immediate antecedent, the world map of Fra

Paolino (Paolino Veneto).²⁸⁴ These are clearly from a quite different source, though, than the outline displayed on the Carignano and Dalorto versions, which rotate the Baltic away from Sanudo's north-south orientation to give it a more correct alignment. Considering that charts did not form part of the standard navigating equipment in northern waters,²⁸⁵ this represents a significant advance. The Jutland peninsula, with an attempt

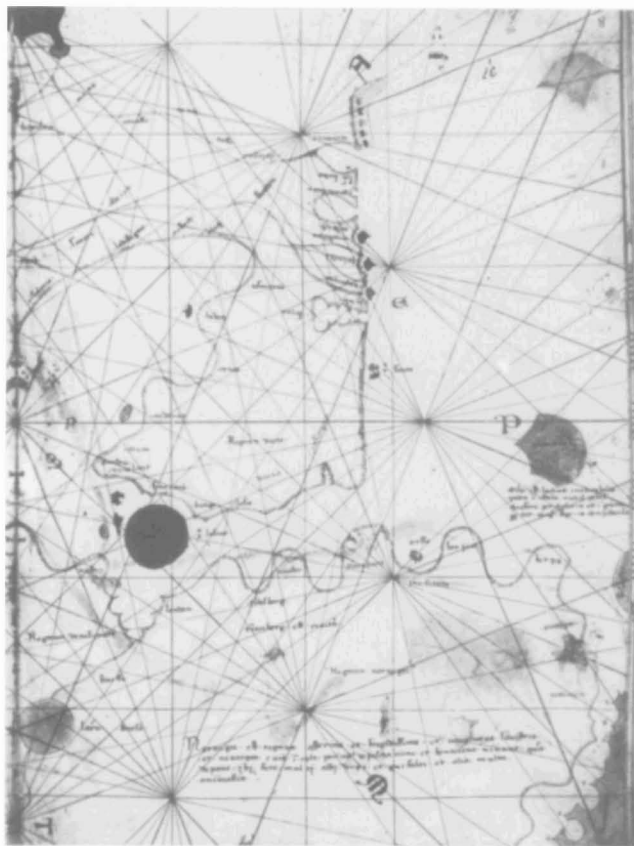


FIG. 19.16. SCANDINAVIA BY BIANCO. Denied access to the Baltic after the 1320s, Mediterranean sailors obtained their limited information about it secondhand. Many chartmakers, particularly Italian ones, omitted northern Europe altogether. One notable exception was Andrea Bianco, whose atlas of 1436 included this detailed separate chart of the region. Size of the original: 37.3 × 26.5 cm. By permission of the Biblioteca Nazionale Marciana, Venice (It. Z.76, c. 6).

283. See particularly Magnaghi, "Alcune osservazioni," 20–23 (note 201).

284. Almagià, *Vaticana*, 1:15b (note 35); Heinrich Winter, "The Changing Face of Scandinavia and the Baltic in Cartography up to 1532," *Imago Mundi* 12 (1955): 45–54, esp. 45–46.

285. Commenting on the practice of northern mariners, William Bourne, in the mid-sixteenth century, had cause to complain of "auncient masters of shippes" who mocked the use of sea charts—quoted in Waters, *Navigation in England*, 15 (note 138). Nevertheless, the Barcelona archives record that in 1390 the merchant Domenech Pujol sent a consignment of eight *cartes de navegar* to Flanders; see Claude

at the Danish islands to its east, guards the entrance to a Baltic whose shape gives no hint of the Gulf of Bothnia. The Baltic's most prominent feature is a much exaggerated Gotland, whose capital, Visby, was one of the major trading centers of northern Europe. Though Norway is not present on the Carignano map, the Dalorto chart already gives it the heavily shaded outline (like a slanting, upside-down capital A) that would typically be found on many later charts.

That the early fourteenth-century picture of Scandinavia should have persisted on portolan charts until well into the following century has been explained in terms of Hanse influence.²⁸⁶ Having no chartmaking tradition of its own, the Hanseatic League was in no position to supply hydrographic details about the Baltic, even had it wanted to.²⁸⁷ In addition, the establishment of a staple at Bruges in 1323²⁸⁸ denied southern ships direct access to the Baltic and hence opportunities for their pilots to make firsthand observations. It follows from this that the Baltic outlines given by Carignano and Dalorto were presumably gathered before 1323. Not only was there to be little improvement to these outlines, but many later charts omitted northern Europe entirely.²⁸⁹ Generally speaking, Italian chartmakers from Vesconte onward more frequently omitted Scandinavia, whereas the Catalans tended to follow Dalorto's example and include it.

THE ATLANTIC ISLANDS

While information about northern Europe remained static on the portolan charts for large parts of the fourteenth and fifteenth centuries, awareness of what lay to the west and south was to grow steadily over the same period. Indeed, the charts themselves were to play an important part in broadcasting knowledge, or theories, about the Atlantic archipelagoes and the western coast of Africa. Because the islands depicted on the charts were stepping-stones for later voyages to America or have been treated as evidence of pre-Columbian discoveries of the new continent itself, this aspect of the subject has attracted more comment than any other. It would require an entire volume to summarize the complex and contradictory arguments about the apparently imaginary islands of Man, Brazil, Antilia, and others.²⁹⁰

The increasing array of names attached to Atlantic islands on fourteenth- and fifteenth-century charts has been conveniently tabulated by Armando Cortesão, the most tireless worker in this particular field.²⁹¹ The identification of these names with the islands of today is, however, a matter of interpretation, and some of Cortesão's conclusions have been challenged. Even when both modern and medieval islands bear the same names, this is no proof of identity. As Admiral Morison ob-

served, "it would have been natural enough for Prince Henry to have used the names of legendary islands for the actual islands that his men discovered."²⁹² It is thus with considerable caution that we should approach apparent representations on the early charts of the four main archipelagoes of the central Atlantic: the Canaries, the Madeiras, the Azores, and the Cape Verde Islands.

The Canaries present the least problem in this respect. Because of their shape and position, there can be no doubt about the authenticity of Lanzarote and Fuerteventura, which both appear (thus named) on Dulcert's chart three years after their documented discovery in 1336.²⁹³ Cortesão's claim that the other three groups were depicted on charts a considerable time before their first mentions in the archival record has not been so readily accepted. He maintained that the Madeira islands are represented on the Dulcert chart, even though the islands are only known to have been discovered in 1418–19.²⁹⁴ For the Azores, Cortesão considered that the 1367 Pizigani chart's *insula de bradır* indicated Terceira, and he interpreted several further instances in the Medici atlas (which he therefore redated to ca. 1370) as

Carrère, *Barcelone: Centre économique à l'époque des difficultés, 1380–1462*, Civilisations et Sociétés 5, 2 vols. (Paris: Moulton, 1967), 1:201 n. 4.

286. Anna-Dorothee von den Brincken, "Die kartographische Darstellung Nordeuropas durch italienische und mallorquinische Portolanzeichner im 14. und in der ersten Hälfte des 15. Jahrhunderts," *Hansische Geschichtsblätter* 92 (1974): 45–58, esp. 54.

287. Von den Brincken, "Nordeuropas," 46 (note 286).

288. Von den Brincken, "Nordeuropas," 54 (note 286).

289. Though the separate sheet devoted to this region in Bianco's atlas of 1436 deserves particular mention; see R. A. Skelton, Thomas E. Marston, and George D. Painter, *The Vinland Map and the Tartar Relation* (New Haven: Yale University Press, 1965), 116, 164.

290. See, for example, Cortesão, *Nautical Chart of 1424* (note 24); idem, *History of Portuguese Cartography*, 2:52–73 (note 3); James E. Kelley, Jr., "Non-Mediterranean Influences That Shaped the Atlantic in the Early Portolan Charts," *Imago Mundi* 31 (1979): 18–35, esp. 27–33; Samuel Eliot Morison, *The European Discovery of America: The Northern Voyages* (New York: Oxford University Press, 1971), 81–111; idem, *Portuguese Voyages to America in the Fifteenth Century* (Cambridge: Harvard University Press, 1940).

291. Cortesão, *History of Portuguese Cartography*, 2:58–59, table I (note 3). This is a significantly reworked version of similar tables published earlier by Cortesão.

292. Morison, *Portuguese Voyages*, 13 (note 290).

293. Cortesão, *History of Portuguese Cartography*, 2:72 (note 3).

294. Cortesão, *Nautical Chart of 1424*, 47 (note 24); Cortesão, *History of Portuguese Cartography*, 2:55, 58 (note 3). That the first archival mention of Madeira dates from 1418–19 is not sufficient reason for assuming that sheet 2 of the Pasqualini atlas must be later than its stated date of 1408 because it names Madeira thus, rather than using its earlier name *do legname*; see Petar Matković, "Alte handschriftliche Schifferkarten in der Kaiserlichen Hof-Bibliothek in Wien," *Programm des königlichen kaiserlichen Gymnasiums zu Wrasdin* (Agram: L. Gaj, 1860), 9. The Pasqualini toponymy is generally ahead of its time.

references to other islands in the group.²⁹⁵ The first definite knowledge of the Azores, however, dates from 1427.²⁹⁶ Lying much too close to Portugal, these fourteenth-century instances have been dubbed the “false Azores” by Cortesão’s detractors.²⁹⁷ Last of all were the Cape Verde Islands, discovered in 1455–56 but already, in Cortesão’s view, partially represented on the 1413 Mecia de Viladestes chart.²⁹⁸ Their earliest unequivocal appearance is in the two 1468 Grazioso Benincasa atlases.

More controversial still is the island of Antilia, first found on the 1424 Zuane Pizzigano chart, to which Cortesão devoted a separate study.²⁹⁹ His assertion that Antilia and the islands close to it (*satanazes*, *ymana*, and *saya*) “are intended to represent the easternmost part of the American hemisphere”³⁰⁰ has won little acceptance outside Portugal. It is perhaps more profitable in this context to consider the attitude of other fifteenth-century chartmakers. Where many twentieth-century historians have become mesmerized by Antilia and its immediate neighbors, contemporary chartmakers often ignored them. Grazioso Benincasa, for example, would show these legendary islands when space allowed (as on his 1470 and 1482 charts), but having inserted them on an early atlas in 1463, he failed to make room for them in his later volumes.³⁰¹ Yet Benincasa was one of the main conduits through whom the details of Portuguese discoveries reached the portolan charts.

WESTERN AFRICA

Compared with that of the offshore islands, the charting of Africa’s west coast was more straightforward. The process by which successive Portuguese captains worked their way patiently down the coast, in a series of planned leapfrogs, has been frequently told. So too has the part played after 1415 by Prince Henry the Navigator, particularly in inspiring his men to pass the dreaded Cape Bojador.

The first documented expedition to round Bojador was that of Gil Eanes in 1434; yet information beyond this Mauritanian cape had already been appearing on portolan charts for a century. As with the Atlantic islands, it is hard to tell whether this derived from actual voyages, secondhand information, or pure conjecture. What is clear is that the coverage of the northwestern African coastlines increased steadily on the earliest charts.³⁰²

Table 19.2, p. 412, shows the farthest points reached by successive expeditions. Its right-hand column indicates the first charts to take note of them, thereby supplying an index, albeit an imperfect one, to the dissemination of geographical knowledge.

The Carte Pisane terminated at roughly 33° north,

Vesconte’s atlas of 1318 showed a continuation southward for a further two degrees,³⁰³ and the 1325/30 Dalorto chart added another two to that.³⁰⁴ In its turn, the 1339 Dulcert chart included a few extra names, although these cannot be identified today. Dulcert refers to as *caput de non* what the Catalan atlas and later charts would call *cabo de buyetder*. Although somewhat misplaced, this was evidently intended for Cape Bojador; it clearly represented the limit of fourteenth-century coastal knowledge.³⁰⁵ Beyond that, the early charts offer an ill-defined southeasterly or southerly outline, where

295. Cortesão, *History of Portuguese Cartography*, 2:58 (note 3).

296. Cortesão, *Nautical Chart of 1424*, 47 (note 24). The evidence comes from a note on the 1439 Valseca chart. However, F. F. R. Fernández-Armesto, “Atlantic Exploration before Columbus: The Evidence of Maps,” *Renaissance and Modern Studies* (forthcoming), finds in favor of the fourteenth-century Azores.

297. Heinrich Winter, “The Fra Mauro Portolan Chart in the Vatican,” *Imago Mundi* 16 (1962): 17–28, esp. 18 n. 5.

298. Cortesão, *Nautical Chart of 1424*, 47–48 (note 24).

299. Cortesão, *Nautical Chart of 1424* (note 24). Reactions to its claims were discussed by Cortesão in two later works: *History of Portuguese Cartography*, 2:134–39 (note 3); and “Pizzigano’s Chart of 1424,” *Revista da Universidade de Coimbra* 24 (1970): 477–91. Although this is the first reference to Antilia on a surviving chart, Pedro de Medina mentioned its presence on a Ptolemy manuscript presented to Pope Urban, evidently Urban VI (1378–89); Cortesão, “North Atlantic Nautical Chart,” 8 (note 170). The 1424 chart in the James Ford Bell Library, Minneapolis, is not to be confused with that in the Zentralbibliothek der Deutschen Klassik, Weimar. The latter, often attributed to Conte Hectomano Freducci, was at one time thought to bear the date 1424 and was, on that basis, introduced into discussions about Antilia.

300. Cortesão, *Nautical Chart of 1424*, 3 (note 24). For a more recent interpretation that also sees Antilia and the other Atlantic islands as references to parts of the American continent see Kelley, “Non-Mediterranean Influences,” 27–33 (note 290).

301. Benincasa’s cavalier treatment of Antilia should be contrasted with the invariable appearance of the Cape Verde group in the atlases he drew after 1468. The occasional reappearance of Antilia on sixteenth-century charts—for instance, Georgio Calapoda’s of 1560 in the National Library of Scotland—highlights the danger of overliteral interpretation by historians of cartography, since Calapoda’s atlas of 1552 had contained an adequate representation of America; Norden-skiöld, *Periplus*, pl. XXVI (note 14). To Calapoda, Antilia was presumably just one of the features that belonged on a traditional chart.

302. See the analysis of African names in Kamal, *Monumenta cartographica*, 4.4:1468 (note 203).

303. The 1313 atlas, the earliest of his works to take in northwestern Africa, is incomplete at this point.

304. The extent of the Carignano map cannot now be determined from the available reproductions.

305. Notwithstanding the claim by Paolo Revelli, “Una nuova carta di Batista Beccari (‘Batista Becharius’)?” *Bollettino della Società Geografica Italiana* 88 (1951): 156–66, esp. 156–57 n. 1, that the Genoese rounded Bojador in the fourteenth century. He cites as evidence the Combitis atlas (described merely as Biblioteca Nazionale Marciana MS VI.213), whose supposed 1368 date derives from a misreading of the Irish reference to the 368 islands; see Fiorini, *Projezioni*, 676 (note 98). Hinks, *Dalorto*, 12 (note 76), corrected this error. On the dating of the Combitis atlas see table 19.3, pp. 416–20.

TABLE 19.2 The Cartographic Record of the Western Coast of Africa

Latitude	Longitude	Modern Name	Name on the Charts	First Recorded Sighting		First Chart or Map to Include It
				Date	Discovered by	
33.17N ^a		Azemmour	Zamor			Carte Pisane 1318 Vesconte [1325/30 Dalorto]
31.31N		Essaouira	Mogador			
29.05N		Oued Noun River	[Aluet Nul] ^b			
28.44N		Cap Drâa (Cabo Noun)				[1375 Catalan atlas] 1375 Catalan atlas (although the 1339 Dulcert chart, which names this <i>caput de non</i> , includes four names beyond this point)
27.57N		Cap Juby	[Cauo de Sabium]	1434	Eanes	
26.08N		Capo Bojador	Buyetder			
24.40N		Angra de los Ruivos (Gurnet Bay)		(1435)	Eanes and Baldaia	Referred to in a note on the 1339 Dulcert chart
[23.36N]		Rio de Oro		1436	Baldaia	
22.11N		Ilha Piedra Galha		1436	Baldaia	
20.46N		Cap Blanc/ Capo Blanco		1441	Tristão	1448 Bianco
20.40N		Baie d'Arguin (beyond Baie de Saint-Jean, 19.27N)	Terra dos Negros	1443 1444	Tristão Tristão	
14.43N		Cap Vert		1444	Dias	
14.32N		Cap de Naze	Cabo dos Mastos	1445	Fernandes	[1448 Bianco], 1463 Benincasa, 1459 Fra Mauro ^c world map, Catalan world map in Modena (Estense C.G.A. 1)
12.20N		Cabo Roxo		1446	Fernandes	
12.16N		Ponta Varela	Cabo Vela	1446	Fernandes	
11.40N		Canal do Gêba	Rio Grande	1446	Tristão	1468 Benincasa (Great Britain, private collection)
9.31N		Conakry		1447	Fernandes	
8.30N		Cape Sierra Leone	Capo Liedo	1460	Sintra	
6.19N		Cape Mesurado		1461	Sintra	1468 Benincasa (Great Britain, private collection)
6.06N		Bassa Point	Cauo de Sancta Maria	1461	Sintra	
4.22N	7.44W	Cape Palmas		1470	Costa	1492 Aguiar
	3.44W	Komóe River	Rio de Suero	1470	Costa	
	1.38W	Shama		[1470–71]	Santarém and Escobar	

Latitude	Longitude	Modern Name	Name on the Charts	First Recorded Sighting		First Chart or Map to Include It
				Date	Discovered by	
	3.23E	Lagos River	Rio de Lago	1471	Santarém and Escobar	Portuguese chart in Modena (Estense C.G.A. 5c)
Equator				1473	Gonçalves	
1.52S		Pointe Sainte-Catherine		1474	Gonçalves and Sequeira	
6.05S		Mouth of the Congo River		1483	Cão	Reinel chart in Bordeaux
13.25S		Cabo de Santa Maria	Cabo Lobo, and Pradro	1483	Cão	[1489] Cornaro atlas
21.47S		Cape Cross		1485	Cão	
34.21S	18.28E	Cape of Good Hope		1488	Dias	1492 Behaim globe, Martellus world maps
33.29S	27.08E	Great Fish River				

^aThe coordinates and modern place-name forms in this table have been taken from the continuing series of gazetteers issued by the United States Board on Geographic Names, Office of Geography, Department of the Interior, Washington, D.C.

^bThere is still doubt about a number of the western African discoveries and of the voyages that made them. This table does not pretend to be authoritative in this respect. Nor is it clear what genuine features are shown between Mogador and Bojador on fourteenth-century charts. On the voyages, much use has been made of Armando Cortesão, *History of Portuguese Cartography*, 2 vols. (Coimbra: Junta de Investigações do Ultramar-Lisboa, 1969–71), and of Boies Penrose,

Travel and Discovery in the Renaissance, 1420–1620 (Cambridge: Harvard University Press, 1952). On the names, see Avelino Teixeira da Mota, *Topónimos de origem Portuguesa na costa ocidental de Africa desde o Cabo Bojador ao Cabo de Santa Caterina*, Centro de Estudos da Guiné Portuguesa no. 14 (Bissau: Centro de Estudos da Guiné Portuguesa, 1950).

^cThe claim in Paolo Revelli, ed., *La partecipazione italiana alla Mostra Oceanografica Internazionale di Siviglia (1929)* (Genoa: Stabilimenti Italiani Arti Grafiche, 1937), xciii, that the Fra Mauro map took note of Portuguese discoveries dating from 1458 appears to lack foundation.

the genuine coast trends southwesterly. The various fourteenth-century names (up to four on any one chart) that occur beyond this cape carry little conviction. Among them is Cape Gozola,³⁰⁶ often cited as marking the end of Africa.

Another legendary element found at the southern extremity of some charts was the supposed western branch of the Nile. Shown as flowing into the sea below Bojador, it was sometimes (on the Carignano map, for example) dubbed the River of Gold. One Jaime Ferrer set out in 1346 to search for it, a fact recorded on the Catalan atlas.³⁰⁷ When, ninety years later, Afonso Gonçalves Baldaia discovered what is now the Rio de Oro he bestowed the name on a bay that has no river flowing into it at all.

Despite this modest evidence from the portolan charts, certain broad claims have been made: that the Gulf of Guinea was featured on maps before its documented discovery in 1470–72, and even that the rounding of the Cape of Good Hope in 1488 had been anticipated.³⁰⁸ The Medici atlas (see appendix 19.1) and various fifteenth-century world maps have been cited in support

of these theories, but reliably documented western African discovery and the systematic colonization of the offshore islands began only with the capture of Ceuta in 1415.

Though the Portuguese are known to have recorded their discoveries on charts, the earliest surviving Portuguese work dates from the end of the fifteenth century.³⁰⁹ We must turn instead to charts made by foreigners such as Andrea Bianco and Grazioso Benincasa for the cartographic record of these voyages. In only two cases are the charts in question dated. Indeed, most have been assigned a date—which is really no more than a terminus post quem—precisely because of the discoveries they include. Little can be learned, therefore, about the time it took for new information to become available

306. Revelli, *Colombo*, 371–75 (note 22).

307. Kamal, *Monumenta cartographica*, 4.2:1235 (note 203).

308. On the Gulf of Guinea see Destombes, *Mappemondes*, 220 (note 10), citing Eva G. R. Taylor, “Pactolus: River of Gold,” *Scottish Geographical Magazine* 44 (1928): 129–44, and on the Cape of Good Hope see Nordenskiöld, *Periplus*, 122 (note 14).

309. See above, p. 374.

outside Portugal. Yet if Bianco in 1448 and Grazioso Benincasa in 1468 were in any way typical, news seems to have traveled fairly fast, since Bianco incorporated discoveries dating from four (or possibly only two) years previously and Benincasa those made seven years before.³¹⁰

It has been claimed that an official policy of secrecy (*sigilo*) prohibited chartmakers from showing the later African discoveries. King Manuel's edict of 1504 demanding silence about the trend of the coast below the river Congo has often been cited. This theory has been challenged,³¹¹ however, and if *sigilo* was operative in the fifteenth century it does not seem to have caused any obvious cartographic delays. Diogo Cão's discoveries south of the Congo in 1483 appear on a Venetian collection of copied charts, one of which is dated 1489 (the Cornaro atlas). Similarly, the results of Bartolomeo Dias's voyage found their way soon afterward onto the world maps of Henricus Martellus Germanus and Martin Behaim's globe of 1492.

THE NORTH ATLANTIC

During the fifteenth century, while Africa's west coast was being plotted, developments were also taking place in the North Atlantic. Arguably the most significant adjustment to have been made to the portolan charts after the early fourteenth century was the correction of the long-standing mismatch of scale between the Mediterranean and Atlantic sections. This was announced by Francesco Beccari on his chart of 1403. Atlantic distances had previously been understated by between 16 and 30 percent.³¹² It remains to be tested which of those chartmakers who followed Beccari incorporated the amended Atlantic scale.³¹³ This improvement notwithstanding, the main trend of the coastline from Flanders to the northern tip of Jutland would not be properly understood until the mid-fifteenth century. A. W. Lang pinpointed Roselli's chart of 1462 as the first to introduce the fresh outline.³¹⁴

In the same way that the portolan charts are an important, if ambiguous, witness to developing knowledge of the Atlantic archipelagoes, so they are frequently cited as evidence of partial Mediterranean understanding of the islands in the North Atlantic. In the process they have inspired further controversy. Winter considered that Iceland was first represented on Jaime Bertran's chart of 1482, though Revelli believed this island was intended by the earlier *archania* of Bartolomeo de Paretto's 1455 chart.³¹⁵ Others saw this innovation as having been foreshadowed by the oval *stillanda* found to the north of Scotland from the time of the earliest Catalan charts onward.³¹⁶ A larger body of opinion prefers to identify Iceland with the mysterious island of Frisland

(*frixlanda*).³¹⁷ Referred to in the account of the questionable Nicolò Zeno voyage to the North Atlantic in the late fourteenth century, Frisland seems first to appear on a dated chart in 1500.³¹⁸ This must raise justified doubts about the proposed fifteenth-century dates for anonymous charts that include it.³¹⁹

CONSERVATISM

In isolating specific elements of the stylistic and hydrographic content of fourteenth- and fifteenth-century

310. It needs emphasizing that these discoveries clearly meant less to Benincasa than they do to twentieth-century historians. Having recorded the west coast of Africa as far as *cauo de sancta maria* on one of the 1468 atlases, he usually terminated his later atlases at *rio de palmeri* (river Sherbro), 1½° farther north.

311. Bailey W. Diffie, "Foreigners in Portugal and the 'Policy of Silence,'" *Terrae Incognitae* 1 (1969): 23–34.

312. Kelley, "Non-Mediterranean Influences," 22 (note 290), suggested an understatement of about 16 percent; Clos-Arceuduc, "Enigme des portulans," 228 (note 129), proposed a figure of almost 30 percent.

313. In a brilliant piece of cartometric analysis, and long before the discovery of the 1403 Francesco Beccari chart with its explanatory note, Hermann Wagner noticed the improvement on (among others) the Batista Beccari chart of 1436 [i.e., 1435]; see Herman Wagner, "The Origin of the Mediaeval Italian Nautical Charts," in *Report of the Sixth International Geographical Congress, London, 1895* (London: Royal Geographical Society, 1896), 695–702, esp. 702; reprinted in *Acta Cartographica* 5 (1969): 476–83. See also Kelley, "Non-Mediterranean Influences," (note 290).

314. Arend Wilhelm Lang, "Traces of Lost North European Sea Charts of the Fifteenth Century," *Imago Mundi* 12 (1955): 31–44, esp. 36–37.

315. Winter, "Catalan Portolan Maps," 4 (note 174); Paolo Revelli, ed., *Elenco illustrativo della Mostra Colombiana Internazionale* (Genoa: Comitato Cittadino per le Celebrazioni Colombiane, 1950), 151.

316. Harald Sigurðsson, *Kortasaga Islands frá öndverðu til loka 16. aldar* (Reykjavik: Bókauktgáfa Menningarsjóðs og Þjóðvinafélagsins, 1971), 258 (English summary on pp. 257–67). Iceland's first cartographic appearance was on the Anglo-Saxon map of ca. 1000 (p. 257).

317. Skelton, Marston, and Painter, *Vinland Map*, 166 (note 289). See also Oswald Dreyer-Eimbcke, "The Mythical Island of Frisland," *Map Collector* 26 (1984): 48–49.

318. Ernesto García Camarero, "Deformidades y alucinaciones en la cartografía ptolemeica y medieval," *Boletín de la Real Sociedad Geográfica* 92 (1956): 257–310, esp. 289. Revelli, *Colombo*, 339 (note 22), discerned Frisland on the 1480 Canepa chart (his plate 80), but the island in question is Stillant.

319. For example, Paris, Bibliothèque Nationale, Département des Cartes et Plans, Rés. Ge. AA 562, and Département des Manuscrits, Ital. 1704. Several writers, among them Sigurðson, *Kortasaga Islands*, 258 (English summary), n. 241 (note 316), dated to the second half of the fifteenth century the undated Catalan chart in the Biblioteca Ambrosiana, Milan, which includes Fixlanda. The various reproductions made of this, for example by Sigurðsson, p. 61, are restricted to details of northwestern Europe and omit the chart's manuscript number. Nevertheless, it seems clear that S.P. 2, 36 (formerly S.P. II, 5) is involved; yet this cannot be earlier than 1530 because of the red cross over Malta.

charts and seeking to identify the moment at which these elements made their first appearance, there is danger that a false impression of constant evolution might have been conveyed in the previous sections.³²⁰ It must be stressed that many charts ignored new information, and it would be quite wrong to see the history of portolan charts purely in terms of successive innovations and unrelenting progress. A number of sixteenth-century chartmakers continued to produce work that is indistinguishable, as far as the outlines are concerned, from that of their predecessors.³²¹ Scholars, whose currency is knowledge, have tended to explain these lapses in terms of cartographic ignorance. The truth is probably more mundane: that chartmakers often omitted fresh discoveries because they lacked relevance for themselves and their clients or because of practical limitations imposed by the material on which they worked.

To many historians of cartography it has been the geographical innovations that have seemed significant. The charts' contemporary users would probably have considered irrelevant the inclusion of any areas they were unlikely to visit if the correlation with trading activity (to be discussed below, pp. 444–45) is accepted. From the commercial viewpoint of most Mediterranean seafarers, the Atlantic coasts would have been of interest only between Morocco and Flanders; indeed, a number of charts stop at the exit from the Mediterranean. The frequent omission of Scandinavia from fourteenth- and fifteenth-century charts can be explained in this way; so, surely, can the refusal of some chartmakers to accommodate either distant Atlantic islands, or western African coastlines where after 1481 the controlling power, Portugal, threatened interlopers with death.³²²

Even if it must remain a mere hypothesis that the apparent shortcomings of some charts reflect the interests of their original purchasers, there is little doubt about the limitations imposed by the size of a single skin. Here the form of the chart must frequently have dictated its content. Though sections of vellum were sometimes joined to offer a larger surface, most charts used only one skin. For a fifteenth-century chartmaker to have incorporated the steadily growing western African coastline would have meant reducing the scale of the Mediterranean, the traditional heart and purpose of his chart.³²³ This he was obviously not prepared to do. Grazioso Benincasa's atlases regularly included a special sheet for western Africa; his separate charts stopped at Bojador. Since they made no atlases, the Catalan draftsmen thereby denied themselves the best opportunity for showing the Portuguese discoveries.

Those were simple omissions. As several writers have pointed out, many of the charts were in no sense up to date.³²⁴ They sometimes continued with outmoded forms or even, as in the case of Petrus Roselli, reverted

to an earlier design.³²⁵ Nordenskiöld considered the 1339 Dulcert chart superior in some respects to Bianco's work of a century later.³²⁶ At best, there was often no visible improvement in the Mediterranean outlines. This led one authority, Heinrich Winter, to conclude that the portolan charts reached their peak with the Pizigani chart of 1367, after which deterioration set in.³²⁷ This harsh judgment has not gone unchallenged. Cortesão and Teixeira da Mota, for example, believed that the charts exhibited "successive improvements," not decline.³²⁸ The best way to test these contradictory opinions is by examining the Mediterranean place-names.

TOPONYMIC DEVELOPMENT

Toponymy is the lifeblood of the portolan charts, providing an unrivaled diagnostic source, and one that can readily be quantified. The names' density and their spread to every part of the chart allow conclusions in which the accidental and local elements are neutralized. If the potential value of the analysis of place-names has been appreciated in the past, the daunting size of the task has presumably inhibited its systematic use.³²⁹

320. Michael J. Blakemore and J. B. Harley, *Concepts in the History of Cartography: A Review and Perspective*, Monograph 26, *Cartographica* 17, no. 4 (1980): 17–23, warn against making evolutionary assumptions.

321. For example, the Freducci family; see Caraci, "Benincasa and Freducci," 42 (note 247).

322. John Horace Parry, *Europe and a Wider World, 1415–1715*, 3d ed. (London: Hutchinson, 1966), 30.

323. The general chart in the British Library's Cornaro atlas (Egerton MS. 73) demonstrates the quite different format required if western Africa was to be included.

324. Andrews noted the lack of development in the representation of the British Isles in "Boundary," 46 (note 249), and "Map of Ireland," 14–15 (note 278).

325. Noted independently by Andrews, "Scotland in the Portolan Charts," 142 (note 249), and Lang, "Lost North European Sea Charts," 40 n. 1 (note 314).

326. Nordenskiöld, *Periplus*, 58 (note 14).

327. Winter, "Catalan Portolan Maps," 7 (note 174).

328. Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:xxvi (note 29).

329. For example, Cornelio Desimoni appreciated the dating potential of toponymy, even if his interpretations about a handful of Ligurian names cannot now be supported. See the "Rendiconto" section of *Atti della Società Ligure di Storia Patria* 3 (1864): CVII. Caraci, too, was well aware of the fundamental importance of toponymy and the need for it to be subjected to minute analysis. His concern, though, was less with the incidence of place-names than with their form, and he used observed linguistic differences to argue in favor of the priority of Italian over Catalan chartmakers; see Giuseppe Caraci, "A proposito di una nuova carta di Gabriel Vallsecha e dei rapporti fra la cartografia nautica italiana e quella maiorchina," *Bollettino della Società Geografica Italiana* 89 (1952): 388–418, esp. 393–99. This theme was expanded in Caraci's later *Italiani e Catalani* (note 175).

TABLE 19.3 Significant Place-Name Additions from Dated Works Applied to Undated Atlases and Charts:

The twenty-one works listed across the top represent dated or datable charts and atlases produced between 1313 and 1426.^a They are arranged in chronological order, with a note on their origin (Catalan, Genoese, Italian, or Venetian). Each is further supplied with a figure representing the number of "significant" new names it introduced (see appendix 19.5 for explanation of this term).

The first column on the left lists by number twenty-four undated works supposedly produced during this same period.^b An examination was made of each undated example to see how many of the toponymic innovations assignable to the successive dated works it contained. The columns of figures indicate the number of new place-names present out of the totals listed at the top. Where charts are very incomplete,

DATED OR DATABLE WORKS

	Vesconte (Venice and Vienna atlases Vesconte combined) ^c	Vesconte (Vatican, Pal. Lat. 1362A)	Vesconte (Vatican, 2972 and Zurich atlases combined)	Vesconte (Lyons)	[Vesconte— London]	Vesconte	Dalorto (treated as later than 1327)	Dulcert	Pizigani	Pizigano	
	1313 It. (24)	1318 It.	(1320) It.	1321 It.	ca. 1322 It.	ca. 1325 It.	1327 It.	1325/30 Cat.	1339 Cat.	1367 Ven.	1373 Ven.
ARABIC											
1		3/10					1/11	4/17	1/10		
CATALAN											
2	12	21	3	2	1	15	1	72	19		
3	4	16	1	1	1	14	2	40/41	17		
4	14	20	3	1	1	12	1	75	17	1	1
5	15	23	3	2	1	15	2	76	20		
6	15	22	3	2	1	14	1	68	19	1	
7	12	22	3	1	1	13	1	76	19	1	
8	3/4	1/4	1/1	1/1				13/15	3/3		
9	11	21	2	2		16	1	62	20	4	3
ITALIAN											
10	5	2	1			1		1		1	1
11	4/6	2/6	1/2			1/14		10/14			
12	2/11	13/27	1/7			5/30	1/1	11/44	1/15		1/19
13	11	11	3		1	3		26			2
14	14	21	3	2	1	15	1	74	19		
15	4/8	7/10	3/5	1/2	1/3	8/10	1/1	7/12	3/4	16/18	10/11
16	3/3	1/3				7/11		9/13	1/2	3/3	2/6
17	16	19	2	2	3	20	2	41	4	16	14
18	15	19	3	2	1	17	2	49	5	5	5
19	1/3	7/9	4/5	2/2	3/3	5/7	1/1	4/6	3/5	10/16	7/11
20	18	24	5	4	2	24	3	57	9	21	15
21	17	26	5	4	3	29	3	54	6	19	17
22	9	24	2	2	2	16		38	4	3	7
23	10	22	2	2	3	18		38	4	5	8
24	13/15	11/12	4/5	2/2	3/3	9/10	1/1	9/12	3/4	17/18	13/15

^aBecause this study begins with Vesconte and is concerned with documenting the addition of names, the 1313 atlas was considered only for its toponymic innovations in the areas previously covered by his earliest chart, dated 1311 (i.e., the Black Sea and the eastern half of the Mediterranean). Two dated charts were omitted from the analysis: the untraceable 1404 Pongeto chart and the Arabic Kâtibî chart of 1413. Three others were found to contain no significant additions: the Viladestes charts of 1413 and 1428 and the Briatico chart of 1430.

^bUndated charts that could not be included in this analysis were as follows: the Carignano map; the chart formerly in the Prince Youssouf Kamal collection, Cairo (reproduced in Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51), 4.2:1206; and the fragment in the Public Record Office, London, MPB 38 (all three on the grounds of legibility); the Catalan fragment stolen from the Archivio di Stato, Venice; and the unsigned chart in the Corsini collection, Florence. (I am grateful to Geraldine Beech for drawing my attention to the Public Record Office chart.) The chart in the Hispanic

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a second figure has been added to show the number of that year's additions that fall within the chart's reduced area.^c

If allowance is made for marked differences between Catalan and Italian works, these figures point to the most likely time slot for each undated work, by reference to the 415 toponymic innovations found on the dated examples. In the list of charts that follows, the dates

proposed in the past are contrasted with those suggested by this analysis. It must be stressed that these cannot on their own provide reliable dates of construction, merely more plausible dates for their toponymic content.^d

Catalan Atlas	Soler	Beccari	Pasqualini	Virga	Cesanis	Viladestes	[Pizzigano]	Beccari	Giroldi	Post-1430 Additions	TOTAL
(1375)	1385	1403	1408	1409	1421	1423	1424	1426	1426		
Cat.	Cat.	Gen.	Ven.	Ven.	Ven.	Cat.	It.	Gen.	Ven.		
11	10	50	17	1	1	1	9	17	1	31	415

4	1										
7	1										
9	4										
8	4										
9	9					1					
1/1		3/10									
8	5	7				1	3	4		2	
1		1	1 ^f								
		3/28									
2		1	1								
		3/10									
	1	4	4	1							
	1	7	3								
			2/7		1						
2	1	7	15		1						
		2	10		1						
1	2	3	2	1				1		1	
1	2	5	2	1				1		1	
		1/6	7/9		1						

Society, New York (chart 1), attributed to Giroldi with a date about 1425, was only partially legible from Stevenson's reproduction. Its names, however, conformed to the pattern of the 1426 Giroldi chart. A number of other works have been implausibly assigned by previous researchers to the period before 1430. The suggestion that the chart in Venice, Museo Civico Collezione Correr, Port. 40 (Morosini Gatterburg 469) should be dated to about 1400—on the grounds of its supposed similarities to the Pizigani and Virga charts of 1367 and 1409—was noticed too late for the chart to be included in this exercise;

see Marcel Destombes, "La cartographie florentine de la Renaissance et Verrazano," in *Giornate commemorative di Giovanni da Verrazano*, Istituto e Museo di Storia della Scienza, Biblioteca 7 (Florence: Olschki, 1970), 19–43, esp. 23–24 (where referred to under its former number "Correr 38"). The earlier catalog of the collection, to which Destombes did not refer, assigned the chart, without stated reason, to the sixteenth century; see Lucia Casanova, "Inventario dei portolani e delle carte nautiche del Museo Correr," *Bollettino dei Musei Civici Veneziani* 3–4 (1957): 17–36, esp. 32, 34.

TABLE 19.3—continued

^cFor example, where the Arabic Maghreb chart has only four of the seventy-nine Dalorto names, the fraction 4/17 shows that it still contains roughly a quarter of those that fall within its limits. So that the overall patterns should not be completely smothered, this second figure has normally been omitted. Where charts are incomplete or partially illegible, the figures inevitably give a distorted picture.

^dNontoponymic factors must be taken into account as well. Because of the lack of Catalan toponymic innovations between 1385 and 1430, the dates proposed for Majorcan work might be far too early. For example, the first of the Catalan charts assigned to the late fourteenth century has a toponymic profile similar to that of the 1423 Viladestes chart.

^eConflicting opinions about the priority of one 1318 Vesconte atlas over another are discussed by Paolo Revelli, *La partecipazione italiana alla Mostra Oceanografica Internazionale di Siviglia (1929)* (Genoa: Stabilimenti Italiani Arti Grafiche, 1937), lxxvi. Since the place-name analysis cannot separate the two, it is logical to treat them as a single entity.

^fApparent “erratics” on this and other undated charts should probably be interpreted as unrecognized innovations. These would demonstrate that the significant additions were not necessarily new names; they might be the traditional names for less important natural features. Every chart has its unique features, some names occur erratically over a long period, and there are numerous inconsistencies within the work of a single chartmaker.

THE UNDATED WORKS AND THEIR NEWLY PROPOSED DATES

ARABIC

1. Milan, Biblioteca Ambrosiana, S.P. 2, 259 (Maghreb chart).

Previously proposed date: late 13th to mid-16th century.

Earliest date from table 19.3: first half of 14th century.

For reproductions see Youssouf Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51), 4.3:1336, and Juan Vernet-Ginés, “The Maghreb Chart in the Biblioteca Ambrosiana,” *Imago Mundi* 16 (1962): 1–16, esp. 1.

CATALAN

2. London, British Library, Add. MS. 25691.

Previously proposed date: ca. 1320–50.

Earliest date from table 19.3: ca. 1339.

For a reproduction see Kamal, *Africae et Aegypti*, 4.3:1334 (1 above).

3. Florence, Biblioteca Nazionale Centrale, Port. 22.

Previously proposed date: 14th to 16th century.

Earliest date from table 19.3: late 14th century.

4. Venice, Biblioteca Nazionale Marciana, It. IV, 1912.

Previously proposed date: ca. 1330 to 15th century.

Earliest date from table 19.3: late 14th century.

5. Naples, Biblioteca Nazionale Vittorio Emanuele III, Sala dei MSS. 8.2.

Previously proposed date: ca. 1390–1429.

Earliest date from table 19.3: late 14th century.

For a reproduction see Kamal, *Africae et Aegypti*, 4.3:1331 (1 above).

6. Paris, Bibliothèque Nationale, Rés. Ge. AA 751.

Previously proposed date: end 14th century to ca. 1416.

Earliest date from table 19.3: late 14th century.

For reproductions see Kamal, *Africae et Aegypti*, 4.4:1396 (1 above) and Armando Cortesão, *History of Portuguese Cartography*, 2 vols. (Coimbra: Junta de Investigações do Ultramar-Lisboa, 1969–71), 2:51.

7. Paris, Bibliothèque Nationale, Rés. Ge. B 1131 (Soler).

Previously proposed date: ca. 1380–90.

Earliest date from table 19.3: late 14th century.

For a reproduction see Kamal, *Africae et Aegypti*, 4.3:1322 (1 above).

8. Paris, Bibliothèque Nationale, Rés. Ge. D 3005 (fragments).

Previously proposed date: beginning to mid-15th century.

Earliest date from table 19.3: early 15th century, but see note 219.

9. Florence, Biblioteca Nazionale Centrale, Port. 16.

Previously proposed date: mid-14th century to ca. 1439.

Earliest date from table 19.3: first half of 15th century.

The Portuguese flag over Ceuta provides a terminus post quem of 1415 if the unconvincing argument that the flag was a later addition is disregarded; see Alberto Magnaghi, “Alcune osservazioni intorno ad uno studio recente sul mappamondo di Angelino Dalorto (1325),” *Rivista Geografica Italiana* 41 (1934): 1–27, esp. 5. For reproductions see Kamal, *Africae et Aegypti*, 4.4:1463–64 (1 above), and Charles de La Roncière, *La découverte de l’Afrique au Moyen Age: Cartographes et explorateurs*, Mémoires de la Société Royale de Géographie d’Égypte, vols. 5, 6, 13 (Cairo: Institut Français d’Archéologie Orientale, 1924–27), pl. XVIII.

ITALIAN

10. Cortona, Biblioteca Comunale e dell’Accademia Etrusca (Cortona chart).

Previously proposed date: mid-14th century.

Earliest date from table 19.3: early 14th century.

For a reproduction see Vera Armignacco, “Una carta nautica della biblioteca dell’Accademia Etrusca di Cortona,” *Rivista Geografica Italiana* 64 (1957): pls. I–III. See fig. 19.11.

11. Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 14207 (fragment).

Previously proposed date: 14th century.

Earliest date from table 19.3: first half of 14th century.

Roberto Almagià discussed its place-names, noting that all were written in black ink and that several significant towns were absent; see *Monumenta cartographica Vaticana*, 4 vols. (Rome: Biblioteca Apostolica Vaticana, 1944–55), vol. 1, *Planisferi, carte nautiche e affini dal secolo XIV al XVII esistenti nella Biblioteca Apostolica Vaticana*, 24–26. Neither he nor Giuseppe Caraci, *Italiani e Catalani nella primitiva cartografia nautica medievale* (Rome: Istituto di Scienze Geografiche e Cartografiche, 1959), 312–13, mentions the strong likelihood—confirmed by my personal examination—that the red pigment used for the important names on this badly damaged chart has proved to be fugitive. There are several other instances where this has definitely occurred: for example, on the 1413 and 1423 Mecia de Viladestes charts and on the 1469 Benincasa atlas in the British Library. Because of the Vatican chart’s incompleteness and semilegibility, no comment is possible about the presence or absence of Dulcert names and hence about Almagià’s claim (p. 24) that this fragment is one of the earliest surviving examples of Catalan work. Almagià’s firm belief in the chart’s Catalan origin was later modified in favor of possible Genoese authorship; see Marcel Destombes, “Cartes catalanes du XIV^e siècle,” in *Rapport de la Commission pour la Bibliographie des Cartes Anciennes*, 2 vols., International Geographical Union (Paris: Publié avec le concours financier de l’UNESCO, 1952), 1: 38–63, esp. 38–39. This point has yet to be resolved.

12. Amsterdam, Nico Israel.

Previously proposed date: ca. 1320–25.

Earliest date from table 19.3: there are insufficient data for a judgment.

The chart was sold to Nico Israel, antiquarian booksellers, and appears in their Fall 1980 catalog, *Interesting Books and Manuscripts on Various Subjects: A Selection from Our Stock . . .*, catalog 22 (Amsterdam: N. Israel, 1980), no.1, and Sotheby’s *Catalogue of Highly Important Maps and Atlases*, 15 April 1980, lot A. Both catalogs reproduce the chart. See also note 274.

13. Washington, D.C., Library of Congress, vellum chart 3.

Previously proposed date: ca. 1320–50.

Earliest date from table 19.3: mid-14th century.

For a reproduction see Charles A. Goodrum, *Treasures of the Library of Congress* (New York: H. N. Abrams, 1980), 93.

14. Florence, Biblioteca Medicea Laurenziana, Gaddi 9 (Medici atlas—except larger-scale Adriatic and Aegean).

Previously proposed date: 1351 to post-1415.

Earliest date from table 19.3: ca. 1351.

For reproductions see Kamal, *Africae et Aegypti*, 4.2:1246–48 (1 above), and A. E. Nordenskiöld, *Periplus: An Essay on the Early History of Charts and Sailing-Directions*, trans. Francis A. Bather (Stockholm: P. A. Norstedt, 1897), 115, pl. X.

15. Milan, Biblioteca Ambrosiana, S.P. 10, 29 (Pizigano atlas 1373—larger-scale Adriatic and Aegean).

Previously proposed date: post-1381.

Earliest date from table 19.3: ca. 1373.

16. Venice, Museo Storico Navale (fragments).

Previously proposed date: 13th century to ca. 1400.

Earliest date from table 19.3: beginning 15th century.

17. Lyons, Bibliothèque de la Ville, MS. 179.

Previously proposed date: 14th century to ca. 1400.

Earliest date from table 19.3: beginning 15th century.

For a reproduction see Charles de La Roncière, *Les portulans de la Bibliothèque de Lyon*, fasc. 8 of *Les portulans Italiens*, in Lyon, Bibliothèque de la Ville, *Documents paléographiques, typographiques, iconographiques* (Lyons, 1929), pls. X–XIV.

18. Barcelona, Archivo de la Corona de Aragón, Caja II.

Previously proposed date: 14th century to ca. 1550.

Earliest date from table 19.3: early 15th century.

Though this is considered to be Catalan (e.g., by Julio Rey Pastor and Ernesto García Camarero, *La cartografía mallorquina* [Madrid: Departamento de Historia y Filosofía de la Ciencia, 1960], 51), the name pattern is that found on Italian charts. Among its strange (and probably misleading) features is the absence of the Canaries, included wherever there was room on all charts after Dalorto’s of 1325/30.

19. Florence, Biblioteca Medicea Laurenziana, Gaddi 9 (Medici atlas—larger-scale Adriatic and Aegean).

Previously proposed date: 1351 to post-1415.

Earliest date from table 19.3: first half of 15th century.

20. London, British Library, Add. MS. 18665 (Giroldi?).

Previously proposed date: ca. 1425.

Earliest date from table 19.3: first half of 15th century.

21. Genoa, Biblioteca Civica Berio (Luxoro atlas).

Previously proposed date: late 13th century to ca. 1350.

Earliest date from table 19.3: first half of 15th century.

For reproductions see Kamal, *Africae et Aegypti*, 4.2:1245 (1 above); Cornelio Desimoni and Luigi Tommaso Belgrano, “Atlante idrografico del medio evo,” *Atti della Società Ligure di Storia Patria* 5 (1867): 5–168, pls. X–VIII (reengraved copies); and Nordenskiöld, *Periplus*, pl. XVIII (14 above).

22. Venice, Biblioteca Nazionale Marciana, It. VI, 213 (Combitis atlas).

Previously proposed date: 1368 to ca. 1400.

Earliest date from table 19.3: first half of 15th century.

For a reproduction see Kamal, *Africae et Aegypti*, 4.3:1333 (1 above). See also note 305.

TABLE 19.3—continued

23. London, British Library, Add. MS. 19510 (Pinelli-Walckenaer atlas—except larger-scale Adriatic and Aegean).
 Previously proposed date: 1384.
 Earliest date from table 19.3: first half of 15th century.
 For reproductions see Kamal, *Africae et Aegypti*, 4.3:1316–19 (1 above), and Nordenskiöld, *Periplus*, pls. XV–XVI (14 above).

24. London, British Library, Add. MS. 19510 (Pinelli-Walckenaer atlas—larger-scale Adriatic and Aegean).
 Previously proposed date: 1434.
 Earliest date from table 19.3: first half of 15th century.
 For a reproduction see Nordenskiöld, *Periplus*, pl. XVII (14 above).

There are, however, inevitable dangers inherent in this type of analysis, as Cortesão and Caraci have warned.³³⁰ Despite these limitations, place-names provide the best evidence of the relation of one chart to another. They also have a major role to play in revealing less obvious patterns of progress or retrogression, and in helping to date charts that lack an author's legend.

A mistake commonly made in the past was the failure to distinguish between reliably dated charts and those whose dating represented no more than an estimate. Any conclusions drawn from data that incorporated charts of the second category are inherently fallible, and the so-called Tammar Luxoro atlas (named after a former owner and now preserved in the Biblioteca Civica Berio, Genoa) provides a good example of this. Nordenskiöld's parallel transcriptions from four works³³¹ supposedly offered a useful spread of three centuries, because he dated the first of these, the Luxoro atlas, to the beginning of the fourteenth century. A recent comparison by Kelley of names at the head of the Adriatic³³² also included the Luxoro atlas, now assigned to about 1350. As can be demonstrated from an overall examination of its names, the work almost certainly belongs to the fifteenth century (see table 19.3, pp. 416–20). It is obviously dangerous to base arguments on charts that have been frequently redated in the past, since they may be moved again in the light of fresh information. Nearly all the undated (but supposedly early) charts and atlases have been misused in this way.

The conclusions that follow are based on a new analysis of the mainland names from Dunkirk southward to Gibraltar and then around the Mediterranean and Black seas to Mogador (Essaouira) in Morocco. Its findings (summarized in table 19.3 and explained in appendix 19.5), some expected and others surprising, invite a radical reassessment of the nature and evolution of the portolan charts. Altogether, forty-seven out of fifty-seven charts and atlases definitely or supposedly produced in the period up to 1430 were studied in detail. In this way the arbitrary selection of data usually employed in studies of this kind was avoided. In the past, toponymic analysis of portolan charts usually consisted either of columns of names extracted from, at most, a handful of works or of comparisons covering only limited stretches

of coastline. Whether because of insufficient charts or limited areas, previous attempts have always left two issues unresolved: whether the same conclusions hold good for the work of other chartmakers, and whether they could be applied to other areas.

This fresh survey, by uncovering different patterns of toponymic development for the various parts of the region under consideration, demonstrated that past extrapolations from small samples were unrepresentative and frequently misleading.³³³ Unwitting emphasis was also given in some earlier studies to the occasional omission of standard names, probably the result of carelessness by the chartmaker. The analysis further revealed that inconsistencies within the output of a single chartmaker can even be matched on overlapping sections of a single atlas.

It can be confirmed, though, that after the early fourteenth century there was little increase in the total number of names listed between Dunkirk and Mogador. One of the latest Vesconte works, the British Library atlas of about 1325, includes more names, for instance, than the Catalan atlas of half a century later, or even the 1593 atlas by Vincenzo di Demetrio Volcio.³³⁴ Except for the very earliest period when regular additions were being incorporated, therefore, a simple name total is no easy pointer to the date of compilation.

Such general assertions still leave several basic questions unanswered. Might not a work drawn to a much larger scale display a corresponding increase in its toponymy? If a chart of 1330 and another of 1530 proved to be indistinguishable in terms of simple name totals, could anything of value be learned from examining the

330. Cortesão, "North Atlantic Nautical Chart," 6 (note 170); Caraci, "Benincasa and Freducci," 34–35 and 39 n. 5 (note 247).

331. Nordenskiöld, *Periplus*, 25–44 (note 14).

332. Kelley, "Oldest Portolan Chart," 42 (note 58).

333. William C. Brice, "Early Muslim Sea-Charts," *Journal of the Royal Asiatic Society of Great Britain and Ireland* 1 (1977): 53–61, esp. 60, considered one of the more static sections of coastline, that between Bejaia (Bougie) and Annaba (Bône). This led him to the false general conclusion that "the Italian-Catalan repertory of names remained remarkably consistent."

334. Nordenskiöld, *Periplus*, 25–44 (note 14), giving the Latinized form of the author's name. The respective totals for the continuous coastline between Dunkirk and Mogador are 1,191 (late Vesconte), 1,121 (Catalan Atlas), and 1,076 (Volcio).

incidence and form of individual names? From the answers to these questions come new and important insights into the development, dating, and interrelations of the early charts.

RELATION OF SCALE TO TOPONYMIC DENSITY

It might reasonably have been expected that the larger the chart, the denser the toponymy. Not only has this assumption proved wide of the mark, it almost certainly inverts the correct order of priority between scale and place-names. No instance has yet been encountered of a chartmaker's reducing the number of names to fit a smaller format.³³⁵ Indeed, it is highly unlikely that most draftsmen would have possessed this kind of editorial skill.³³⁶ The more likely inference is that the overriding need to accommodate the full complement of place-names imposed its own minimum limits on the scale. These restrictions were not absolute, of course, but were relative to the size of handwriting. In its turn, the size of the writing on a particular chart fluctuated according to the amount of space available.

Areas of special name density sometimes provide an exception to this rule, when large writing or small scale necessitated a number of omissions. Peninsulas and sharp turns in the coast, like the southern extremities of Italy and Greece, are instances of this. But where the names were spread out along an uncomplicated coastline—as for Turkey's Black Sea shore or North Africa—it can safely be said that the scale was limited by the place-names and not vice versa. Even the smallest atlases, like the Tammar Luxoro and the 1318 (Vienna) Vesconte, conform to this pattern despite containing charts that measure a mere 11 by 15 centimeters and 19 by 20 centimeters respectively. Broadly speaking, the smaller the atlas format, the more leaves required. Thus the Luxoro atlas is spread over eight sheets and the Vienna Vesconte over nine.

Although the place-names' indispensability set minimum restrictions of scale, there were no upper limits. The relation of scale to toponymic density can be tested in another way by considering examples drawn at increased scales. Unlike a chart, an atlas could be constructed at varying scales. Vesconte did this regularly, and although his earliest surviving atlas of 1313 has the Aegean drawn at twice the scale of the other sheets, no region was consistently favored in his atlases. Later draftsmen began to use scale to emphasize the Adriatic, Aegean, and Black seas. In some cases this was probably inadvertent—the Black Sea, for instance, naturally commanded a sheet to itself regardless of how the Mediterranean was divided up. From the time of the 1373 Francesco Pizigano atlas onward, though, there are indications of a conscious manipulation of scale. By

these means the Pizigano atlas enlarged both the Adriatic and the Aegean, as did, for example, the Medici, Pinelli-Walckenaer, and 1426 Girolodi atlases. These two seas were of great importance for the eastward-looking trading and colonizing ventures of Genoa and Venice.

There is little evidence, however, that the larger-scale sheets in portolan atlases contained more names,³³⁷ although, as with so many generalizations about portolan charts, this too may need qualifying. A handful of surviving fifteenth-century examples indicates that more specialized charts were sometimes produced, limited to a small section of the regions normally covered.³³⁸ The 1424 chart seems to be the first of these. Renowned for its Antilia, it needs to be valued also for its contribution to the toponymy of France and the Iberian peninsula. A number of unusual names are to be found also on the neglected chart of the Adriatic, drawn by Antonio Peluchan in 1459.³³⁹ Similarly, the 1470 Nicolo chart of the Adriatic and Aegean was described by Almagià as being "rich in names."³⁴⁰ From these examples it is clear that the extra space permitted by the larger scale of detailed separate charts was occasionally used to increase the number of place-names.

This did not happen, however, with Grazioso Benincasa's separate chart of the Adriatic, drawn in 1472.³⁴¹ Its total of 166 names includes only 16 that are not to be found on the relevant sheet in the atlas of 1473; and 9 of the names in the atlas are absent from the chart.

335. Unless the small and sparsely lettered Arabic chart in the Biblioteca Ambrosiana, Milan (the Maghreb chart), should be interpreted in this way.

336. It is significant that the marginal illustrations in *La sfera* (attributed to Leonardo Dati) merely extracted from a portolan chart the red names (for the more important places), ignoring the more numerous black ones; see Almagià, *Vaticana*, 1:128 (note 35), and also note 72.

337. The Medici atlas's larger Adriatic sheet has far more names but can be shown to be later; see appendix 19.1 and table 19.3, pp. 446–48 and 416–20, respectively.

338. The small-format Maghreb chart should not be seen as an example of this (see p. 445 and note 533), nor should a sheet like the one in the Museo Storico Navale, Venice, which is clearly the sole survivor of an atlas.

339. Although noted by Uzielli and Amat di San Filippo, *Mappamondi*, 75 (note 35), this important chart has been consistently ignored by commentators since.

340. Roberto Almagià, "Intorno ad alcune carte nautiche italiane conservate negli Stati Uniti," *Atti della Accademia Nazionale dei Lincei: Rendiconti, Classe di Scienze Morali, Storiche e Filologiche*, 8th ser., 7 (1952): 356–66, esp. 360. Since the Nicolo chart is evidently unreproduced, this point could not be checked.

341. Preserved in the Museo Correr, Venice, this was discussed by Marina Salinari (formerly Marina Emiliani), "Notizie su di alcune carte nautiche di Grazioso Benincasa," *Rivista Geografica Italiana* 59 (1952): 36–42. She transcribed the names, comparing them with the atlas of 1473. Caraci, "Grazioso Benincasa," 287 (note 17), arrived at name totals slightly different from ours. He also suggested that this sheet had formed part of an atlas (p. 286), but all the indications are to the contrary.

Yet the larger scale certainly allowed a far more realistic outline of the intricate Dalmatian coastline³⁴²—an indication of the distinction that needs to be made between hydrographic and toponymic development.³⁴³

SIGNIFICANT PLACE-NAME ADDITIONS

The total number of place-names on charts after about 1325 remains relatively static, therefore, increasing neither with the passage of time nor (generally) with enlargement of scale. But once the names are examined individually, there emerges a changing pattern that has remained unsuspected by most previous commentators. Winter's phrase "the agreed conservatism of the chart-makers" sums up a common attitude.³⁴⁴ Nordenskiöld found complete correspondence between the work of Vesconte and "all portolanos of the normal type from the 14th–17th centuries."³⁴⁵ More recently, R. A. Skelton concluded that the prototype chart "was reproduced with no structural alterations for nearly four centuries."³⁴⁶ Steadily changing patterns of place-names might not normally be considered to form part of the "structure" of a class of maps. But given that the Mediterranean and Black Sea names are applied on the portolan charts to broadly unchanging coastlines, they demonstrate the importance that contemporaries attached to this particular element. Nordenskiöld, and the many others who followed him, based their generalizations about toponymic conservatism on the admittedly static majority. But what mattered was the sizable changing minority now revealed: more than five hundred place-names for coastlines where an average chart would have fewer than three times that number in all.³⁴⁷ The extent and frequency of these toponymic changes invite a new respect for the early portolan charts, as well as a new awareness of the living, and not static, tradition they represent.³⁴⁸

It might have been anticipated that fresh names would have been added infrequently, marking out as significant prototypes the occasional portolan charts that conveyed the new information. True, some are more important in this respect than others. But what is particularly surprising, about the early charts at least, is that all the dated or datable ones produced up to 1408 are innovators. Each one injects into the communal bloodstream at least a few names that show up in later work.³⁴⁹

The third row in table 19.3 can be read off on its own to provide the total of significant place-name additions found on successive dated or datable charts. Nowhere is this development more marked than in the earliest stages, particularly in the work of Pietro and Perrino Vesconte (identified in table 19.3 as Italian because, although Genoese, they worked partially or entirely in Venice). Pietro's earliest production, the eastern Medi-

terranean chart of 1311, brought in a wealth of names not found in *Lo compasso da navigare*, the earliest surviving *portolano* of the Mediterranean, or on the *Carte Pisane*.³⁵⁰ But when attention is focused exclusively on improvements the two Vescontes made to their own work—in other words, starting with the 1313 atlas for the areas covered in 1311 and the 1318 atlases for the remainder—we find they contributed in total no fewer

342. Salinari, "Notizie," 38–39 (note 341). Her belief that this hydrographic improvement was not entirely due to the increase of scale is hard to accept and was challenged by Caraci, "Grazioso Benincasa," 286 (note 17). The 1472 chart provides confirmation of Salinari's earlier conclusion that the expected connection does not exist between Grazioso Benincasa's charts and the sailing directions for the Adriatic and points east that he produced between 1435 and 1445; see Marina Emiliani (later Marina Salinari), "L'Arcipelago Dalmata nel portolano di Grazioso Benincasa," *Archivio Storico per la Dalmazia* 22 (1937): 402–22, esp. 407.

343. Two other undated charts should be mentioned here: a supposedly fifteenth-century chart of the archipelago that was in private hands in Tortona a century ago (see Uzielli and Amat di San Filippo, *Mappamondi*, 101 [note 35]), and the Lesina chart of the Caspian Sea, which, though probably dating from the first quarter of the sixteenth century, might well be based on an earlier prototype; see note 48 and also Renato Biasutti, "Un'antica carta nautica italiana del Mar Caspio," *Rivista Geografica Italiana* 54 (1947): 39–42.

344. Heinrich Winter, "The True Position of Hermann Wagner in the Controversy of the Compass Chart," *Imago Mundi* 5 (1948): 21–26, esp. 22.

345. Nordenskiöld, *Periplus*, 56 (note 14). Page 45 contains a very clear statement of the views of the "conservative" school. In the opinion of Taylor, *Haven-Finding Art*, 113 (note 7), "a single master-copy appears to have been available from the outset, from which all later ones show merely deviations in detail."

346. R. A. Skelton, *Maps: A Historical Survey of Their Study and Collecting* (Chicago: University of Chicago Press, 1972), 8.

347. See note 334.

348. Ironically, an earlier study that purported to demonstrate this very point by highlighting toponymic development on sixteenth- and seventeenth-century charts proves, on closer examination, to require reinterpretation. Giuseppe Caraci, "Inedita cartografica—1, Un gruppo di carte e atlanti conservati a Genova," *Bibliofilia* 38 (1936): 170–78, considered 301 mainland names between Marseilles and Cattaro (Kotor) on six works dated between 1563 and 1676. Comparing these with the listing of pre-1500 names given by Kretschmer, *Die italienischen Portolane* (note 48), Caraci found that some 14 percent of the names he was considering were missing from Kretschmer's catalog, and he concluded that most of these referred to new or expanded settlements (p. 170). Unfortunately, Kretschmer had missed a number of early names, and a check of Caraci's supposedly innovative mainland names found that only 6 percent were actually absent from charts of the fourteenth and fifteenth centuries and from the 1512 Vesconte Maggiolo atlas. In contrast, therefore, to what will be shown for the early period, this indicates that sixteenth- and seventeenth-century charts were toponymically static.

349. The addition of fresh names seems to conflict with the static overall totals. The explanation is that some of the new names replaced existing ones and others were exclusive to one particular chartmaking center.

350. The wide variations in the names of *Lo compasso* (ca. 1250—but see note 107), the *Carte Pisane* (late thirteenth century), and the 1311 Vesconte chart made it impractical to include the first two in the general place-name analysis.

than 119 significant additions. These are spread out among the different productions, serving, incidentally, to confirm the chronological sequence of Vesconte works earlier indicated by the evolving cartography of the British Isles.³⁵¹ There is nothing here to support Hinks's judgment that the Vescontes' work showed little originality.³⁵²

The insertion of new names has no significance for the present analysis until these innovations are imitated. In developmental terms, unique names can be ignored. Two important and complementary insights flow from an investigation of the way fresh names were introduced and then later repeated. In the first place, when viewed diachronically this analysis identifies the first dated appearance of names that were destined to be regularly repeated thereafter. This is, pure and simple, a dating aid. On the other hand, when approached synchronically the data demonstrate the interdependence or mutual isolation of Catalan, Genoese, and Venetian chartmakers by emphasizing those names whose inclusion or omission is indicative of a particular "school." These two aspects will be considered in turn.

TOPONYMY AS A DATING TOOL

Once the toponymic development on datable portolan charts from the Carte Pisane to 1430 has been systematically analyzed, it is possible to approach the undated charts with more confidence. Past attempts supply instructive warnings, as James E. Kelley pointed out.³⁵³ He noted a two-and-a-half-century disparity in the case of the Arabic chart in the Biblioteca Ambrosiana, Milan (the Maghreb chart). This was dated to the late thirteenth century by Uzielli in 1882, to perhaps the mid-sixteenth century by Nordenskiöld in 1897, and to various points in between by other researchers.³⁵⁴ Uzielli even suggested dates two hundred years apart within ten pages of the same work.³⁵⁵

Extraordinary though it may seem, this difference is not without parallel. To previous generations, no chart could be left undated (or usually unauthored). When no evidence was available, guesswork took over. The anonymous Catalan fragment in the Archivio di Stato, Venice, which was dated to the period 1490–1502 in a 1907 exhibition, had to be reassigned by Marcel Destombes to the first half of the fourteenth century.³⁵⁶ Unfortunately it has since been stolen and has never, apparently, been reproduced in full. The chart in Uppsala and the so-called Richelieu atlas in the Bibliothèque Nationale (Département des Manuscrits, Français 24909) have both been ascribed at different times to the fourteenth, fifteenth, and sixteenth centuries.³⁵⁷ The most extreme case is that of the Matteo Prunes chart in the Biblioteca Monumento Nazionale, Cava de' Tirreni.

Visibly signed by this sixteenth-century chartmaker, the work has nevertheless been assigned to the fifteenth and fourteenth centuries and even to the beginning of the thirteenth.³⁵⁸ Clearly, a more scientific approach than this had to be found.

The place-name data provide for the first time an objective yardstick for dating the early Mediterranean and Black Sea charts—works that can rarely be fixed in relation to documented discoveries. The way this information can be applied to otherwise undatable charts offers approximation only, not precise or foolproof answers. Like all other exercises of this type, it can only work from the assumption that the document in question is typical of its period. Each undated chart is therefore assigned to its most logical chronological position in the documented evolution of the toponymy found on dated charts.

This method cannot, of course, distinguish between a later copy and its model, nor can it readily give credit for any innovations that might be present on an undated chart.³⁵⁹ If used uncritically, without consideration of any other factors, this approach might provide misleading results, suggesting too early a date for a slavish copy and too late a slot for one that was ahead of its time. To obviate errors in the new dates proposed, paleo-

351. See above, pp. 407–9. For the totals of significant additions introduced on successive Vesconte productions see the top line of table 19.3.

352. Hinks, *Dalorto*, 3 (note 76).

353. Kelley, "Oldest Portolan Chart," 25 (note 58).

354. Uzielli and Amat di San Filippo, *Mappamondi*, 229 (note 35); Nordenskiöld, *Periplus*, 46–47 (note 14).

355. Uzielli and Amat di San Filippo, *Mappamondi*, 229, 237 (note 35).

356. *Catalogo delle Mostre Ordinate in Occasione del VI Congresso Geografico Italiano* (Venice, 1907), 73; Destombes, "Cartes catalanes," 53–54 (note 99).

357. Both have been reassigned to the sixteenth century: for Uppsala see Kretschmer, *Die italienischen Portolane*, 148 (note 48); for the Richelieu atlas see Winter, "Late Portolan Charts," 39 (note 129).

358. This chart was assigned to the beginning of the thirteenth century by Manuel Francisco de Barros e Sousa, Viscount of Santarém, *Estudos de cartographia antiga*, 2 vols. (Lisbon: Lamas, 1919–20), 1:52. The fourteenth-century suggestion came from Giuseppe de Luca, "Carte nautiche del medio evo disegnate in Italia," *Atti dell'Accademia Pontaniana* (1866): 3–35, esp. 11; reprinted in *Acta Cartographica* 4 (1969): 314–48. Rey Pastor and García Camarero, *Cartografía mallorquina*, (note 28), provide three distinct entries (pp. 86–87, 96, 97) for charts at the Biblioteca Monumento Nazionale, located in the monastery of La Trinità della Cava, near Cava de' Tirreni (between Naples and Salerno). Nevertheless, these sketchy and clearly second-hand descriptions, two of which mention the second half of the fifteenth century, can all apply to the faded Prunes chart reproduced in "Mostra cartografica" in *Atti del XI Congresso Geografico Italiano, Naples, 1930* (1930), 4:32–42, reproduction facing 326. The director of the Biblioteca confirms that only one chart is involved.

359. The Cornaro atlas is the best example of an archaic work; the 1403 Francesco Beccari chart is the most striking instance of innovation.

graphic expertise might also have to be invoked (though we must remember that scribes would sometimes even reproduce the handwriting of the manuscript they were copying).

The application of the place-name analysis to undated charts or atlases involved noting in each case the number of significant additions they included. Since every significant new name had been bracketed with the year of its first observed appearance, it was possible to prepare separate “toponymic profiles” for the undated works (see appendix 19.5).³⁶⁰ The results for the works that have traditionally been assigned to the period up to 1430 are found in table 19.3 where the dates proposed in the past for each chart or atlas are compared with those indicated by its toponymic makeup.

In a number of cases earlier suggestions (or perhaps one from a range of alternatives) are reinforced. Several instances, however, challenge long-held assumptions. The Dalorto/Dulcert type chart in the British Library (Add. MS. 25691), considered by Heinrich Winter to be earlier than the Dalorto chart, actually contains as many as possible of the names first found on the definitely later Dulcert chart.³⁶¹ The place-name analysis also contradicts received opinions about five of the early Italian atlases. It indicates, for example, that the supposedly homogeneous Medici atlas in reality contains two sheets incorporating names not in circulation at its presumed date of execution, 1351 (see appendix 19.1). Conversely, the same data, when applied to the 1373 Francesco Pizigano atlas, reveal remarkable similarities between the core of the work and the larger-scale sheets, which are usually considered to be later. More drastic still is the clear indication that three “fourteenth-century” atlases—the Combitis, Luxoro, and Pinelli-Walckenaer volumes—should be removed altogether from that century.

In this context, the information summarized in table 19.3, pp. 416–20, has a further role to play. Common patterns of significant additions spotlight links between particular charts and can reveal a chartmaker’s hidden signature. There is, for example, a close correlation in these respects between the Pinelli-Walckenaer and Combitis atlases. This substantiates their close match of style. Indeed, idiosyncrasies in the handwriting leave little doubt that both are in the same hand (see fig. 19.9).³⁶² In the same way, the remarkable consistency of the toponymic profiles extracted from the Luxoro atlas and the 1421 Francesco de Cesanis chart prompted their closer comparison through reproductions (see appendixes 19.2 and 19.3). Despite the early fourteenth-century date often claimed for the former (see above, p. 420), its writing shares a number of peculiarities with the reliably dated Cesanis chart (see fig. 19.10).³⁶³ Although the divergence of scale between the two, and

hence the size of handwriting, results in inevitable differences, it is permissible to make a fairly confident attribution of the Luxoro atlas to Cesanis.³⁶⁴

TOPONYMY AS A GUIDE TO THE INTERRELATIONS OF CHARTS

The data displayed in table 19.3, pp. 416–20, can be used in yet another way to reveal the influence exerted by one chartmaker, or one center of production, over another. The most striking conclusion to emerge from this reading of the evidence is that only up to perhaps 1350 was there free interchange of information between different chartmakers. For this first period, the practitioners can be characterized, however loosely, as members of a single school, sharing at least partially the same constantly renewed sources of toponymic information. Several of the Italian charts that seem to belong to this period were influenced at least as much by Catalan place-

360. For explanation of the particular use of the term “significant” see appendix 19.5.

361. Winter read the Dalorto date as 1330 as in Winter, “Catalan Portolan Maps,” 7 (note 174), and considered the British Library chart to be “prior to 1324 because in it the Aragon colours do not yet appear on Sardinia,” Winter, “Fra Mauro,” 17n. (note 297). The British Library chart incorporates nineteen of the twenty Dulcert innovations; the place where the twentieth (Gux) would fall on the west coast of Morocco is illegible. Giuseppe Caraci reached a similar conclusion about the relation of Add. MS. 25691 to the Dalorto and Dulcert charts; see Giuseppe Caraci, “The First Nautical Cartography and the Relationship between Italian and Majorcan Cartographers,” *Seventeenth International Geographical Congress, Washington D.C., 1952—Abstracts of Papers*, International Geographical Union (1952): 12–13. His assertion that Add. MS. 25691 is Italian cannot, however, be accepted.

362. Both are datable to the first half of the fifteenth century on the strength of their names (see table 19.3, pp. 416–20), despite the 1384 commencement date of the Pinelli-Walckenaer atlas’s calendar (see appendix 19.1) and the fictitious 1368 date proposed for the Combitis atlas (see note 305). That the two atlases have the same author seems not to have been remarked before, although Cortesão, *History of Portuguese Cartography*, 2:50 (note 3), came close to it.

363. For instance, a period after each word and an intermittent wavy *l*. Previous writers had anticipated the relegation of the Luxoro atlas to the fifteenth century. Cesare Paoli, “Una carta nautica genovese del 1311,” *Archivio Storico Italiano*, 4th ser., 7 (1882): 381–84, esp. 382, thought the handwriting later than commonly supposed; more recently Quaini, “Catalogna e Liguria,” 554 (note 60) assigned it to the mid-fifteenth century; and Revelli, *Colombo*, 251–52 (note 22), pointed out that the work’s binding was reminiscent of one from the fifteenth century.

364. Since Cesanis was a Venetian, this attribution overturns the commonly held assumption that the Luxoro atlas is a Genoese work. See, for example, Giuseppe Piersantelli, “L’Atlante Luxoro,” in *Miscellanea di geografia storica e di storia della geografia nel primo centenario della nascita di Paolo Revelli* (Genoa: Bozzi, 1971), 115–41, esp. 127–29. Nevertheless, Venetian authorship had already been suggested in 1864; see the “Rendiconto,” CV–CVI (note 329), and Marinelli, “Venezia,” 954 (note 97), who made a definite claim for Venice.

name innovations as by those of the Vescontes. Thereafter the regionalism, of which there are already hints at the outset, grows steadily more evident, until by about 1375 it has become the dominant tendency.

This shift can be demonstrated as follows. The names introduced by the Vescontes and by Dalorto win a lasting place on the portolan charts. Even if a higher proportion of Vesconte names will appear on Italian charts and of Dalorto names on Majorcan productions, almost all charts drawn before 1430 include a clear majority of those available from both sources. Yet the twenty Dulcert innovations of 1339 found little favor with Italian chartmakers, who often incorporated fewer than a third of them.³⁶⁵ There then follows a thirty-year hiatus before dated charts resume in 1367. Now the development of separate regional toponymic “vocabularies” becomes more marked, with the forty-eight Pizigani innovations being almost entirely ignored by later Catalan chartmakers and the twenty-one names introduced on the Catalan atlas and Soler chart making an equally small impact on subsequent Italian work. Indeed, the local influences are so strong that “Italian” is a misnomer. The innovative 1426 chart of the Genoese Batista Beccari adopts almost all the 1375–85 Catalan additions but has fewer than half of those first disseminated by the Venetian Pizigani (1367–73). For names, as for decorative embellishment, the Genoese looked to Majorca instead of their more distant rival Venice. The largely unoriginal chart by the Venetian Girolodi (also of 1426) shows the pattern in reverse, being strong on Pizigani names and weak on Catalan ones.

By the late fourteenth century, and on at least to 1430, the presence or absence of new names provides a pointer, therefore, to the likely place of production. That chartmakers remained largely ignorant of (or unimpressed by) the names introduced in other centers allows us with some confidence to designate the Dulcert innovations as Catalan, the Pizigani additions as Venetian, the Beccari ones as Genoese, and so on. With so few original charts extant, there must remain the strong possibility that even earlier lost works deserve the credit for introducing some of the names onto the portolan charts. In other words, our dates for a number of new names might be too late. But the consistency of the regional patterns leaves little doubt that most of the innovations have been ascribed to the correct chartmaking center. If “Venetian” names, for example, had actually been borrowed from lost Catalan charts, they would show up in later Catalan work. Yet this does not happen. It thus becomes clear that the impetus from Majorca, so strong with Dalorto/Dulcert, fades thereafter. Only a further 21 names (1375–85) are attributable to that source over the next hundred years, compared with 135 additions by Italian chartmakers.³⁶⁶ As a result, the Catalan chart produced by Mecia de

Viladestes in 1423 includes no fifteenth-century innovations at all, since these had all been Italian.³⁶⁷

Had that particular chart lost its author’s legend, it would have been assigned, using toponymic evidence alone, to about 1380. It is essential, therefore, that the charts of the three main producing centers, Majorca, Genoa, and Venice, be related to the distinctive toponymic patterns of their places of origin before dating can be attempted. No unsigned Genoese charts have been identified with certainty for the period up to 1430. Were any to emerge, it seems likely that their names would be closer to those on the Beccari charts than are those of any surviving works.

It is possible, though this remains to be investigated, that the tendency to regional isolation may later have been reversed. The 1468 productions by the Majorcan Roselli and the Anconitan Grazioso Benincasa were specifically chosen for the pilot place-name study to reveal the extent of mid-fifteenth-century toponymic divergence between Majorcan and Italian work (see appendix 19.5). In fact, they proved to be remarkably similar.

Whereas many names found their way, if belatedly, onto the charts produced in other centers, some remained the almost exclusive hallmark of one particular “school.” A few examples, covering the period up to 1430, must suffice. Near Sibenik, the names *port l’ospital*, *artadur*, and *zarona* appear only on Catalan charts (exceptions being provided by the Medici atlas and, in the first two cases, by the 1403 and 1426 Beccari charts). The Greek port Lepanto (Naupaktos), which is rendered *nepanto* on the earliest Italian charts, is given additionally as *lepanto* by Catalan draftsmen (with the 1403 Beccari chart the only Italian example here). On the other hand, the Adriatic offers several instances of names entirely ignored by the early Catalan chartmakers. Between Manfredonia and Rimini the following examples can be cited: *lesna*, *fortor*, *salline*, *cerano*, and *fumissino* (with the almost exclusively Catalan *potencia* nearby).³⁶⁸ *Novegradi* (the Croatian port of Novi)³⁶⁹ is similarly omitted from Catalan charts.

365. Except the Genoese Beccari family and the anonymous compiler of the Medici atlas.

366. The loss of the Catalan duchy of Athens and Thebes about 1380, marking as it did the beginning of Catalan withdrawal from the eastern Mediterranean, can plausibly be linked to this decline in cartographic inspiration.

367. This is the opposite conclusion from that reached by de La Roncière, *Afrique*, 1:139 (note 100), who considered the toponymy of the 1426 Batista Beccari chart to be a mere echo of the steadily developing Catalan work of the period. This is one of many instances where misleading results have been produced by superficial toponymic comparisons.

368. The non-Catalan instances of *potencia* are found on the Library of Congress and Nico Israel charts and on the Medici atlas.

369. Kretschmer, *Die italienischen Portolane*, 627 (note 48). This essay’s conclusions about the injection of new names and the regional

THE SIGNIFICANCE OF PLACE-NAME CHANGES

So far the names have been treated collectively to construct a developmental framework against which undated charts could be assessed and regional interrelationships demonstrated. When considered individually, each added or abandoned name makes its own small contribution to the history of the Mediterranean. Cumulatively, this represents a vital and little-used source.³⁷⁰ Because of the scarcity of regional or local maps in the Middle Ages,³⁷¹ the portolan charts are the earliest surviving cartographic documents to name a great many settlements, as well as numerous natural features. We have already shown how, contrary to expectation, the toponymy of the Mediterranean was under constant review by the portolan chartmakers. Enough names can be recognized today or related to contemporary documents to make it clear that most derived from sound authority.³⁷² With their toponymic credentials established, the portolan charts can be consulted, with all necessary caution, as primary documents. What they show and what they omit should be considered an important comment on aspects of the medieval world. Had the influx of new names or the purging of obsolete ones occurred only at widely separated intervals, the portolan charts would be a much less useful and convincing record of the growth and decay of coastal Mediterranean settlements. Additional significance attaches to a name first found, say, on a dated chart of the fifteenth century because of the existence of successive earlier charts that had failed to show it.³⁷³

Before the portolan chart toponymy can offer any insights into the changing political, commercial, navigational, or even religious importance of different places, we need to have some idea of the time lag involved—the gap between the historical event and its recognition in cartographic form. Unfortunately, few coastal villages were the result of a conscious creation (though the date of their first church might sometimes be a useful indicator), and it is impossible to identify the moment they passed from obscurity to significance. There are nevertheless a few towns whose origins are documented, and the labors of local historians may yet add to this number.

The Apulian port of Manfredonia was founded in 1258 by King Manfred, who transferred the population of Siponto to a fresh and healthy site nearby. Although the old name survived on charts for centuries, the new form was already recorded on the *Carte Pisane* (though not, significantly, on *Lo compasso da navigare* or the Cortona chart).³⁷⁴ Belforte (at the head of the Adriatic) owes its origin, as its name suggests, to the Venetian fort constructed there in 1274.³⁷⁵ Its first dated appearance on a portolan chart is not, as might have been anticipated, on one of Vesconte's Venetian productions,

but on the chart drawn by Dulcert in Majorca in 1339. The castle at Mola di Bari dates from 1278, but it was a century before the 1373 Francesco Pizigano atlas named it. Novi, the Croatian village that Kretschmer identified with *noue gradi*, was founded in 1288 and added to the charts for the first time by Vesconte about 1325.³⁷⁶ Though built on the site of Olivule in 1295,³⁷⁷ Villefranche did not supplant its predecessor on the portolan charts until the mid-fifteenth century. Vico Equense (south of Naples), which was reconstructed at the end of the thirteenth century, was also ignored by the charts for a century and a half. Like Novi, Bilbao illustrates the rapidity with which new information could be absorbed by the chartmakers. Founded about the year 1300 on a site some eight miles inland, it and its harbor Portugaleta (*galleto*), were already noted by Dulcert in 1339.

Accentuated by the Black Death, which swept across western Europe after 1348, the fourteenth and fifteenth centuries were a period of drastic demographic and economic decline. Overall, it took until the early sixteenth century for population numbers in Europe to return to their 1300 levels.³⁷⁸ It is not surprising, therefore, that for our next examples we should have to turn to the late fifteenth century, when population was expanding once again. Giulianova (south of Ancona) was founded in 1470, and the castle at Pizzo (near the toe of Italy) was built in 1486 by Ferdinand of Aragon. Of these only the latter is included in Vesconte Maggiolo's atlas of 1512. Unfortunately, the unevenness of this admittedly patchy sample allows us to draw only one conclusion

component of toponymic lists find general corroboration in a detailed study of one small area, Cyprus, although the island's unique history, particularly its capture by Venice in 1489, had special cartographic implications. See Tony Campbell, "Cyprus and the Medieval Portolan Charts," *Kupriakai Spoudai: Deltion tēs Etaireias Kupriakōn Spoudōn, Brabeuthen upo tēs Akadēmias Athēnōn* 48 (1984): 47–66, esp. 52–58 and the tables.

370. But see Quaini, "Catalogna e Liguria," 551–53 (note 60).

371. Harvey, *Topographical Maps*, 88 (note 8).

372. See Kretschmer, *Die italienischen Portolane*, 559–687 (note 48).

373. Obsolete names, however, are likely to have survived longer through inertia. See the glossary at the end of Kretschmer's *Die italienischen Portolane* (note 48), for instances of this.

374. Motzo, "Compasso da navigare," XXX (note 103); Armignacco, "Carta nautica," 197 (note 243).

375. Kretschmer, *Die italienischen Portolane*, 625 (note 48).

376. Kretschmer, *Die italienischen Portolane*, 627 (note 48). 1325 is the most likely date for the Sanudo-Vesconte atlas in the British Library (Add. MS. 27376*).

377. Motzo, "Compasso da navigare," XXVIII (note 103).

378. M. M. Postan, E. E. Rich, and E. Miller, eds., *The Cambridge Economic History of Europe*, 3 vols. (Cambridge: Cambridge University Press, 1963), vol. 3, *Economic Organization and Policies in the Middle Ages*, 37. See also J. C. Russell, "Late Ancient and Medieval Population," *Transactions of the American Philosophical Society*, n.s. 48, pt. 3 (1958): 5–152.

about the pace of toponymic absorption on the portolan charts: that it was unpredictable and erratic.³⁷⁹

Besides those places whose origin can be pinpointed, there were others, ultimately of more importance, that grew sufficiently during the fourteenth and fifteenth centuries, either in physical size or in perceived significance, for the chartmakers to take note of them. A number of these were even picked out in red on their first recorded appearance.³⁸⁰ Several of the best-known places are listed below. The form in which they are rendered on the charts and the date of their first identified mention are given in parentheses.

Harfleur (*arefloe*, 1385)
 Cherbourg (*ceriborg*, 1318)
 Gijón (*gigon*, 1426)
 Viareggio (*viaregio*, by 1512)
 Livorno (*ligorna*, 1426)
 Pozzuoli (*poçuol*, 1403)
 Monfalcone (*montfarcom*, 1339)

Livorno was already recorded under that name at the beginning of the tenth century, but it was not until the brief period of Genoese control (1407–21) that it came to supplant its close neighbor Porto Pisano as the chief port at the mouth of the Arno. It is no coincidence that Livorno is first named on surviving charts in 1426, five years after its new overlord, Florence, acknowledged the town's superiority over Porto Pisano.³⁸¹ What is given cartographic recognition, therefore, is not Livorno's foundation but its coming of age. Many similar instances could be cited. The Basque harbor Pasajes had been a whaling center since the tenth century, yet it is a late addition to the charts. Gijón and Taggia have early medieval buildings and are (at least in the latter case) of certain Roman origin, but they are both missing from the early charts.

In attempting to match the cartographical and historical realities, it needs to be emphasized that, while a noncartographic approach to portolan chart toponymy may unearth valuable evidence, this must always remain secondary to that derived from the charts themselves. Whether the inclusion or omission of a particular place is a true reflection of its importance at the time in question is a matter for the local historian. To the historian of cartography, the toponymic information has intrinsic value. It is a primary record of the knowledge available to the seafaring peoples of the Mediterranean at different periods. Distorted or fictitious names are as much a part of the pattern as those that are clearly recognizable. Indeed, unfamiliarity with an area's place-names may reflect the infrequent contact of those who supplied the charts' raw data and hence provide pointers to the latter's identity.

THE CHARTMAKERS' INFORMANTS

The travels of Marco Polo left a very obvious mark on the Asian section of some medieval world maps, but changes to the Mediterranean area were subtle and anonymous. Among those who might have acted as informants for the chartmakers would have been travelers, some of them on pilgrimage. For example, Marino Sanudo, the Venetian for whom Pietro Vesconte drew several atlases, returned from Palestine in 1306.³⁸² Yet if his firsthand knowledge was made available to Vesconte, it did not result in a single addition to the toponymy of the eastern Mediterranean.³⁸³ Had Francesco Beccari not decided to "make public for the removal from all persons of any matter of doubt" the improvements that he had recently made to the standard portolan chart, we should have been left to guess how most of the new information must have reached the chartmakers.³⁸⁴

The Francesco Beccari chart in question (now at Yale) is dated 1403. In his long "address to the reader" the author explains how he had lengthened the Atlantic distances on all the charts he himself had drawn since 1400 (fig. 19.17, and see above, p. 414): "the marrow of the truth having been discovered concerning these [things] aforesaid through the efficacious experience and most

379. That a number of names present in the mid-thirteenth-century *Lo compasso da navigare* (note 103) are not found on charts until the fifteenth century or later warns of divergence between the written and the cartographic records. Examples are: *capo de lardiero* and nearby *san trope*, and *capo de sancta maria* (at Italy's heel). Another would be *fanaro* at the entrance to the Bosphorus; this was repeated by Vesconte but then lapsed for a century; see Elisaveta Todorova, "More about 'Vicina' and the West Black Sea Coast," *Etudes Balkaniques* 2 (1978): 124–38, esp. 129, where Fanaro was thought to have first appeared on charts in the fifteenth century.

380. The assertion in Nordenskiöld, *Periplus*, 18 (note 14), that the list of red names remained static through the centuries is not correct. Working from monochrome reproductions, however, it was impossible to make a systematic check on this important barometer of contemporary significance.

381. Giuseppe Gino Guarnieri, *Il porto di Livorno e la sua funzione economica dalle origini ai tempi nostri* (Pisa: Cesari, 1931), 32. The first dated chart to show Livorno is Batista Beccari's of 1426. Its inclusion on the Pinelli-Walckenaer atlas is another reason for doubting the latter's traditional date of 1384 (see table 19.3, pp. 416–20). Porto Pisano remained active as a harbor up to the fifteenth century; thus the attempt by Nordenskiöld, *Periplus*, 46 (note 14), to date the construction of a prototype portolan chart before its supposed destruction in 1290 is unconvincing.

382. De La Roncière, *Lyon*, 11 (note 34).

383. The coast between Alexandretta (Iskenderun) and Alexandria is toponymically one of the most static stretches on the portolan charts. There is no difference here between the Vesconte charts of 1311 and 1327. Nor does the Sanudo *portolano* add any names for this section; see Kretschmer, *Die italienischen Portolane*, 237–46 (note 48), for a transcription.

384. Francesco Beccari, "Address to the Reader." This and the following two quotations are taken with kind permission from the translation given in H. P. Kraus, Booksellers, *Twenty-five Manuscripts*, catalog 95 (New York: H. P. Kraus, [1961]), 63–64.

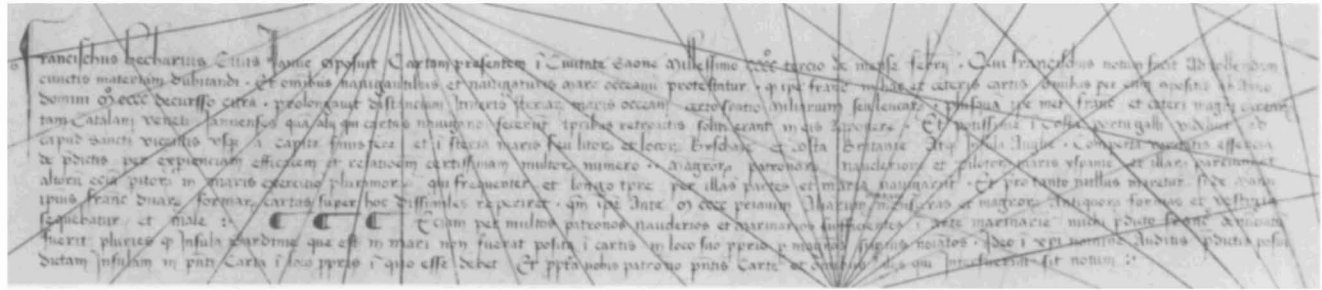


FIG. 19.17. THE ADDRESS TO THE READER ON THE 1403 BECCARI CHART. Francesco Beccari puts forward, among other things, his reasons for lengthening the Atlantic distances and for adjusting the position of Sardinia. In both cases, as he explains, modifications were made after complaints and advice were received from the seafarers themselves.

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sure report of many, i.e. masters, ship-owners, skippers and pilots of the seas of Spain and those parts and also of many of those who are experienced in sea duty, who frequently and over a long period of time sailed those regions and seas.”³⁸⁵ There was another point on which “the forms and traces of old masters” had led him astray. He continues, “It was several times reported to me . . . by many owners, skippers and sailors proficient in the navigational art, that the island of Sardinia which is in the Sea, was not placed on the charts in its proper place by the above mentioned masters. Therefore, in Christ’s name, having listened to the aforesaid persons, I placed the said island in the present chart in its proper place where it ought to be.”³⁸⁶

From this invaluable statement we learn of frequent contact between the chartmaker Beccari and assorted masters, shipowners, skippers, pilots, and sailors to whose criticisms he had responded. His meaning is unequivocal: improvements were the result of comments from those who had used the charts at sea and found them wanting. This passage is as crucial as it is unique, for it explains both the charts’ practical use and the mechanism by which their content was changed.³⁸⁷ Beccari refers specifically to two cartographic features, the understated Atlantic distances and the location of Sardinia. Both of these were sufficiently major to be worth mentioning. He is mute about lesser changes, such as those affecting place-names. But this is hardly surprising; as we have shown, the toponymy was under almost continuous review. It is safe to assume, though, that Beccari and his fellow chartmakers derived this type of information in the same way and from the same seafaring sources.³⁸⁸ Indeed, there is no plausible alternative, since it is anachronistic fancy to suppose that any medieval expedition would have been sent out to verify hydrographic or toponymic details about the Mediterranean. If chartmakers acquired the new names by word

of mouth from returning sailors, it might be expected that the toponymic input would reflect the prevailing patterns of trade. The way a number of the additional names occur next to important commercial centers—for example, Seville, Valencia, Genoa, Rome, Sibenik, Sevastopol, Izmir, Alexandria, and Algiers—supports that view.

THE BUSINESS OF CHARTMAKING SCRIBAL TRADITIONS

By the fourteenth century, the monastic scriptoria had lost their monopoly to workshops run on strictly business lines. The Venetian artists’ guild that had been set up by 1271 was essentially an organization of independent masters with their attendant journeymen and apprentices.³⁸⁹ Yet if there are no documented links between the production of the earliest charts and the monastic scriptoria, there are signs that some of the chartmaking conventions represented old habits put to a new use. Considering that the earliest practitioners must presumably have been trained as scribes, this is hardly surprising. The use of red, for example, to emphasize important words, or “red-letter days,” was an

385. Beccari, “Address to the Reader,” 63–64 (note 384).

386. Beccari, “Address to the Reader,” 64 (note 384). Wagner, “Italian Nautical Charts,” 479 (note 313), observed, before the discovery of the Beccari chart, that Sardinia was placed too close to Africa on the early charts.

387. Kelley, “Non-Mediterranean Influences,” 18 (note 290), approaching from the cartometric angle, arrived at a very similar interpretation of the mechanism of change on the portolan charts.

388. Though piracy could well have played an important part in distributing information; see below, pp. 439–40 and note 485 for the *San Nicola* incident.

389. Elena Favaro, *L’arte dei pittori in Venezia e i suoi statuti*, Università di Padova, Pubblicazione della Facoltà di Lettere e Filosofia, vol. 55 (Florence: Leo S. Olschki, 1975), 25.

established medieval tradition, perpetuated by the chartmakers in their special treatment of the more significant place-names. Then again, many liturgical works, and almost all books of hours, included a calendar for use in calculating the paschal moon. Just as the prediction of future full moons was essential for fixing the date of Easter, and hence the greater part of the church's year, so the same lunar information was vital to the mariner. Forearmed with knowledge of the moon's age, he could calculate the time of high water, essential for safe piloting outside the Mediterranean.³⁹⁰ Thus portolan atlases, from the earliest survivor of 1313 onward, often start with a lunar calendar (see also appendix 19.1).

As Kelley observed, the oldest charts contain more name contractions than the later ones (though the fifteenth-century author of the Combitis and Pinelli-Walckenaer atlases was an exception to that rule), and he convincingly interprets this as "a carryover from the highly abbreviated shorthand of Latin texts."³⁹¹ This is additional evidence of a continuing tradition rather than a fresh start. The mixing of colored inks and their application to prepared sheets of vellum, the careful copying of words in a neat and uniform hand—these were the skills already required of those who produced books. No doubt the chart imposed some special demands: the precise and repeated reproduction of coastal outlines, sometimes at altered scales, for example. But as far as the tools of the trade and their application were concerned, the portolan chart draftsmen obviously belonged to an existing tradition. Nor should we assume that chartmaking became totally separate from other related activity. Cresques Abraham was described as being both a "master of maps of the world" and a compass maker, just as Mecia de Viladestes was classified as a compass maker in 1401, twelve years before the date of his earliest known chart.³⁹² We may reasonably anticipate, therefore, the future discovery of other noncartographic documents by chartmakers, like Arnaldo Domenech's table of weights and measures.³⁹³

WORKSHOPS OR SINGLE INDIVIDUALS?

"Little or nothing," as Eva G. R. Taylor admitted, "can be said about the way a professional chartmaker organized his business and ordered his workroom."³⁹⁴ Yet it is commonly assumed that portolan charts were constructed in workshops, even though no documentary evidence has been adduced in support.³⁹⁵ Nor has any detailed paleographic examination been made of specific charts or atlases to test if more than one hand was involved. Moreover, the involvement of a workshop rather than a solitary chartmaker removes one of the main justifications for any attribution—namely the unique handwriting of a specific individual.³⁹⁶ Whether single

or multiple hands are involved and whether one chartmaker's signed work has consistent and distinctive characteristics are points that could be resolved. No doubt they will be one day. At this stage we would merely caution against the automatic assumption that no chartmaker ever worked alone.

Occasional instances exist where some form of collaboration is openly acknowledged. This is made explicit on a pair of charts where the author's legends bracket the names of two chartmakers: first, that produced by the Pizigani brothers in 1367, and second, Bertran and Ripoll's chart of 1456. In neither case is the nature of the cooperation specified. Indeed, both author's legends are strange in that the singular form *composuit* is employed. To deepen the confusion, the variant readings proposed for the wording on the 1367 chart leave unresolved the name of Francesco Pizigano's collaborator and even whether there might have been more than two brothers involved.³⁹⁷

Although an illuminated manuscript might be produced by a single individual, the labor would often be divided between a scribe, a rubricator, and one or more painters. It is therefore likely that the corner miniatures in Vesconte's atlases, for example, were the work of another man. It is also possible that Francesco Pizigano's collaborator(s) was responsible for the artistic flourishes of the 1367 chart, since the 1373 atlas he signs alone is perfectly plain. A similar interpretation is proposed by

390. The Catalan atlas of 1375 contains the earliest surviving diagram showing, for various named harbors in Brittany and along the English Channel, the "establishment of the port": in other words, the bearing of the new moon at the time of high and low water on the day concerned. For explanation see Taylor, *Haven-Finding Art*, 137–38 (note 7), and Grosjean, *Catalan Atlas*, 38 (note 94).

391. Kelley, "Oldest Portolan Chart," 43 (note 58).

392. Grosjean, *Catalan Atlas*, 13 (note 94). As Grosjean points out, in this context "compass maker" implies not a precision-instrument maker but an artist who painted the decorative compass disk (pp. 13–14). On Viladestes see de La Roncière, *Afrique*, 1:126–27 (note 100). In sixteenth-century Portugal, it was common to combine the roles of chartmaker and manufacturer of nautical instruments; see Teixeira da Mota, "Influence," 228 (note 61). Another later example is provided by the sixteenth-century English compass maker and chartmaker Robert Norman; see Eva G. R. Taylor, *The Mathematical Practitioners of Tudor and Stuart England* (Cambridge: Cambridge University Press, 1954), 173–74.

393. Walter W. Ristow and R. A. Skelton, *Nautical Charts on Vellum in the Library of Congress* (Washington, D.C.: Library of Congress, 1977), 3–4.

394. Taylor, *Haven-Finding Art*, 113 (note 7).

395. For example, see Almagià, *Vaticana*, 1:43b (note 35); Cortesão, *History of Portuguese Cartography*, 2:216 (note 3).

396. Pietro Vesconte has been credited (without justification) with workshops in both Genoa and Venice. On Genoa, see Revelli, *Colombo*, 237 (note 22); on Venice, see Degenhart and Schmitt, "Sanudo und Veneto," 6, 67 (note 226).

397. Cortesão, *Nautical Chart of 1424*, 20 n. 1 (note 24).

Almagià to explain absent or incorrect initial letters for some of the inscriptions on the Vatican's unsigned chart, Borgiano V.³⁹⁸ It is unfortunate that the only clear account so far unearthed of how functions were divided in practice should describe an exceptional group of world maps rather than a typical portolan chart. Nevertheless, it allows too many insights into contemporary working methods to be ignored.

From surviving legal documents we know that in 1399 a Florentine merchant, Baldassare degli Ubriachi, commissioned from Jefuda Cresques and Francesco Beccari, both then in Barcelona, four large and elaborate world maps for presentation to various European monarchs. Jefuda Cresques was the son of Cresques Abraham, the supposed author of the Catalan atlas. These 1399 world maps would probably have been similar to that work, although considerably larger, and like the Catalan atlas would have been built up around a portolan chart core. The documents, which were interpreted by R. A. Skelton,³⁹⁹ clearly differentiated the contributions to be made by the two men. The Majorcan Jew Jefuda Cresques (here given his postconversion name, Jacme Ribes) was dubbed *maestro di charta da navichare* and was to draw the basic maps; the *dipintore* Beccari would then embellish them. Since Ubriachi's agent was required to collect the unfinished maps from Cresques and deliver them to Beccari, it is clear that the two men worked independently. Another passage anticipated that Beccari might require an assistant artist, the decision being left up to him. This incident provides, as Skelton pointed out, "a record of a Genoese mapmaker established, if temporarily, in Catalonia and collaborating with a Mallorcan, thus exemplifying the cultural continuum of the Western Mediterranean area."⁴⁰⁰

It is when we pass from these well-attested cases of temporary cooperation between mature chartmakers to consider the possibility of permanent workshops that we move off firm ground. A workshop implies both a unit containing several individuals and a system of apprenticeship to convey skills from one generation to another. To assess the likelihood that chartmaking was carried out in ateliers we are forced into an oblique approach, because no early chartmaker has left any account of how he operated.

The thirteenth-century Venetian artists' guild, already referred to, embraced a wide range of craftsmen. Its statutes relating to apprenticeship and the ordering of workshops offer a relevant analogy.⁴⁰¹ Indeed, Pietro Vesconte and the other early chartmakers active in Venice might well have been members of the organization, since, from the beginning of the fourteenth century, all who practiced as artists were obliged to belong to it.⁴⁰²

The guild's statutes, the oldest of their kind in Italy,⁴⁰³ indicate that the small workshop was the normal unit

of production. The owner was officially limited to two qualified assistants and a single apprentice, though he could apply for a special license to exceed those numbers.⁴⁰⁴ If that is the background against which we should set Vesconte, an example from fifteenth-century Genoa indicates an even smaller scale of operations. Although his name is not found on any surviving chart, Agostino Noli is known to us from a petition he addressed to the doge and Council of Elders in 1438, in which he claimed to have been the only chartmaker then active in Genoa.⁴⁰⁵ His plea for remission of taxes was granted, with the proviso that he instruct his brother in the mysteries of chartmaking. The Genoese authorities would hardly have made that stipulation if Noli had belonged to a workshop or if he had already taken on an apprentice. A mere fifteen years later we encounter a second, similar instance. The Genoese priest Bartolomeo de Pareto, in a document dated 1453, was described as the city's most experienced chartmaker.⁴⁰⁶ A single chart in his hand, dated 1455, has come down to us. Nevertheless, his documented ecclesiastical appointments, which included a spell as a papal acolyte in Rome, are hard to reconcile with the idea of a permanent cartographic workshop.⁴⁰⁷

398. Almagià, *Vaticana*, 1:32–33 (note 35).

399. Skelton, "Contract" (note 206). The forms Cresques Abraham and Jefuda Cresques are used because Jews during this period used patronymics rather than surnames.

400. Skelton, "Contract," 109 (note 206).

401. The statutes are discussed in Favaro, *Arte dei pittori in Venezia* (note 389).

402. Favaro, *Arte dei pittori in Venezia*, 26 (note 389). Unfortunately, records relating to practitioners survive only for the period after 1530.

403. Favaro, *Arte dei pittori in Venezia*, 15, 27 (note 389).

404. Favaro, *Arte dei pittori in Venezia*, 26 (note 389).

405. Marcello Staglieno, "Sopra Agostino Noli e Visconte Maggiolo cartografi," *Giornale Ligustico* 2 (1875): 71–79; and more accessibly, Revelli, *Colombo*, 460–61 (note 22). Revelli, *Mostra Colombiana*, 39 (note 315), proposed, without supporting evidence, that Noli might have drawn the Genoese world map (Florence, Biblioteca Nazionale, Port. 1).

406. "Pro Bartolomeo Pareto," *Atti della Società Ligure di Storia Patria* 4 (1866): 494–96, esp. 495. The relevant sentence reads: "Hac itaque animadversione commoti erga egregium presbiterum Bartolomeum de pareto peritum in arte ipsa conficiendarum cartarum navigabilium et quod alius nullus sit in hac urbe huius ministerii edoctus quodque predictum hoc eius ingenium ars et ministerium non modo utile verum etiam necessarium sit Januensibus navigantibus" (With this thought in mind they turned their attention to the distinguished priest Bartolomeo de Pareto, a man experienced in the art of constructing sailing charts, both because there was no one else in this city [Genoa] who was so skilled in this craft and because his specialized talents, already mentioned, were not only useful but of genuine necessity for Genoese sailors. Author's translation).

407. On his ecclesiastical appointments see Michele G. Canale, *Storia del commercio dei viaggi, delle scoperte e carte nautiche degli Italiani* (Genoa: Tipografia Sociale, 1866), 456–57.

APPRENTICESHIP

Writing about 1400, Cennino Cennini described the awesome variety of accomplishments expected of an artist.⁴⁰⁸ In his case these had taken twelve years to acquire.⁴⁰⁹ A chartmaker's initiation would presumably have been less rigorous, even when we remember that several of those working in the austere Italian manner also showed themselves capable of artistic flourishes in the Catalan style when the occasion demanded (unless the ornamentation was done by someone else). Yet there are indications that some form of apprenticeship for chartmakers might well have been involved.

What has been seen as direct evidence of this occurs in the author's legend of Roselli's chart of 1447 (preserved in Volterra). Roselli declared that he had drawn this, "de arte Baptista Beccarii"—a reference to the Genoese chartmaker, whose charts of 1426 and 1435 survive. This vital phrase has been the subject of much argument: Winter, for example, interpreted it as an "expression of esteem," and Revelli as an acknowledgment to a teacher.⁴¹⁰ This dispute formed part of the broader controversy about nationality. Roselli was claimed for both Spain and Italy, although all his extant charts are thoroughly Catalan in style and are signed from Majorca.⁴¹¹ It is not known where Beccari practiced his trade, but his 1426 chart demonstrates his ability to work in the Catalan manner that Roselli would later repeat. What might be a third link in the same apprenticeship chain—if that is what it is—occurs in the inscription found on Arnaldo Domenech's chart of 148—(the final digit is unclear), where he signs himself "dizipolus petri Rossel."⁴¹²

Apprenticeship is sometimes indicated by the charts themselves. Occasional clumsiness—for example, several attempts at scraping the hidden circles on sheets of one of the British Library's Grazioso Benincasa atlases (Add. MS. 6390) or an abandoned circle on the 1424 chart—suggests the inexperienced hand of an apprentice. Kelley also noticed sloppy work, "almost as if the job was left to a junior member of the staff."⁴¹³ In general, however, the portolan charts display the competence of their creators. The insertion of hundreds of names in a neat and consistent hand was probably the most difficult part of the training. Although it was possible to remove a mistake by scraping the vellum surface, in practice this was rarely attempted.⁴¹⁴ Once a wrong name was started it would be crossed out, abandoned, or merged with the correct one. Lapses of concentration of this kind are found on most charts, even if infrequently. Since any blemishes would be permanent ones, accuracy must have been one of the most essential skills for a novice draftsman.

Hard evidence from the fourteenth and fifteenth centuries is so sparse on the topic of apprenticeship that it

is justifiable to invoke briefly the analogy of the well-documented seventeenth-century Drapers' (or Thames) School in London.⁴¹⁵ To produce by hand charts that in complexity fall roughly midway between the Italian and Catalan-style productions of the earlier period, English apprentices had to serve a minimum of seven years. While this example reveals how apprenticeship within a single organization could create a "school" of chartmakers, it would be unwise to assume that a similar mechanism operated in Italy before 1500.

In the first place, the shared style of the English chartmakers had led them to be designated a "school" before their interrelationship via the Drapers' Company of the City of London was discovered.⁴¹⁶ There are occasional signs of a common style in fourteenth- and fifteenth-century Mediterranean work. The treatment of inland lakes is strikingly similar on the 1408 Pasqualini atlas and the productions of Girolodi some decades later, just as a third Venetian, Francesco de Cesanis, signs his chart of 1421 across the neck in exactly the manner adopted by Girolodi in the following year. If this points to the existence of a Venetian school, similar shared features of style hint at what may well turn out to be a comparable organization in Majorca (or more strictly Palma).

408. Cennino d'Andrea Cennini da Colle di Val d'Elsa, *Il libro dell'arte: The Craftsman's Handbook*, trans. Daniel V. Thompson, Jr. (New Haven: Yale University Press, 1933).

409. Cennini, *Libro dell'arte*, 2 (note 408).

410. Winter, "Roselli," 4 (note 224); Revelli, *Colombo*, 312 (note 22).

411. And a recently discovered chart of 1447 has the author's legend in Catalan; see Kenneth Nebenzahl, *Rare Americana*, catalog 20 (Chicago: Kenneth Nebenzahl, 1968), no. 164.

412. The unsubstantiated claim that Berenguer Ripoll, who jointly signs with Jaime Bertran the chart of 1456, might have been the latter's apprentice was made by Rey Pastor and García Camarero, *Cartografía mallorquina*, 82 (note 28).

413. Kelley, "Oldest Portolan Chart," 38 (note 58).

414. The Dijon chart is the only instance so far noted in which names have been scraped off and rewritten; see Raynaud-Nguyen, "Hydrographie" (note 37).

415. Tony Campbell, "The Drapers' Company and Its School of Seventeenth Century Chart-Makers," in *My Head Is a Map: Essays and Memoirs in Honour of R. V. Tooley*, ed. Helen Wallis and Sarah Tyacke (London: Francis Edwards and Carta Press, 1973), 81–106; Smith, "Thames School," 45–100 (note 185). While this essay was in press, an apprenticeship document was published; see Giovanna Petti Balbi, "Nel mondo dei cartografi: Battista Beccari maestro a Genova nel 1427," in Università di Genova, Facoltà di Lettere, *Columbeis I* (Genoa: Istituto di Filologia Classica e Medievale, 1986), 125–32. In the agreement, dated 17 August 1427, the nine-year-old boy Raffaellino Sarzana, son of a sailor ("navigator"), was apprenticed for eight years to Batista Beccari to learn the art of making charts ("artem faciendi cartas et signa pro navigando"). I owe this note to Corradino Astengo.

416. Ernesto García Camarero, "La escuela cartográfica inglesa 'At the Signe of the Platt,'" *Boletín de la Real Sociedad Geográfica* 95 (1959): 65–68.

There are certainly affinities between the two signed Soler charts, the Catalan atlas, and other Catalan work of that general period. De La Roncière pointed out that these practitioners were mostly Jews, who had a virtual monopoly of chartmaking in Majorca.⁴¹⁷ What he termed “L’école cartographique des Juifs de Majorque” included Cresques Abraham and his son Jefuda Cresques as well as Jaime Bertran and the converts Mecia de Viladestes and Gabriel de Valseca. Reparaz hinted also at a possible Jewish origin for Petrus Roselli.⁴¹⁸ He interpreted the reference in 1387 to “the” Christian master as an indication that there was only one non-Jewish cartographer working in Majorca at the time, perhaps Guilermo Soler. In the choice of “Jerusalem” rather than “Santo Sepulcro” as the label for the Holy City vignette—for example, in the Catalan atlas—de La Roncière detected the hidden signature of a Jewish cartographer.⁴¹⁹

The signed Italian output from this period, on the other hand, is more notable for its stylistic dissimilarity. A further problem is raised by the peripatetic career of Grazioso Benincasa. The author’s legends of his surviving productions, which range from 1461 to 1482, chronicle his movements: Genoa (1461),⁴²⁰ Venice (1463–66), Rome (1467), Venice again (1468–69), Ancona (his hometown, 1470), Venice once more (1471–74), and Ancona again (1480–82).⁴²¹ How could even one apprentice have followed in this hectic wake?

Whatever doubts there might be about apprenticeship, it is fair to assume that chartmaking skills were often passed on within a family.⁴²² This might have been the case with all those who shared a surname; it must certainly have applied to Pietro and Perrino Vesconte (unless only one individual was involved), to Grazioso Benincasa and his son Andrea, and to Cresques Abraham and his son Jefuda. This pattern would be continued in the sixteenth century by the Caloiro y Oliva, Freducci, Maggiolo, Oliva, Olives, and Prunes families. Conte Hectomano Freducci imitated the Benincasa style so closely (he was, like them, from Ancona) that it is highly probable he learned his skills from one or other of the Benincasas, presumably transmitting them in turn to his own son Angelo.

THE PRACTITIONERS

At present there are some forty-six men known to us by name as active chartmakers during the fourteenth and fifteenth centuries.⁴²³ These are listed, with their productions, in appendix 19.2. Unfortunately, no details are available about most of these individuals beyond what can be gleaned from the author’s legends of their charts. Five of them would have been entirely forgotten

were it not for acknowledged copies of their work in the Cornaro atlas (British Library, Egerton MS. 73): Alvixe Cesanis, Zuane di Napoli, Cristoforo and Zuane Soligo, and Domenico de Zuane. Agostino Noli is another for whom we have faint echoes but no substantial legacy, while Nicolo de Pasqualini described himself as the “son of Nicolo”—presumably a reference to a chart-making father.⁴²⁴ That the names of fifteen others have come down to us only through mention on a unique portolan atlas or chart demonstrates the narrow line dividing recognition from oblivion. And then, of course, there are all those who decided to remain anonymous or whose handiwork has failed to survive (at least as far as the author’s legend is concerned).

The fragmentary nature of the biographical information so far available about the known chartmakers makes a composite social picture all the more difficult to sketch in. Not surprisingly, some of their number were, or had been, sailors. For example, Andrea Bianco specifically described himself on his chart of 1448 as *comito di galia* (a senior officer on a galley), and official documents survive that link him with almost annual galley sailings throughout the period 1437–51.⁴²⁵

417. De La Roncière, *Afrique*, 1:121–41, esp. 126–28 (note 100).

418. Reparaz, “Essai,” 322 (note 175).

419. De La Roncière, “Une nouvelle carte,” 117 (note 48). See also Oton Haim Oren, “Jews in Cartography and Navigation (from the XIth to the Beginning of the XVth Century),” *Communication du Premier Congrès International d’Histoire de l’Océanographie* 1 (1966): 189–97; reprinted in *Bulletin de l’Institut Océanographique* 1, special no. 2 (1968): 189–97.

420. According to a legal document of 1460, he was already then domiciled in Genoa; see Marina Emiliani (later Marina Salinari), “Le carte nautiche dei Benincasa, cartografi anconetani,” *Bollettino della Reale Società Geografica Italiana* 73 (1936): 485–510, esp. 486.

421. The other recorded instances of early chartmakers on the move are these: the Genoese Vescontes worked in Venice; the Genoese Francesco Beccari was in Barcelona in 1399–1400; and the Majorcan Domenech was in Naples at some point in the 1480s (the last digit of his chart’s date is illegible). Carignano and Mecia de Viladestes made journeys to Sicily—the former in 1316 (Ferretto, “Carignano,” 44 [note 76]), the latter in 1401 (Reparaz, “Essai,” 325 [note 175]). Others were sailors at some stage in their careers.

422. This natural tendency was actively encouraged in the Venetian statutes: a master who took on a relative was exempt from the usual dues, whereas a son setting up on his own had to pay a fine; see Favaro, *Arte dei pittori in Venezia*, 25 (note 389).

423. This figure includes Giovanni da Carignano, whose known production is more properly a land map than a chart. It also makes the assumption that Dalorto and Dulcert were a single individual and that there were two Vescontes.

424. Almagià, “Stati Uniti,” 360 (note 340), surmised that Nicolo de Pasqualini might be the same as Nicolo de Nicolo, though the dates of their respective charts (1408 and 1470) make this highly improbable.

425. Cornelio Desimoni, “Le carte nautiche italiane del Medio Evo—a proposito di un libro del Prof. Fischer,” *Atti della Società Ligurica di Storia Patria* 19 (1888–89): 225–66, esp. 260, interpreted

Bianco signed his 1448 chart from London. That was the only year in the period 1445–51 for which his destination is not independently documented. No doubt, as in 1446, 1449, and 1450, he was an officer on one of the Flanders galleys. Three ships were certainly fitted out by the Venetian Senate in February 1448, two of them intending to call at London. Presumably Bianco drew the chart ashore during the three and a half months allotted for cargo loading and customs clearance.⁴²⁶ Bianco is also recorded as having collaborated with Fra Mauro on his celebrated world map, as payments made to him between 1448 and 1459 testify.⁴²⁷ Although his will survives—one was made on 15 September 1435, the year before the earlier of his two surviving works—it is, unfortunately, silent about his professional activities.⁴²⁸

Another chartmaker, Grazioso Benincasa, though giving no hint of this in the signatures on his charts, had been a shipowner or captain (*padrone*) in the period leading up to the first of his many surviving charts and atlases, dated 1461. It was the loss of his ship to a Genoese corsair (as revealed in legal documents of 1460–61) that apparently ended his career afloat.⁴²⁹ That Benincasa could call on at least a quarter of a century's experience of practical sailing is clear from a collection of notes in his hand that survived (until World War II) in his native Ancona. Dated from 1435 to 1445, these comprised sailing directions for the Adriatic, Aegean, and Black seas, "ascertained and seen with my own eyes."⁴³⁰ Grazioso Benincasa's eldest son Andrea seems to have followed closely in his father's footsteps, being active both as a chartmaker and as a galley commander.⁴³¹ A fourth chartmaker with practical seafaring experience may possibly be added to this brief list. Cortesão has suggested a tentative identification between Jorge de Aguiar (the author of a 1492 chart that is the first extant to be signed and dated by a Portuguese) and a nobleman navigator of that name who disappeared in 1508 on a voyage to India.⁴³²

The author's legend to a little-discussed fifteenth-century chart informs us that its compiler, Antonio Pelechán, was also connected with the sea, though in a land-based administrative post. Pelechán described himself as

comito as second-in-command; Revelli, *Mostra Colombiana*, 174 (note 315), described Bianco as a galley commander, adding the unsupported statement that he had sailed along the west coast of Africa. Pompeo Gherardo Molmenti, *Venice: Its Individual Growth from the Earliest Beginnings to the Fall of the Republic*, 6 vols. in 3 pts., trans. Horatio F. Brown (London: J. Murray, 1906–8), pt. 1, *The Middle Ages*, 134, noted that galley commanders were known as *comiti* from the thirteenth century, their title changing to *sopra-comiti* during the fifteenth. The regulations drawn up in 1428 by Andrea Mocenigo and copied out in the Cornaro atlas of ca. 1489 are addressed to the *patronj e sora chomiti de galie*. See British Museum, *Catalogue of the Man-*

uscript Maps, 1:20 (note 40). If this leaves Bianco's status in some doubt (see also note 433), another source indicates that he had indeed risen to the rank of commander, at least by 1460. Freddy Thiriet, ed., *Délibérations des assemblées vénitienes concernant la Romanie*, 2 vols. (Paris: Mouton, 1966–71), 2:221, records that in June of that year Bianco was one of nine candidates for the post of admiral of the Cyprus galleys. Though he was not successful, his qualities were recognized in his appointment as counselor to the new admiral. On Bianco's galley sailings see Biblioteca Nazionale Marciana and Archivio di Stato, *Mostra dei navigatori veneti del quattrocento e del cinquecento*, exhibition catalog (Venice, 1957), nos. 180–89.

426. See Rawdon Brown et al., eds., *Calendar of State Papers and Manuscripts, Relating to English Affairs, Existing in the Archives and Collections of Venice, and in Other Libraries of Northern Italy*, 38 vols., Great Britain Public Record Office (London: Her Majesty's Stationery Office, 1864–1947), 1:67–71.

427. See Tullia Gasparrini Leporace, *Il Mappamondo di Fra Mauro* (Rome: Istituto Poligrafico dello Stato, 1956), 5 ("Presentazione" by Robert Almagià) and 11.

428. Venice, Archivio di Stato, *Notarile Testamenti*, folder 1000, testament 303. I owe this reference to David Woodward. I am grateful to the director of the Archivio di Stato, Maria Francesca Tiepolo, for transcribing the difficult Venetian hand involved, and to Timothy Burnett, Department of Manuscripts, British Library, for helping with the translation.

429. Emiliani, "Carte nautiche," 486 (note 420). Revelli, *Mostra Colombiana*, 92 (note 315), pointed out that Benincasa's earliest dated chart was issued from Genoa because the unfinished litigation forced him to remain in that city.

430. "Tochate chon mano, et vegiute cholli occhi." See Ernesto Spadolini, "Il portolano di Grazioso Benincasa," *Bibliofilia* 9 (1907–8): 58–62, 103–9, 205–34, 294–99, 420–34, 460–63, esp. 104; reprinted in *Acta Cartographica* 11 (1971): 384–450. Spadolini also disposes of the often repeated fiction that the Benincasa portolano contained charts (p. 61).

431. Spadolini, "Benincasa," 60 (note 430), cites an unverifiable source for the assertion that Andrea Benincasa was given command by the Venetian authorities of "una galera per andare in corso." Revelli, *Mostra Colombiana*, 70 (note 315), adds the unsupported statement that this occurred during the war between Venice and Turkey (presumably the first war of 1463–79 or the second of 1499–1503).

432. Cortesão, *History of Portuguese Cartography*, 2:212 (note 3). An even more tentative identification is that suggested by an unsigned entry in the *Diccionari biogràfic*, 4 vols. (Barcelona: Alberti, 1966–70), vol. 1, s.v. "Jaume Bertran." This Bertran was a mariner who captured a pirate off Majorca in 1453. Another scholar records a Jacme Bertran as *patron* of the Majorca galley, both in that same year and in 1455; see Carrère, *Barcelone*, 2:638, 926 n. 1 (note 285). About the middle of the fifteenth century, Jacme, who belonged to a family of converted Jews settled in Majorca and Valencia, went to live in Genoa (Carrère, *Barcelone*, 2:584). In 1456, "Jachobus" Bertran signed the first of his three known charts. Although the surname was a fairly common one at the time, the possibility that the chartmaker was a seaman finds an echo in the suggestion by Rodolico that the prefix "Mestra" on his 1489 chart might denote (as with Juan de la Cosa in 1500) the status of a pilot. See Niccolò Rodolico, "Di una carta nautica di Giacomo Bertran, maiorchino," *Atti del III Congresso Geografico Italiano*, Florence, 1898, 2 vols. (1899) 2:544–50, esp. 545. A similar suggestion is made in an unsigned entry in *Enciclopedia universal ilustrada Europeo-Americana*, 70 vols. and annual supplements (Madrid and Barcelona: Espasa-Calpe, 1907–83), 68:1187, that the Matias Viladestes who commanded a galley belonging to Francés Burgés in 1415 should probably be identified with the Mecia de Viladestes who signed the 1413 chart. In the same work (66:838–39) Gabriel Valseca is also termed a *navegante*.

armirai de Rutemo.⁴³³ At that time, 1459, Retimo (Rethymnon) in Crete formed part of the Venetian dominions, and its *armirai* was entrusted with the practical administration of the port. This office would have demanded experience in both seamanship and navigation. An unadorned chart of the Adriatic is all that survives in his hand. A close parallel exists between Pelechan's position and that occupied in 1496 by Andrea Benincasa. As *capitano del porto* of Ancona, he was responsible for the harbor's fortifications.⁴³⁴ Taken in conjunction with other official posts he is known to have held, Andrea's atlas of 1476 and charts of 1490 and 1508 must represent the fruits of a less than full-time occupation.⁴³⁵

Pelechan and Andrea Benincasa were not the only chartmakers to enjoy privileged status. Vesconte was consulted by the Venetian authorities when the first Flanders fleet was being organized in the early fourteenth century.⁴³⁶ Cresques Abraham, the supposed author of the Catalan atlas, was accorded special rights by King Pedro of Aragon—a reflection of his ability, since like other Jews he had suffered initially from discrimination.⁴³⁷ A more remarkable example comes just after our period when the Genoese authorities used a hundred-lire annuity to lure Vesconte Maggiolo back from Naples in 1519.⁴³⁸

These instances are of rewards for skill; they tell us little about the social origins of the individuals concerned. Grazioso Benincasa, on the other hand, is known to have been of noble birth, and Pietro Vesconte evidently belonged to one of Genoa's ruling families.⁴³⁹ It is possibly no coincidence, therefore, that the only recorded portraits of early chartmakers should have concerned these two. One of the cornerpieces on the Black Sea sheet of Pietro Vesconte's 1318 (Venice) atlas features a man seated at an angled table and working on a chart (plate 31).⁴⁴⁰ It is only natural to speculate that Vesconte himself was probably the subject. The second instance, consisting of paired portraits of Grazioso and Andrea Benincasa, was set into a world map. Mentioned in 1536, this has unfortunately failed to survive.⁴⁴¹

It would be quite wrong to suppose from this brief catalog that we could sketch in a similar profile of high birth and exalted social status for all the other named and nameless chartmakers of the period. It is precisely patricians like Benincasa whom history remembers; his humbler colleagues have no memorial but their charts.⁴⁴² A fairer picture of a chartmaker's true social position is probably the one that emerges from Agostino Noli's petition of 1438. Describing himself as "very poor," Noli managed to persuade the Genoese authorities to grant him ten years' tax exemption—among other reasons because they accepted that his work, though time-consuming, was not very lucrative.

433. Venice, Archivio di Stato. Uzielli and Amat di San Filippo, *Mappamondi*, 75 (note 35), misread the author's name as Antonio Pelegan e Miraro of Resina. The correct transcription of the author's legend—for which the assistance of Maria Francesca Tiepolo is gratefully acknowledged—would be: "antonio pelechan armirai / de rutemo o fato questo chol/fo 1459 adi 4 luito." A similar instance is provided by the sixteenth-century chartmaker Antonio Millo, who signed his "Arte del navegar" as "Armiraglio del Zante"; see Uzielli and Amat di San Filippo, *Mappamondi*, 216 (note 35). For an interpretation of *armirai* as a chief navigating officer on a ship or for a fleet, in which sense the term was applied to Andrea Bianco, see Frederic C. Lane, *Venice: A Maritime Republic* (Baltimore: Johns Hopkins University Press, 1973), 169, 277, 343–44.

434. Emiliani, "Carte nautiche," 488 (note 420).

435. As must the work of other "amateurs," like the priest Pareto and the Tripoli physician Ibrāhīm al-Mursī—on the latter see Ettore Rossi, "Una carta nautica araba inedita di Ibrāhīm al-Mursī datata 865 Egira = 1461 Dopo Christo," in *Compte rendu du Congrès Internationale de Géographie* 5 (1926): 90–95 (11th International Congress, Cairo, 1925).

436. It is not clear whether this refers to Pietro or Perrino Vesconte; see de La Roncière, *Afrique*, 1:43 (note 100), and Crone, *Maps and Their Makers*, 17 (note 11).

437. Grosjean, *Catalan Atlas*, 13 (note 94).

438. Revelli, *Colombo*, 472–78 (note 22). This sum was still being paid to Vesconte's successors in 1650.

439. On Benincasa see Emiliani, "Carte nautiche," 485 (note 420); on Vesconte see Revelli, *Colombo*, 237, 418 (note 22). Matković, "Wien," 7 (note 294), described his family as holding important posts in Venice during the period 1270 to 1339. Recently a document was published purporting to show that Vesconte was a surgeon; see Piersantelli, "Atlante Luxoro," 135–38 (note 364). Given the proficiency of Vesconte's charts, it is surprising to learn from a Venetian legal dispute of 1326 or 1327 that one "Petrus Visconte" from Genoa was well thought of as a surgeon. He was able to command a large fee when called out to a Treviso lawyer, Pietro Flor, who was thought to be on the verge of death from acute dropsy. However, the document, whose Latin text is transcribed in full by Piersantelli, does not provide a totally convincing identification between the surgeon and the chartmaker. In the first place, Pietro and Perrino Vesconte signed between them eight surviving works, stating their last name as Vesconte or Vessconte, never Visconte. Nor is any reference made in the document to chartmaking, unless the name of one of those who testified on his behalf, Rigo da le Carte, is construed in that light. The last mention of Pietro Vesconte, according to another document cited by Piersantelli, was in Genoa in 1347 (pp. 137–38).

440. Pagani, *Vesconte*, 20 (note 47), and Mollat du Jourdin and de La Roncière, *Sea Charts*, 14 (note 40).

441. Emiliani, "Carte nautiche," 489 (note 420). A slightly later example of what has been tentatively identified as a self-portrait set into a sea atlas is that of Jean Rotz; see Helen Wallis, ed., *The Maps and Text of the Boke of Idrography Presented by Jean Rotz to Henry VIII, Now in the British Library* (Oxford: Viscount Eccles for the Roxburghe Club, 1981), 38; idem, "The Rotz Atlas: A Royal Presentation," *Map Collector* 20 (1982): 40–42, esp. 42.

442. Though Desimoni, "Elenco," 48 (note 62), refers to the Beccari family sepulcher in Genoa. Exceptions are also provided by the Genoese priests Giovanni da Carignano and Bartolomeo de Pareto. Carignano featured in contemporary records a dozen times between 1291 and 1329; see Ferretto, "Carignano," 36–45 (note 76). For documents concerning Pareto, see Canale, *Storia del commercio*, 88, 457 (note 407). The only chartmakers featured so far in the *Dizionario biografico degli Italiani* (Rome: Istituto della Enciclopedia Italiana), whose publication started in 1960, are Batista Beccari, the two Benincasas, and

THE CHART TRADE

Our general ignorance about the individual chartmakers is matched by the very limited information available about their customers. That many charts must have been drawn for navigational use, and hence acquired by sailors, is discussed in a later section. But specific documentary evidence tends to relate to the more flamboyant productions, especially world maps in the Catalan style. Those that were commissioned from Jefuda Cresques and Francesco Beccari in 1399 for presentation to royalty have already been mentioned. The Catalan atlas of 1375 was probably made for the king of France; and other examples, since vanished, were ordered by members of the Aragonese royal family.⁴⁴³ Another possible royal commission has been identified among the less obviously regal productions. The prominent arms of Castile and Leon on the 1426 Batista Beccari chart led Winter to suppose that it might have been made for the “Spanish crown” (more correctly, the king of Castile).⁴⁴⁴ There is no doubt, however, that the unsigned Vatican atlas that Pietro Vesconte drew for Marino Sanudo was one of two presented to Pope John XXII in 1321.⁴⁴⁵ Pareto’s chart of 1455, although not now in the Vatican, was probably made for Pope Nicholas V, who died that same year.⁴⁴⁶ Both men were Genoese, and Pareto served as one of the papal acolytes. Another prince of the church, Cardinal Raffaello Riario, was the recipient of Benincasa’s unusually ornate chart of 1482.⁴⁴⁷

It is from the author’s legend itself that we learn the identity of the individual who commissioned one of Benincasa’s 1468 atlases (British Library, Add. MS. 6390), the Genoese doctor and diplomat Prospero da Camogli.⁴⁴⁸ It is possible that the author’s legend on the 1426 Batista Beccari chart would have resolved the doubts about its original owner, since the final words before it becomes completely illegible have been read as “mense novembris ad requisicionem et nomine.”⁴⁴⁹

Coats of arms on contemporary bindings are another pointer, if an oblique one, to the identity of the original recipient of the atlas concerned. The arms of the Venetian Cornaro family are featured on two anonymous atlases: on the outer covers of one in Lyons and on the bookplate of the Cornaro atlas in the British Library.⁴⁵⁰ Another undated atlas, recorded last century in Ventimiglia, bore the arms of the celebrated Usodimare family.⁴⁵¹ A similar personal mark, this time at the edge of the 1447 Valseca chart, was identified by Hamy as that of Francesco de Lauria.⁴⁵² A coat of arms (since overpainted) identifies Borso d’Este (d. 1471) as the recipient—probably in 1466—of a manuscript Ptolemy, whose final double folio contains a portolan chart that is considered to form an integral part of the work.⁴⁵³

It is also likely that some of the Italian families who

are recorded as the earliest known owners of charts and atlases now in public collections may have been those who actually commissioned the works in question.⁴⁵⁴ Unfortunately no proof of this, with the invaluable commercial documentation that might accompany it, has yet come to light. Among indications of a more general kind we can cite the instance of the Cortona chart, whose prominent naming of that town led Armignacco to suspect a Cortonese commission.⁴⁵⁵

Bianco (in notes by Angela Codazzi). The four-volume Catalan equivalent, *Diccionari biogràfic* (note 432), has brief unsigned notes on Dulcert and Macià Viladestes only. The *Enciclopedia italiana di scienze, lettere ed arti* (note 4) has separate headings for Grazioso Benincasa and Pietro Vesconte only (both by Roberto Almagià); the *Enciclopedia universal ilustrada* (note 432) has unsigned notes on Valseca and Matias Viladestes only.

443. Reparaz, “Essai,” 293–97 (note 175), citing, for the full transcriptions, Antoni Rubió y Lluch, *Documents per l’historia de la cultura catalana mig-èval* (Barcelona: Institut d’Estudis Catalans, 1908–21). See also Rey Pastor and García Camarero, *Cartografía mallorquina*, 66 (note 28).

444. Winter, “Roselli,” 2 (note 224). The Italian atlas in the Bibliothèque Nationale, Département des Manuscrits, MS. Lat. 4850, belonged to Louis XII (1499–1515); see Georges Deulin, *Répertoire des portulans et pièces assimilables conservés au Département des Manuscrits de la Bibliothèque Nationale* (typescript, Paris, 1936), 20.

445. Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 2972, see Almagià, *Vaticana*, 1:17a (note 35).

446. Uzielli and Amat di San Filippo, *Mappamondi*, 74 (note 35).

447. Riario is not specifically mentioned by name, but the family’s arms occur three times on the chart, surmounted by a cardinal’s hat; see Emiliani, “Carte nautiche,” 501 (note 420). Manuel Francisco de Barros e Sousa, Viscount of Santarém stated that the 1321 Perrino Vesconte atlas in Zurich was made for the doge of Venice; see his “Notice sur plusieurs monuments géographiques inédits du Moyen Age et du XVI^e siècle qui se trouvent dans quelques bibliothèques de l’Italie, accompagné de notes critiques,” *Bulletin de la Société de Géographie*, 3d ser., 7 (1847): 289–317, esp. 295 n. 1; reprinted in *Acta Cartographica* 14 (1972): 318–46. However, this stems from a misreading of the later note added beneath the author’s legend.

448. This is the only pre-1500 chart or atlas that actually spells out the name of the dedicatee, “Prospero Camulio Medico.” On Camogli see Revelli, *Colombo*, 354, 469 (note 22).

449. Desimoni, “Elenco,” 48 (note 62).

450. On the Lyons atlas see de La Roncière, *Lyons*, 15 (note 34); on the Cornaro atlas (Egerton MS. 73) see British Museum, *Catalogue of the Manuscript Maps*, 1:17 (note 40).

451. Uzielli and Amat di San Filippo, *Mappamondi*, 101 (note 35).

452. Foncin, Destombes, and de La Roncière, *Catalogue des cartes nautiques*, 23 (note 52).

453. Paris, Bibliothèque Nationale, Département des Manuscrits, MS. Lat. 4801. See Elisabeth Pellegrin, “Les manuscrits de Geoffroy Carles, président du Parlement de Dauphiné et du Sénat de Milan,” in *Studi di bibliografia e di storia in onore di Tammaro de Marinis*, 4 vols. (Verona: Stamperia Valdonega, 1964), 3:313–17. I am grateful to the conservateur en chef, Denise Bloch, for this reference and for other observations.

454. This suggestion has been made in connection with one of the 1447 Roselli charts, formerly owned by the Martelli family of Florence; see Nebenzahl, *Rare Americana*, no. 164 (note 411).

455. Armignacco, “Una carta nautica,” 192 (note 243).

How these early chartmakers operated—whether they always worked on commission or sometimes drew charts for stock—remains largely a matter of speculation.⁴⁵⁶ Under the terms of the 1399 agreement, Cresques and Beccari were contracted to work exclusively for Ubriachi, not leaving Barcelona until the task was completed.⁴⁵⁷ Besides fees, Beccari, at least, received living expenses. This type of all-embracing patronage, however, was probably atypical.

There seem to be a number of parallels between the production of charts and that of books of hours, “the late medieval bestseller.”⁴⁵⁸ Indeed, their histories are roughly contemporary, since the earliest surviving book of hours dates from the middle of the thirteenth century.⁴⁵⁹ Just as no two charts are alike, so books of hours tend to reflect, in the regional or even local variations of their text and decoration, the fact that most were tailor-made for particular clients.⁴⁶⁰ Since those who commissioned hours included shopkeepers and kings,⁴⁶¹ the quality ranges from the workaday to the sumptuous. With the charts, this breadth of choice might not have been available if a particular practitioner worked only in one style, whether plain or ornate. But it would be wrong to rule out the possibility that the degree of ornamentation, or total lack of it, sometimes reflected the size of the customer’s purse.

With books of hours as well as charts, the more extravagant productions, while representing the pinnacle of the pyramid, were valued as art objects from the outset and must reasonably be assumed to have come down to us in disproportionate numbers. The unpretentious hours for actual devotional use, the functional chart for navigational use—these have hardly survived at all, even though they represent the vast majority of those produced. A history of portolan charts ought to be largely concerned with these everyday charts, which were destined to be casually discarded once salt water and constant unrolling had obliterated their outlines. With survival, with glamour, and occasionally with documentation on their side, it is inevitable, though, that the deluxe productions should have received the lion’s share of comment.⁴⁶²

A contractual link between an artist and his patron was the standard procedure in medieval Italy. Unfortunately, verbal agreements were considered sufficient for all but major projects.⁴⁶³ Notarized contracts usually laid down fees and a completion date, but this potential source of valuable information was often sidestepped. It is probably for this reason that up to now only one contract involving chartmakers has come to light. Because of the unusually large scale of the world maps commissioned from Cresques and Beccari in 1399, the eleven months that the latter claimed to have expended on the two productions⁴⁶⁴ is of little use in computing

the time required to draw even the most elaborate portolan chart. More relevant would be the three weeks quoted by a mid-seventeenth-century English chartmaker.⁴⁶⁵

Despite the weeks or months that each chart would have entailed, a number of signed fourteenth- and fifteenth-century works are dated to a particular day.⁴⁶⁶ The topicality this can give is admirably illustrated by the chart drawn at Alexandria in 1497 by the Jewish chartmaker Jehuda ben Zara. Dated 8 February, its author’s legend refers to the deposition of the sultan of Cairo a few days before (fig. 19.18).⁴⁶⁷ This precision in dating could have proved embarrassing had the charts normally been made for stock and then failed to sell. It would have been a simple matter, however, to have left them unsigned until a purchaser was found.



FIG. 19.18. A TIMELY POSTSCRIPT ON A PORTOLAN CHART. Written by Jehuda ben Zara, this legend dated 8 February 1497 refers to the deposition of the sultan of Cairo a few days earlier. Such precision is, however, rare on surviving charts, which, if dated at all, usually refer only to the year. Photograph from the Biblioteca Apostolica Vaticana, Rome (Borgiano VII).

456. When the future Juan I of Aragon requested a world map from Majorca in 1379, he expressed a readiness either to buy an existing one or to commission a fresh example; see Rubió y Lluch, *Documents*, 2:202 (note 443).

457. Skelton, “Contract,” 108 (note 206).

458. L. M. J. Delaisse’s phrase, quoted in John Harthan, *Books of Hours and Their Owners* (London: Thames and Hudson, 1977), 9.

459. Harthan, *Books of Hours*, 13 (note 458).

460. Harthan, *Books of Hours*, 12 (note 458).

461. Harthan, *Books of Hours*, 31 (note 458).

462. And, one can add, of reproduction: most of the purely functional charts remain unpublished. Harthan makes a similar point about books of hours; see his *Books of Hours*, 31 (note 458).

463. Hannelore Glasser, *Artists’ Contracts of the Early Renaissance* (New York: Garland Publishers, 1977), 1.

464. Skelton, “Contract,” 108 (note 206).

465. Nicholas Comberford; see Smith, “Thames School,” 91–92 (note 185).

466. As is frequently found in contemporary manuscript books of the period; see Andrew G. Watson, *Catalogue of Dated and Datable Manuscripts c. 700–1600 in the Department of Manuscripts, the British Library* (London: British Library, 1979).

467. Almagià, *Vaticana*, 1:47 (note 35).

An invaluable glimpse of the chart trade in action is provided by a series of late fourteenth-century documents in Barcelona. Relating in each case to the merchant Domenech Pujol, they describe how, on several occasions in 1390 and 1392, he entrusted *cartes de navegar* in batches of four to the mariners Pere Folch or Pere Jalbert for them to sell in various parts of the Mediterranean.⁴⁶⁸ Alexandria, Genoa, Naples, Pisa, and Sicily were all mentioned. These documents are surprising in two ways. In the first place, Barcelona is not known to have been a chartmaking center of note in the fourteenth or fifteenth century, and the only reference to that city in an author's legend occurs over sixty years later on the Bertran and Ripoll chart of 1456. Second, these records, which are unique in demonstrating the activities of a medieval dealer in sea charts, suggest that the practice was widespread. It is improbable that Pujol drew the charts himself, and he seems to have handled them like any other merchandise. Jalbert, for example, was instructed to barter his consignment in Alexandria for pepper, and the recipient would presumably have sold the charts in his turn. Between chartmaker and chart user, therefore, there might have been three or more intermediaries.

The relevance and usefulness of portolan charts to all the mariners of the Mediterranean and Black seas presumably explains the risk Pujol took in shipping them without having definite orders in advance. Folch, for instance, in the final commission of 23 October 1392 was asked to sell his charts in either Sicily or Pisa. The Pujol documents also state the values of the consigned charts.⁴⁶⁹ The four groups of four charts ranged in price from 8 *libra*, 16 *sueldos* to 7 *libra*, 17 *sueldos*. Each single chart would thus have been valued at approximately 2 *libra*. This figure can be compared with the sums agreed upon by Francesco Beccari for work on the large world maps he prepared about ten years later (also in Barcelona) in collaboration with Jefuda Cresques. The smaller size (150 × 310 cm) commanded 60 Aragonese florins, the larger (368 cm square) 100 florins.

Data derived from the cathedral records of Burgos allow us to relate those three figures to contemporary wages and prices. A laborer, for example, would have had to work some 26 days to earn the price of one of the Pujol charts, about 480 days for the smaller of the Beccari-Cresques world maps, and 800 days for the larger. The world maps were respectively some seven and twenty-one times the size of an average chart (65 × 100 cm). Though no more than a single skin would presumably have been involved, the price of each Pujol chart was equivalent to about twenty large sheets of unused parchment. If this indicates that the cost of raw materials formed only a small part of the chart's selling price, Beccari's claim for expenses of roughly three times

the daily laboring wage confirms that chartmakers were reasonably well paid.⁴⁷⁰

That twenty-four charts should have been shipped out by one man in the space of two years from a city not otherwise known to have supported a single resident chartmaker⁴⁷¹ shows how unwise it would be to rely exclusively on the author's legends of surviving charts for information about the various centers of production. Nevertheless, this evidence is of value if approached with caution. Of sixty fourteenth- and fifteenth-century works whose place of construction is stated, roughly a third were made in Majorca and another third in Venice.⁴⁷² The strength and importance of Venice need no substantiating, but the leading role of Majorca might seem surprising. However, a modern map of the Mediterranean, compiled on the basis of the routes described in the mid-thirteenth-century *Lo compasso da navigare*, demonstrates the extent to which the Balearics functioned as a crossroads in terms of maritime communications.⁴⁷³ This would have made Palma the natural center for chartmaking activities in the Catalan-speaking world. Alexandria, Ancona, Genoa, and Rome are all mentioned more than once in the author's legends of known charts, but—like Barcelona—Lisbon, London, Naples, Rethymnon, Savona, and Tripoli are each named only on a single document.⁴⁷⁴ These figures are distorted because people like Roselli invariably included a full author's legend while others equally consistently

468. Carrère, *Barcelone*, 1:201 n. 4 (note 285). The earliest reference is to a group of eight charts, sent via an unnamed agent to Flanders. 469. See Carrère, *Barcelone*, 1:201 n. 4 (note 285).

470. On the Beccari-Cresques contract, see above p. 430. The information on currencies and values derives from the following, to which I was kindly directed by Angus MacKay; see his *Money, Prices and Politics in Fifteenth-Century Castile* (London: Royal Historical Society, 1981), 141, 144, 150; also Peter Spufford and Wendy Wilkinson, *Interim Listing of the Exchange Rates of Medieval Europe* (North Staffordshire: Department of History, University of Keele, 1977), 189. The figures were based on the following currency equivalents: for 1390, 1 florin = 0.55 *libra* = 23 *maravedies*; for 1400, 1 florin = 48 new *maravedies*.

471. Though it is not impossible that Pujol himself imported the charts into Barcelona from Majorca.

472. References to the author's birthplace (e.g., "de Janua") have sometimes been misinterpreted as the place of construction (e.g., "in Janua"). For the individual instances see appendixes 19.2 and 19.4. For Majorca: "Civitate maioricarum," that is, Palma, whenever the town was stated.

473. Quaini, "Catalogna e Liguria," 569; see also 560 (note 60).

474. In connection with Naples, mention should be made of Zuane di Napoli, one of those known only from the Cornaro atlas. Tripoli is cited in the author's legend of the 1461 al-Mursi chart, without specifying whether the Libyan or Lebanese town was involved. Rossi, "Carta nautica araba," 91 (note 435), detected a Maghreb hand and seems to have assumed that the chart was drawn in North Africa. It is significant that Francesco Beccari, in the note to his 1403 chart, distinguished Catalan, Venetian, and Genoese practitioners "as well as others who made navigational charts in past times" (see note 384).

omitted it. A third of the total is contributed by the peripatetic Benincasa alone.

Though there has been a tendency to see the first two centuries of portolan chartmaking as spread evenly between Majorca, Genoa, and Venice, Genoa's contribution has sometimes been overstated.⁴⁷⁵ This is largely because Genoese historians have been more active in this field than their Venetian counterparts. Virtually no information about chartmaking has emerged from the Venetian archives (yet it is hard to believe that none exists). Indeed, it is from documents unearthed in Genoa's archives that we see how nearly chartmaking died out completely in that city, as exemplified by the fifteenth-century Noli and Pareto documents already mentioned. Nor does the dispatch by Pujol of four charts from Barcelona to Genoa in 1392 suggest that the native industry was flourishing at the end of the preceding century. Of the five other Genoese involved (leaving aside the possibly relevant Dalorto/Dulcert), Giovanni da Carignano belongs strictly outside the portolan chart tradition, neither Pietro or Perrino Vesconte nor Batista or Francesco Beccari ever definitely worked in Genoa, and only Albino da Canepa seems to have displayed wholehearted loyalty to his native city. The willingness of Genoese chartmakers to emigrate is also illustrated by the case of Vesconte Maggiolo, referred to earlier.

The appearance of the few unquestionably Genoese charts is additional testimony against the existence of a distinctive and continuous tradition of chartmaking in that city. The strong influence of Majorcan models is immediately apparent. If it is objected that the ornamented Catalan style is first found on the charts of Dalorto/Dulcert, for whom Genoese origin is claimed—and hence that it was the Majorcans who were the imitators—there are strong counterarguments. First, no surviving chart earlier than Pareto's of 1455 actually states that it was drawn in Genoa (if we except the Carignano map), and second, the work of known Genoese chartmakers incorporates only some of the Catalan characteristics. As far as the decorative elements are concerned, it is most reasonable to see Genoese work as an imitation or *précis* of the Catalan style.⁴⁷⁶

Genoa's slender contribution (at least after the earliest period) must be contrasted with the preeminent role Venice played in portolan chart construction before 1500. To the twenty-one works that were signed from there must be added a further handful that have been plausibly attributed to Venetian practitioners on stylistic grounds.⁴⁷⁷ Marked in most cases by the absence of any details beyond those essential for navigation, Venetian work has as its hallmark a distinctive austerity. If future research succeeds in tying down the numerous unsigned works to a particular place of origin, on stylistic or orthographic grounds, it seems likely that Majorca (pre-

sumably Palma) and Venice will be seen as the only centers capable of supporting established schools of chartmaking during our period.

THE FUNCTION OF THE PORTOLAN CHARTS

It is not unreasonable to assert that a portolan chart becomes of greater interest once it has reached its first owner. It is undoubtedly true that a chart, whether considered as an artifact or as a cartographic record, derives added significance from the way it was used. Indeed, this question of function is arguably the most crucial of all.

ARCHIVAL PURPOSE

Two dimensions need to be separated, the instructional and the practical, though inevitably they tend to overlap. The best example of work intended for instructional rather than shipboard use is the British Library's Cornaro atlas. Its thirty-four sheets include eight versions of the standard portolan chart (variously on one, two, or three sheets).⁴⁷⁸ Among the charts devoted to particular areas, the Aegean is treated five times and the Black Sea four times. This duplication extends to variant outlines for the Black Sea and Adriatic, paired for comparison on single sheets.

The most likely explanation for this strange Venetian collection is that it comprises archival copies of what was considered to be the best Italian, Catalan, and Portuguese work. There are strong indications that the atlas dates from about 1489.⁴⁷⁹ Its juxtaposition of Portuguese discoveries in Angola, made just six years earlier, and charts of the Mediterranean, some of whose models

475. The claim has even been made that early fourteenth-century Genoa was the center of chartmaking with its own official municipal workshop; see Laura Secchi, *Navigazione e carte nautiche nei secoli XIII–XVI*, catalog of an exhibition held at the Palazzo Rosso, Genoa, May to October 1978, 38, citing Giuseppe Piersantelli, *L'atlante di carte marine di Francesco Ghisolfi e la storia della pittura in Genova nel Cinquecento* (Genoa, 1947), 1–7. In this context a distinction needs to be made between "Genoa" and the "Genoese."

476. Though this reverses the judgment of Andrews, "Scotland in the Portolan Charts," 138 (note 249). The toponymic originality of Batista and Francesco Beccari should, however, be emphasized here (see table 19.3, pp. 416–20). The presence of Francesco Beccari in Barcelona in 1399 (see p. 430) also stresses the cartographic links between Genoa and Catalonia, as do both the title and theme of Quaini, "Catalogna e Liguria" (note 60), and the 1392 shipment of charts from Barcelona to Genoa, see above, p. 437.

477. For instance, attributions to Girolodi by Andrews, "Rathlin Island," 33–34 n. 1 (note 247).

478. British Museum, *Catalogue of the Manuscript Maps*, 1:17–20 (note 40).

479. Cortesão gives a full collation of this work in his *History of Portuguese Cartography*, 2:195–200 (note 3), and discusses earlier descriptions of it.

had been drawn at the beginning of the century, suggests a continuing respect for work that we might have supposed would be considered out of date.⁴⁸⁰ P. D. A. Harvey has pointed out that there was a unique appreciation in late fifteenth-century Venice of the value of maps to an administration.⁴⁸¹ Might we be seeing here the nautical aspect of this same cartographic consciousness?

A similar archival interpretation can perhaps be placed on some of the other surviving atlases. The alternative drafts of the Adriatic found in the Medici atlas (see appendix 19.1) probably have the same explanation as those in the Cornaro volume (fig. 19.19). Besides copies made for the record, we can also point to the insertion of additional material into the Pinelli-Walckenaer and Pizigano atlases as possibly reflecting a similar documentary purpose.⁴⁸² A note about a pilgrimage to the Holy Land on the reverse of the Cortona chart⁴⁸³ draws attention to another function that the charts could have performed: namely, to plan or record a voyage.

SHIPBOARD USE

These examples can only give us a small part of the picture, however, because the evidence that portolan charts were used on board ship is overwhelming. The earliest discovered reference to a medieval sea chart already makes this clear. When the French king Louis IX (Saint Louis) set out from Aigues-Mortes for Tunis in 1270 he was forced to make for Cagliari in a storm. To reassure the king that they were close to land, the captain showed him what must have been a chart, although the account of this voyage was written in Latin and used the words *mappâ mundi*.⁴⁸⁴ The same ambiguous term recurred in 1294 when the prince of Aragon demanded restitution for a ship, the *San Nicola* of Messina, which had been seized by Italian pirates.⁴⁸⁵ The inventory listed

480. The accompanying text also includes fourteenth- and early fifteenth-century material; see Revelli, *Colombo*, 351 (note 22).

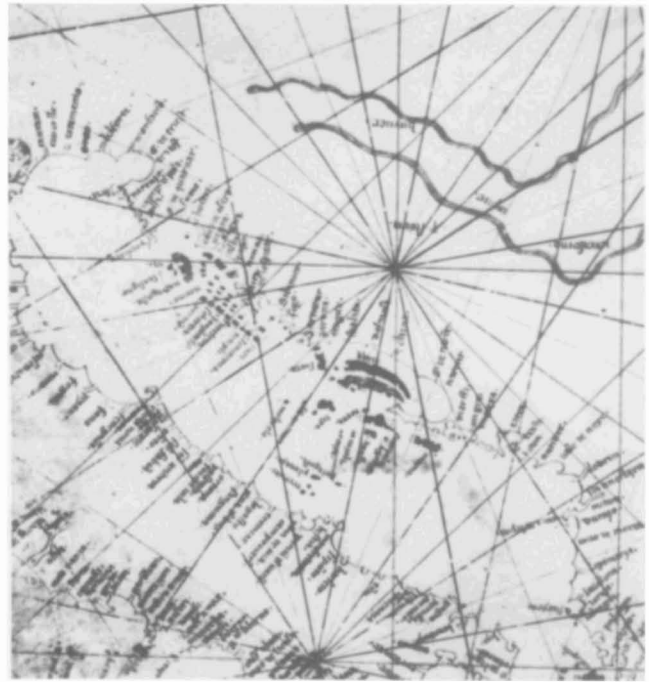
481. Harvey, *Topographical Maps*, 60–61 (note 8). For a similar appreciation in mid-fifteenth-century Genoa, see the Noli petition referred to on p. 430.

482. On the Pinelli-Walckenaer atlas see Marie Armand Pascal d'Avezac-Macaya, "Fragments d'une notice sur un atlas manuscrit de la Bibliothèque Walckenaer: Fixation des dates des diverses parties dont il se compose," *Bulletin de la Société de Géographie*, 3d ser., 8 (1847): 142–71, esp. 171. On the Pizigano see Errera, "Atlanti," 91–96 (note 221).

483. Armignacco, "Una carta nautica," 186 (note 243), and Caraci, *Italiani e Catalani*, 278 (note 175).

484. Guillaume de Nangis, "Gesta Sanctæ Memoræ Ludovici" (Life of Saint Louis), in *Recueil des historiens des Gaules et de la France*, 24 vols., ed. J. Naudet and P. Daunou (Paris: Imprimerie Royale, 1738–1904), 20 (1840): 309–465, esp. 444.

485. Charles de La Roncière, "Un inventaire de bord en 1294 et les origines de la navigation hauturière," *Bibliothèque de l'École des Chartes* 58 (1897): 394–409.



(a)

(b)



FIG. 19.19. ISTRIA IN THE MEDICI ATLAS. The occurrence of markedly different drafts of the Adriatic in this apparently homogeneous atlas suggests that they were intended as archival copies. The detail of the Isthrian section from one of two smaller-scale charts (a) displays the range of names typical of the mid-fourteenth century. By contrast, larger-scale sheet (b) includes names such as *san iacomo* (first found on a dated chart in 1367) and *setrenice* (first found in 1408), while the earlier *cauo de osero* has been dropped. By permission of the Biblioteca Medicea Laurenziana, Florence (Gaddi 9, charts 6 and 3 respectively).

no fewer than three charts—if the text has been correctly interpreted. More demonstrative still is the Aragonese ordinance of 1354 decreeing that each galley should carry a pair of sea charts.⁴⁸⁶ If that seems excessive, a Genoese ship seized three years later had no fewer than four charts on board.⁴⁸⁷ Further evidence of shipboard use can be found in the fifteenth century. Francesco Becari specifically addressed the important note on his 1403 chart to “all those who do or shall sail the ocean sea,”⁴⁸⁸ and the submissions of Noli and Pareto to the Genoese authorities stressed the navigational value—indeed, necessity—of sea charts, bracketing them firmly with the magnetic compass.

Thus, documentary evidence that early portolan charts formed a recognized part of marine equipment has to be reconciled with the equally clear indications, set out in the previous section, that other examples were constructed with the pleasure and enlightenment of landsmen in mind.⁴⁸⁹ There is no ready agreement, however, about the line of demarcation between the two types and about how surviving charts should be distinguished according to the supposed alternatives of navigational or ornamental function. In the most radical interpretation, all the practical wayfinding charts have failed to survive (except for the occasional fragment). The lack of navigational markings on those charts available for study today (a point to be discussed in the following section) has been seen as further proof that almost all extant examples should be considered a different species from those intended for shipboard use.⁴⁹⁰ Systematic chemical analysis of those charts that betray evident water staining, to test for traces of salt, would inject some needed data into what has been a largely theoretical discussion.

It is commonly assumed, for example, that none of the more elaborate productions would have been taken to sea, and that it was the plain Italian-style charts that were used, and normally worn out, on board ship. Though there is no firm evidence to support this thesis, and though the distinction functional versus artistic has little relevance in a medieval context, it does seem a plausible interpretation. Charts shipped to meet the requirements of the Aragonese decree or just for operating needs would presumably have been inexpensive, and hence unadorned, in marked contrast to lavish productions like the celebrated Valseca chart of 1439. But the earlier warning against oversimplification along nationalist lines must be repeated. Each of the main chart-making centers, and probably most of the individual practitioners, was presumably capable of manufacturing navigational or luxury charts as required.

If there has been disagreement about the function of the separate charts, it has been generally supposed that volumes of portolan charts were intended from the outset for the library shelf.⁴⁹¹ This theory, however, has

several drawbacks. In the first place, an atlas offered the mariner a number of practical advantages over a chart. Portuguese discoveries in the Atlantic islands and along the west coast of Africa, for instance, could not be properly accommodated on a normal chart.⁴⁹² Then again, a succession of overlapping charts, sometimes fixed to rigid boards and protected by a leather binding, would have been both easier to use and more durable, since they would have been less subject to crinkling and distortion and would have presented a flat surface to a parallel ruler. The paschal calendar found in some atlases might have a purely religious significance, but the lunar calendar that more frequently prefaces such volumes was an essential part of a navigator's equipment if the Atlantic tides were to be accurately predicted (for calendars see appendix 19.1).

It has to be admitted, however, that the earliest recorded explanation of the “establishment of the port” is found in the Catalan atlas, and the most extensive set of navigational rules and sailing directions is in the Cornaro atlas⁴⁹³—both of which have survived precisely because they were not risked at sea. The first can be interpreted as a cosmological compendium, the second as a collection of file copies; but there is every reason to suppose that the essential navigational information contained in those works found its way to sea in less ostentatious forms. The most likely vehicle would be a portolan atlas, and the example drawn in 1436 by the galley officer Andrea Bianco may well be a case in point, since it is prefaced by a sheet that includes mathematical

486. Hamy, “Origines,” 416 (note 47). Some authorities have cited other dates for this ordinance: 1352—for example, Reparaz, “Essai,” 286 (note 175); and 1359—Clements R. Markham, *The Story of Majorca and Minorca* (London: Smith Elder, 1908), 172. It is worth noting that a comparable ordinance of 1331 makes no reference to sea charts; see José Maria Madurell y Marimon, “Ordenanzas marítimas de 1331 y 1333,” *Anuario de Historia del Derecho Español* 31 (1961): 611–28.

487. De La Roncière, *Afrique*, 1:123 n. 2 (note 100).

488. See note 384.

489. Giuseppe Caraci, “Un'altra carta di Albertin da Virga,” *Bollettino della Reale Società Geografica Italiana* 63 (1926): 781–86, esp. 783, employed the term *carta d'uso* for those in the first category; Mollat du Jourdin and de La Roncière (i.e., Isabelle Raynaud-Nguyen), *Sea Charts*, 200 (note 40), described an example of the second category as “a work of art, a collector's piece.” It needs to be emphasized that there are no differences of hydrographic or toponymic content between the two types.

490. For example, Giuseppe Caraci, “An Unknown Nautical Chart of Grazioso Benincasa, 1468,” *Imago Mundi* 7 (1950): 18–31, esp. 20, talked of “the very rare examples known up to this date of nautical maps destined to be really used.”

491. Almagià, *Vaticana*, 1:viii (note 35).

492. The Catalan solution was to produce a world map, but these could never have been taken to sea.

493. Derek Howse, “Some Early Tidal Diagrams,” *Revista da Universidade de Coimbra* 33 (1985): 365–85, esp. 366–68. British Museum, *Catalogue of the Manuscript Maps*, 1:20–21 (note 40).

tables, known as the *Toleta* (to be discussed below). It can only be speculated that Bianco's atlas was taken to sea; but in another case there are strong indications that this was definitely the case.

Among the Vatican's collections is an anonymous atlas dated 1452.⁴⁹⁴ Almagià considered it to be Venetian in origin, probably from the workshop of Girolodi. He also detected several significant additions in a number of different later hands. The lunar table (whose nineteen-year cycle could be endlessly repeated) had been annotated to identify the relevant letters for the years 1561, 1571, and 1618; a comment, probably in a sixteenth-century hand, had been placed beside Paxos; and four notes had been added, in three different sixteenth-century hands, describing the approaches to various harbors. Thus, for more than a century and a half this atlas (which came to the Vatican only in the nineteenth century) was being updated with practical navigational information.⁴⁹⁵ When taken with the other arguments, the Vatican atlas demonstrates the possibility, if not the probability, that, like portolan charts, some portolan atlases were taken to sea, even if their extra cost might have restricted them to the larger ships.

NAVIGATIONAL PRACTICE

If the foregoing points firmly to a practical seafaring role for at least some portolan charts and atlases, it throws no light on their precise function. For this it is necessary to take a brief look at contemporary navigational practice. Faced with their modern-looking coastal outlines, it is tempting to take for granted supposed analogies between the use of medieval charts and the function of their modern counterparts. The little that can be learned of early navigation advises caution in this respect.⁴⁹⁶ Instruments such as the cross-staff and quadrant were available from at least the early fourteenth century,⁴⁹⁷ but more than three hundred years afterward they had still failed to make any discernible impact on Mediterranean sailing. Countering various claims that the Portuguese had merely taken over for their own use techniques of astronomical navigation already being practiced in the Mediterranean, Teixeira da Mota convincingly demonstrated that Mediterranean sailors adopted scientific techniques only in the eighteenth century.⁴⁹⁸ Until then, charts with rhumb lines had proved adequate for the traditional methods of dead reckoning (estimates of position in terms of the direction and distance traveled).

There were two main reasons for this. First, the relatively small distances involved in the Mediterranean meant that it was most unusual for a ship to be more than a week out of sight of land;⁴⁹⁹ indeed, in the separate Mediterranean basins the coast would be seen every day and errors would never be allowed to accu-

multate.⁵⁰⁰ Second, the early astrolabes—accurate, at best, to the nearest one-sixth of a degree of latitude (or about 18 km)—while acceptable for oceanic sailing, were too inexact for the smaller Mediterranean distances.⁵⁰¹ The authorities cited by Teixeira da Mota were writing in the sixteenth and seventeenth centuries, but there is no reason to doubt that their consistent descriptions of Mediterranean navigational methods are equally applicable to the medieval period. Of particular significance is António de Naiera's comment, made in 1628, that Mediterranean pilots took no note of compass variation, since this discloses an unbroken link with the fourteenth and fifteenth centuries when the users of the earlier charts were apparently unaware of the phenomenon.

The earliest extant account of Mediterranean navigational practice, though written by a poet and thus less reliable than the later descriptions of experienced mariners, confirms this continuity. In his "Documenti d'amore," which was composed at the very beginning of the fourteenth century, close to the time of the earliest charts, Francesco da Barberino referred to just three navigational aids: chart, lodestone (magnetized needle), and *larlogio* (sandglass).⁵⁰² Though Barberino provides no corroboration for this, it is conceivable that by this early date sailors were already aware of a mathematical device designed to calculate both the effective distance gained at sea when the ship had been forced off its direct course, for example by headwinds, and the new optimum direction involved.

The method was first described, as far as is known, in "Arbre de Sciencia," a work composed between 1295 and 1296 by Ramón Lull.⁵⁰³ Termed by subsequent writers the *Raxon de marteloio*, this method was accompanied by mathematical tables (*Toleta*) enabling its

494. Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 9015. Discussed in Almagià, *Vaticana*, 1:43–44 (note 35).

495. The latitude scales, inserted later on a number of early charts, should be viewed in the same light; see above, p. 386.

496. For an account of Mediterranean navigation in the period before the development of the portolan charts, see above, pp. 386–87.

497. George Sarton, *Introduction to the History of Science*, 3 vols. (Baltimore: Williams and Wilkins, 1927–48), vol. 3, *Science and Learning in the Fourteenth Century*, 600–601, 696.

498. Teixeira da Mota, "Art de naviguer," 140 (note 70).

499. Teixeira da Mota, "Art de naviguer," 137 (note 70), quoting Alonso de Santa Cruz, ca. 1555.

500. Teixeira da Mota, "Art de naviguer," 138 (note 70), quoting António de Naiera, 1628.

501. Teixeira da Mota, "Art de naviguer," 130 (note 70).

502. Francesco Egidi, ed., *I Documenti d'amore di Francesco da Barberino secondo i MSS originali*, 4 vols., Società Filologica Romana: Documenti di Storia Letteraria 3 (Rome: Presso la Società, 1905–27), 3:125–26.

503. Cortesão, *History of Portuguese Cartography*, 1:205 (note 3). However, it has been suggested that Italian sailors were using the method in the second half of the thirteenth century, and the *Toleta's*

actual use at sea.⁵⁰⁴ The two oldest surviving examples of the *Toleta* are both Venetian and considered to date from the early fifteenth century: one was copied out in the late fifteenth-century Cornaro atlas (fig. 19.20), and another inserted into Bianco's atlas of 1436.⁵⁰⁵ A *martilogium* is mentioned, however, in a 1390 Genoese inventory,⁵⁰⁶ and in 1382 Cresques Abraham had supplied the king of Aragon with "certain tables"⁵⁰⁷—a reference plausibly interpreted as denoting the *Toleta*, particularly since "navigating tables" and a world map were linked in a single request nine years later.⁵⁰⁸ It seems likely, though, that the *Toleta*'s origin should be pushed back a further century because the passage in Lull's "Arbre de Sciencia," though ambiguous, contains the word "instrument," and this is considered to refer to the explanatory tables.⁵⁰⁹

Armed with the *Toleta* alone, the navigator would have been involved in the multiplication calculations referred to by both Lull and Bianco.⁵¹⁰ To avoid this, a "circle and square" diagram was devised. Appropriately, an example of this is included in Bianco's atlas.⁵¹¹ Once he had absorbed the *Raxon* and equipped himself with

(mathematical tables) creation was ascribed to the mathematical school associated with Leonardo Pisano and his pupil Campano da Novara, see Motzo, "Compasso da navigare," LI (note 103).

504. Opinions differ as to the correct translation of *Raxon de marteloio*. Nordenskiöld, *Periplus*, 53 (note 14), seeking evidence of Catalan inspiration, looked for an explanation in the Spanish words for counting and hammer—a reference, he suggested, to the striking of the ship's bell to mark the watches; others saw it as Italian, the first word being interpreted as rule, the second remaining a mystery. For detailed explanations of how the *Toleta* worked, see Cotter, "Problems of Plane Sailing," 5–11 (note 137); Nordenskiöld, *Periplus*, 53 (note 14); and Taylor, *Haven-Finding Art*, 118–21 (note 7). The navigator, having estimated the distance run and the angle between the actual and desired courses (expressed as a number of quarter-winds), could then read off from the tables the distance the ship was off her course as well as the length of the course made good. Confusingly, a recent book uses the term *marteloio* to describe the underlying rhumb-line network of the standard portolan chart instead of the "circle and square" diagram; compare Mollat du Jourdin and de La Roncière, *Sea Charts* 12 (illustration), 276–77 (glossary) (note 40), and Taylor, *Haven-Finding Art*, pl. VIII (note 7).

505. On the Cornaro atlas (Egerton MS. 73) see British Museum, *Catalogue of the Manuscript Maps*, 1:20 (note 40). The section entitled "La Raxom del Marteloio" is undated, and there is no apparent justification for coupling it with the next passage, containing "Hordeni e chomandamenti" issued by Andrea Mocenigo in 1428, as does Revelli, *Colombo*, 351 (note 22). On Bianco's atlas see Nordenskiöld, *Periplus*, 53 (note 14).

506. Revelli, *Colombo*, 453 (note 22).

507. "Quasdam tabulas in quibus est figura mundi"; see Rubió y Luch, *Documents*, 2:253 (note 443). Taylor, *Haven-Finding Art*, 117 (note 7) interpreted this as a reference to navigating tables.

508. "Nostre mapa mundi e les taules de navegar"; see Rubió y Luch, *Documents*, 1:364 (note 443).

509. Cortesão, *History of Portuguese Cartography*, 1:206–7 (note 3); Taylor, *Haven-Finding Art*, 118 (note 7).

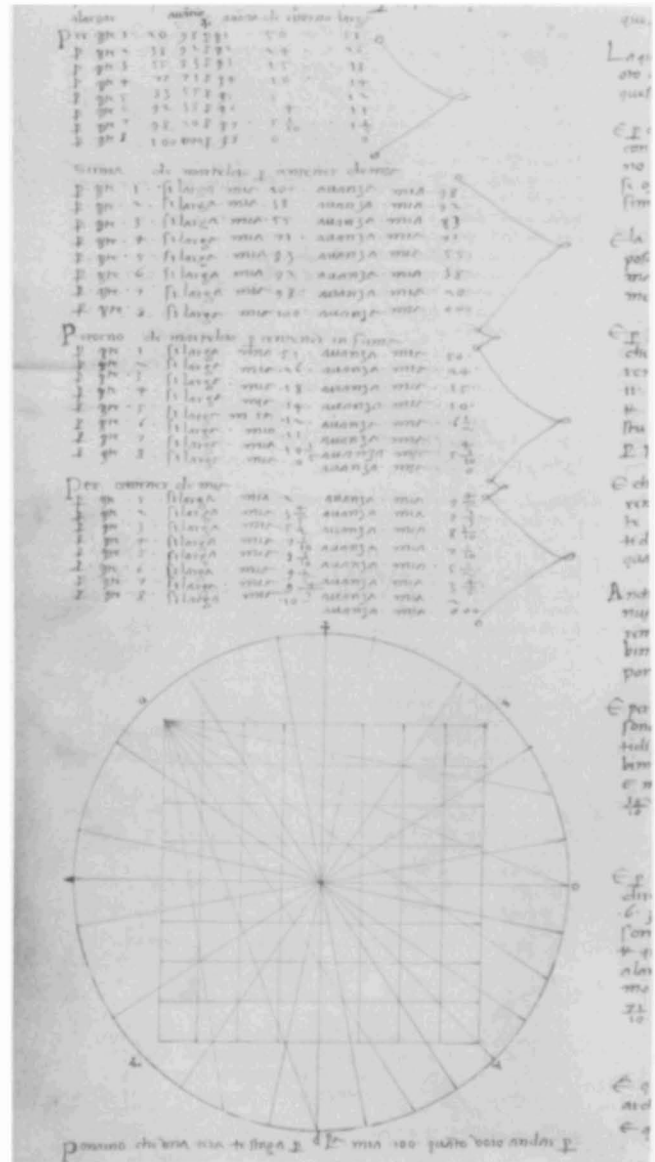


FIG. 19.20. A *TOLETA*. Such mathematical tables were sometimes included in portolan atlases to help the mariner calculate the effective distance gained when his ship had been forced off course and the best new direction to follow. This is one of the oldest extant examples, copied into the late fifteenth-century Cornaro atlas. It seems likely, however, that the *Toleta* was already in existence by the end of the fourteenth century. Size of the original: 41.8 × 14.5 cm. By permission of the British Library, London (Egerton MS. 73, fol. 47v).

510. On Lull see Cortesão, *History of Portuguese Cartography*, 1:206 (note 3). On Bianco see Cotter, "Problems of Plane Sailing," 11 (note 137); Taylor, *Haven-Finding Art*, 116 (note 7). Lane, *Venice*, 169 (note 433) quotes Eva G. R. Taylor that "sailors were the first professional group to use mathematics in their everyday work."

511. Vincenzo Formaleoni, *Saggio sulla nautica antica de' Veneziani con una illustrazione d'alcune carte idrografiche antiche della Biblioteca di San Marco, che dimostrano l'isole Antille prima della scoperta di Cristoforo Colombo* (Venice: Author, 1783), 30.

both the *Toleta* and its graphic solution, any pilot should have been able to “resolve a traverse”: in other words, make the necessary adjustments when tacking or if blown off course. But the *Toleta*’s effectiveness depended on a correct appreciation of the initial position and an accurate estimate of the course sailed. Once again, the essential element was the navigator’s skill and experience, and for this the *Toleta* was no substitute.

If the *Toleta* was employed in Mediterranean navigation—certainly from the early fifteenth and probably from the late thirteenth century—it would have coexisted with the majority of the charts that survive from the period up to 1500, if not with all of them. But when an attempt is made to confirm that these tables were actually used in conjunction with the portolan charts, there is conflicting evidence. In particular, there is confusion about the use of dividers. Bianco specifically stated that the *Toleta* was used without either ruler or dividers.⁵¹² Nevertheless, the equivalent Lull passage included a phrase that has been interpreted as a reference to dividers;⁵¹³ several of the charts itemized in the late fourteenth-century Genoese inventories were accompanied by one or two pairs of dividers;⁵¹⁴ and the leather case enclosing the small 1321 Perrino Vesconte atlas in Zurich has loops through which a pair of dividers would have been slotted.⁵¹⁵ This juxtaposition of chart and dividers can hardly have been accidental. That dividers did indeed play their part in medieval navigation is confirmed by other kinds of documents.

Two fifteenth-century landmen left a record of their shipboard experiences, and while allowance needs to be made for the men’s technical ignorance, both state clearly that the chart was marked in some way during navigational calculations. Pedro Niño’s biographer, writing of events in 1404, described how the sailors “opened their charts and began to prick and measure with the Compass [i.e., dividers].”⁵¹⁶ The account by the German cleric Felix Fabri, written in 1483, differs in its details but confirms that the chart would have been annotated. The seamen, he relates, can “see where they are, even when they can see no land, and when the stars themselves are hid by clouds. This they find out on the chart by drawing a curve from one line to another, and from one point to another with wondrous pains.”⁵¹⁷ However these two passages might be interpreted, they both characterize the chart as a working document. Similarly, Jean Rotz’s navigational treatise, presented to Henry VIII in 1542, prescribed the use of two pairs of dividers to plot a position directly onto the chart.⁵¹⁸

From these written descriptions it would be natural to expect extant charts to display traces of navigational use, either Fabri’s scored circles or the divider holes of Niño and Rotz. Yet no modern scholar has apparently been able to identify marks of this kind on any of the

surviving charts produced before the sixteenth century.⁵¹⁹ Magnaghi’s assertion, on the basis of sixteenth- and seventeenth-century accounts, that any course plotting would have been done in lead pencil and then erased so as to extend the usefulness of an expensive piece of equipment, is unconvincing for the earlier period.⁵²⁰ As discussed above, there is no evidence that an erasable pencil formed part of chart draftsmanship before the sixteenth century; hence there is no justification for assuming its presence on board ship. None of the three, Niño, Fabri, or Rotz, mentions a lead pencil, and a pair of dividers presumably substituted for a drawing instrument.

It remains difficult to reconcile statements implying that the portolan charts would have been pierced by divider holes with the absence of any disfigurement of that kind on those charts that survive. One possible interpretation is that careful use of sharp dividers would have avoided making holes large enough to be visible. It is also likely that new vellum would have retained sufficient suppleness to close up in cases where the dividers did pass right through. Alternatively, the holes

512. “Senca mexura e senca sesto”; see Formaleoni, *Saggio*, 30 (note 511).

513. “Carta e compàs”; see Cortesão, *History of Portuguese Cartography*, 1:207 (note 3), although Taylor, *Haven-Finding Art*, 118 (note 7), translated this as “chart [and] compass (*da navigare*).”

514. Revelli, *Mostra Colombiana*, 36–37 (note 315).

515. Leo Cunibert Mohlberg, *Katalog der Handschriften der Zentralbibliothek Zürich*, 2 vols. (Zurich: Zentralbibliothek Zürich, 1951), 1:89.

516. Díaz de Gámez, *Unconquered Knight*, 97 (note 50). The confusion between the magnetic compass and compasses (i.e., a pair of dividers) exists in other languages besides English.

517. Felix Fabri, *The Wanderings of Felix Fabri, circa 1480–1483 A.D.*, trans. Aubrey Stewart, Palestine Pilgrims’ Text Society, vols. 7–10 (London: Palestine Exploration Fund, 1897), 1:135. What may be a more reliable account of fifteenth-century navigational practices is that given in the recently discovered but still unpublished *Arte del navigare* in the Biblioteca Medicea Laurenziana, Florence. This was compiled in 1464 by an unidentified naval officer who had been at sea since 1434; his background and experiences were thus parallel and contemporary with Grazioso Benincasa’s. For a summary of the navigational content of the manuscript see Claudio de Polo, “*Arte del navigare*: Manuscrit inédit daté de 1464–1465,” *Bulletin du Bibliophile* 4 (1981): 453–61.

518. Wallis, *Jean Rotz*, 81 (note 441). A similar procedure was described by Martin Cortés in 1551; see Waters, *Navigation in England*, 75–76 (note 138), for extracts from the 1561 English edition of his manual.

519. If we discount as irrelevant the divider holes in the scale or through the intersection points, both of which have been cited as evidence of navigational use; see Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 5:3 (note 29), and the description of the chart now with Nico Israel of Amsterdam (see note 67). Pelham, “Portolan Charts,” 26 (note 56), failed to find navigational marks after having specifically searched for evidence of this kind in various European libraries.

520. Magnaghi, “Nautiche, carte,” 324a (note 4).

might have disappeared during the subsequent aging of the skin.⁵²¹ A microscopic examination of extant charts with this in mind is just one of the many tasks awaiting future researchers. If the findings were positive, it might be possible to reconstruct actual voyages from the pattern of prick marks. Many medieval voyages, of course, were made without losing sight of land. On an inshore voyage, the chart could have supplied valuable information on the sequence of coastal features, the location of offshore islands, the relationship of one Aegean island to another, and so on. But use in this way would leave no trace.

CONNECTION WITH TRADE

Besides mariners, the only groups for whom a portolan atlas or chart could have represented meaningful information would have been those engaged in maritime trade⁵²² or in the administration of a colonizing power like Venice. Whether the shipping they manipulated was engaged in cargo carrying or war, all ultimately served the same master, commerce. Genoese and Venetian colonies were essentially trading entrepôts, protected by warships in the same way as Venetian convoys to the North Sea. The use of a portolan chart as an aide-mémoire in a mercantile house has yet to be documented, but it seems likely enough.⁵²³ The inevitable links between navigation and trade are illustrated, first by the inclusion of a table of tariffs for the port of Alexandria⁵²⁴ in the Cornaro atlas's navigational appendix, and second by the guide to weights and measures produced by the chartmaker Arnaldo Domenech.⁵²⁵ Some writers have even seen the creation of the portolan charts as a response to commercial prompting.⁵²⁶ Cortesão and Teixeira da Mota were more specific, noting that in area the early portolan charts "corresponded roughly to the regions to which the Genoese and Venetians extended their trade by sea."⁵²⁷ Those who followed Norden-skiöld in giving the portolan charts a Catalan origin naturally disagreed. What kind of a match, then, can be discerned between the trading patterns of the late Middle Ages and contemporary portolan charts?

To test in detail the hypothesis that the portolan charts were commercial as well as navigational instruments would require a special study of its own. At present we can only offer a few general comments. If the major changes affecting the trading patterns of the Mediterranean and Black Sea littorals were to be briefly summarized, a contrast would be drawn between the inexorable advance of the Ottoman Turk in the East and the partially compensatory Christian victories in the West. Notable among the latter were the Portuguese capture of the Moroccan stronghold of Ceuta in 1415 and the

expulsion of the Moors from Granada in 1492. With Muslims in control of North Africa, Palestine, Asia Minor, the Black Sea, and a large part of the Balkans, it is not surprising that the western Mediterranean and Atlantic took on increasing importance for the Christian trading states.

Kelley suggested that the neck on the portolan charts might have been switched from east to west in response to this commercial change.⁵²⁸ Most of the eastern necks are certainly found on fourteenth-century charts; but this is better explained in terms of southward orientation.⁵²⁹ There is a further objection to Kelley's theory. Writing of "the beginning of a shift from the Mediterranean as a focal point of business to the Atlantic seaboard," the historian Denys Hay concluded that "this had certainly not happened by 1500."⁵³⁰ Yet a listing of restricted area charts—that is, those that, while complete, do not embrace the entire Mediterranean and Black seas—does seem to document for the fifteenth century the swing from east to west that Kelley proposed for the fourteenth and Hay for the sixteenth.

The 1311 Vesconte and (mid-fourteenth century?) Library of Congress charts are both confined to the eastern half of the Mediterranean.⁵³¹ Like most Italian charts, they take the eastern side of the Black Sea as their right-hand limit and extend west as far as required—or to the edge of the vellum. To save space, some chartmakers (and Albertin de Virga in 1409 was evidently the first) even detached the Black Sea and moved it sufficiently westward to align it with the Levant coast.⁵³² To clarify

521. Experiments made at my behest by a modern-day binder, John Llewellyn, showed that if the vellum was kept slightly damp, as would presumably have been the case on board ship, no marks could be seen two years later, whereas holes pierced through dry vellum remained clearly visible.

522. Sea charts occur in the inventories of Barcelona merchants in 1457 and 1472; see Carrère, *Barcelone*, 1:201 n. 2 (note 285).

523. Though the 1432 instance of a Genoese firm's sending its Milanese representative a "beautiful sea chart" comes close to it; recounted in Revelli, *Colombo*, 459–60 (note 22).

524. British Museum, *Catalogue of the Manuscript Maps*, 1:20 (note 40).

525. Ristow and Skelton, *Nautical Charts*, 3–4 (note 393).

526. For instance, Kamal, *Eclaircissements*, 186 (note 164).

527. Cortesão and Teixeira da Mota, *Portugaliae monumenta cartographica*, 1:xxvi (note 29).

528. Kelley, "Oldest Portolan Chart," 24 (note 58).

529. See note 62.

530. Denys Hay, *Europe in the Fourteenth and Fifteenth Centuries* (London: Longmans, 1966), 388.

531. Cortesão, *History of Portuguese Cartography*, 1:220 (note 3), believed that Vesconte would have provided a matching sheet to the west, but no examples of multisection Italian charts have survived from this period.

532. Caraci, "Virga," 784 (note 489), was evidently the first to notice this. He cited also a late sixteenth-century English example. Another instance is the 1421 Francesco de Cesanis chart.

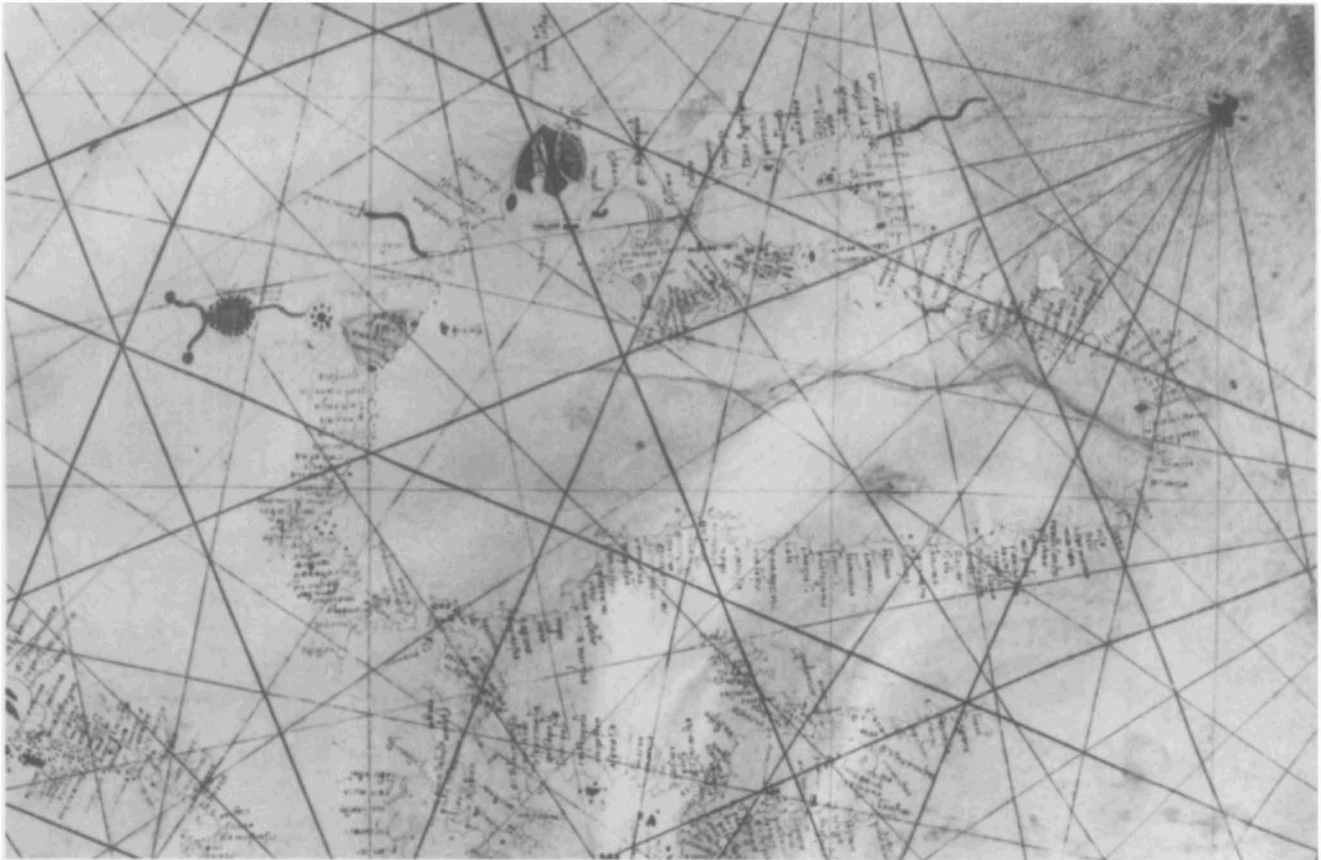


FIG. 19.21. THE BLACK SEA ON THE 1409 CHART OF ALBERTIN DE VIRGA. By detaching the Black Sea from the rest of the outlines (with the Bosphorus repeated), the chart-maker was able to push the Levant coast closer to the right-

hand side of the vellum, thereby making space for more details of the Atlantic. It appears that Virga was the first to do this. Size of the original detail: 15 × 24 cm. Photograph from the Bibliothèque Nationale, Paris (Ré. Ge. D 7900).

what they had done, they showed the Bosphorus twice (fig. 19.21).

On the other hand, the Maghreb chart, if correctly ascribed to the early fourteenth century, is the first to concentrate exclusively on the western Mediterranean.⁵³³ It seems probable, however, that this is either a sheet from an atlas or a copy of one. The 1424 chart by Zuane Pizzigano is thus the earliest of the dated survivors to concentrate on the Atlantic coasts. The undated chart in Florence (Biblioteca Nazionale Centrale, Port. 22), which was probably produced at some point after 1380, is perhaps the first complete chart to exclude the eastern Mediterranean and Black Sea. This example would be followed by several other chartmakers during the course of the fifteenth century. Though not of this type, the 1413 Mecia de Viladestes chart has a similar bias, reflecting in its whaling scene the commercial interests of the Atlantic Europeans (fig. 19.22).

CONCLUSIONS

The importance of the early portolan charts can be summed up as follows. First, it can be stated incontrovertibly that they were the most geographically realistic maps of their time. In many ways the early portolan charts are very modern. The Mediterranean's true shape can be recognized immediately on the earliest charts, yet

533. The early fourteenth century was proposed by Juan Vernet-Ginés, "The Maghreb Chart in the Biblioteca Ambrosiana," *Imago Mundi* 16 (1962): 1–16, esp. 4, and corroborated by the place-name analysis (see table 19.3, pp. 416–20, and also above, p. 423). There is little modern support for the view that the Maghreb chart is the oldest survivor of all, as suggested by Ernest Théodore Hamy, *Etudes historiques et géographiques* (Paris: Leroux, 1896), 31. Since the rhumb line network is incomplete on two sides, the chart could not have been constructed in the normal way on the basis of a hidden circle but must have been directly reproduced, rather than freely copied, from a slightly larger work—see the illustration to Vernet-Ginés's article.

the same could hardly be said of their near contemporary, the Hereford *mappamundi*. Such a close approximation to the true outlines of the Mediterranean and Black seas on the oldest known charts cannot be accidental.

Second, an almost exclusive interest in the real world sets the portolan charts aside from other mapmaking activities of the Middle Ages. Usually made for (and sometimes by) sailors, most of the charts must have been drawn to satisfy a commercial demand. To mariners especially, distance and direction were vital. Since these components were less in demand by scholars, rulers, or administrators, little use was made of compass or scale on maps uninfluenced by the portolan charts. Already impressively accurate at the time of the oldest survivor, these charts reveal considerable hydrographic improvement in the early stages and continuing adjustments to the coastal place-names thereafter. The deterioration of both outlines and toponymy after the mid-sixteenth century confirms the extent to which their earlier vitality had depended on their practical function. By the later period they had ceased to be indispensable. While the knowledge of existing coastlines was being refined, the charts were steadily extending their range to accommodate fresh information. That the charts and their sixteenth-century successors were almost alone in providing a cartographic record of the pre-Renaissance and Renaissance discoveries constitutes their third main claim to historical importance.

Accurate, responsive to change, and essential for navigation, the charts were a necessary if specialized element of medieval life. Like the pen, the breastplate, or the stirrup, they were unremarkable and hence usually passed unremarked. In a sense, this essay is dedicated to the thousands of ordinary charts that served their purpose and then perished. The obvious beauty of a richly illuminated chart is less noteworthy than the perpetuation of the initial coastal accuracy on unadorned charts for more than two centuries.

APPENDIX 19.1 CALENDARS AS A GUIDE TO DATING: THE CASE OF THE MEDICI AND PINELLI-WALCKENAER ATLASES

A number of atlases are preceded by astronomical tables. Whether designed to show the precise time of each new moon or to facilitate calculation of the date of Easter and its allied festivals, these are constructed around the nineteen-year metonic cycle. This related the lunar month to the solar year. Successive years were numbered from 1 to 19 in an endlessly repeated series of golden numbers.¹ One cycle, for instance, began in 1368; hence 1375 was year 8, as the author of the Catalan atlas explains (plate 32).² Since some calendars stipulated the golden numbers for a period of a century or more, chartmakers could make a literal copy of an existing calendar

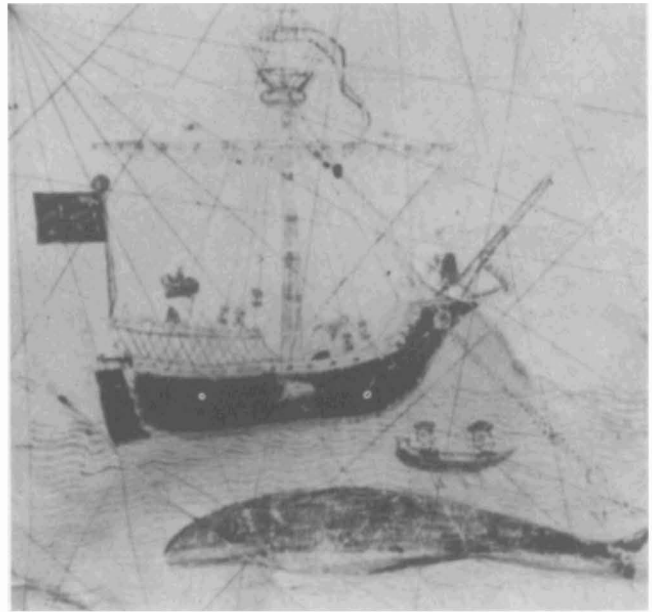


FIG. 19.22. A WHALING SCENE. From the fifteenth century onward, occasional charts emphasized the Atlantic at the expense of the eastern Mediterranean. The shift in commercial interests from the Mediterranean to the Atlantic is illustrated in this vignette from the 1413 chart by Mecia de Viladestes depicting whalers off the coast of Iceland. Size of the original detail: ca. 12 × 13 cm. Photograph from the Bibliothèque Nationale, Paris (Rés. Ge. AA 566).

instead of bringing the golden numbers up to date, without the document's becoming obsolete. Thus, when a calendar's commencement year is indicated, this may differ significantly from the date given for the construction of the atlas to which it belongs.

Grazioso Benincasa, for example, included a lunar calendar and an Easter table in four of his atlases (fig. 19.23).³ Yet the twin tables sometimes have different starting points, and none of the eight would have supplied the correct date for the atlas had the author's legend been missing. With its signature gone, the 1468 atlas would presumably have been assigned to 1451 on the strength of its lunar calendar. Though not a portolan chart, the Albertin de Virga world map of 141– provides a more startling example, with an Easter table starting more than a hundred years before its stated date of construction.⁴ In some cases, however, the dates derived from calendars do

1. On calendars see Christopher R. Cheney, *Handbook of Dates for Students of English History* (London: Royal Historical Society, 1945), and also extensive handwritten notes in the M. C. Andrews Collection at the Royal Geographical Society, London.

2. Georges Grosjean, ed., *The Catalan Atlas of the Year 1375* (Dietikon-Zürich: Urs Graf, 1978), 38.

3. Those of 1468, 1469, 1473, and 1474—respectively London, British Library (Add. MS. 6390); Milan, Ambrosiana; London, British Library (Egerton MS. 2855); and Budapest.

4. Marcel Destombes, ed., *Mappemondes A.D. 1200–1500: Catalogue préparé par la Commission des Cartes Anciennes de l'Union Géographique Internationale* (Amsterdam: N. Israel, 1964), 205.

FIG. 19.23. A COMBINED LUNAR CALENDAR AND EASTER TABLE FROM A PORTOLAN ATLAS. Grazioso Benincasa included tables of this kind in four of his atlases. Three-quarters of this sheet is occupied by a calendar from which the precise time of any new moon could be calculated, and from that the time of high tide. Each list comprises the nineteen golden numbers (here lettered a–t) followed by the day, hour, and number of points (each worth 3.3 seconds) for the years

between 1451 and 1469. The table for calculating the date of Easter for the entire century after 1432 fills the lower right quarter of the sheet. Such calendars and tables must be carefully used when found in undated atlases. This example might have suggested a date of 1451 for its atlas had Benincasa not clearly dated the work 1468. Size of the original: 27.4 × 33.9 cm. By permission of the British Library, London (Add. MS. 6390, fol. 3r).

confirm those on the main document, and occasionally the calendar date can be confidently extended to the whole work. The explanatory note in the Catalan atlas, for instance, refers to the year 1375 in the present tense.⁵ Likewise, an unsigned atlas in the Vatican carries the reference in its lunar table to “el presente ano” 1452.⁶

5. Grosjean, *Catalan Atlas*, 38 (note 2). However, Gonçal (Gonzalo) de Reparaz, *Catalunya a les mars: Navegants, mercaders i cartògrafs catalans de l'Edat Mitjana i del Renaixement (Contribució a l'estudi de la història del comerç i de la navegació de la Mediterrània)* (Barcelona: Mentova, 1930), 83, and Giuseppe Caraci, *Italiani e Catalani nella primitiva cartografia nautica medievale* (Rome: Istituto di Scienze Geografiche e Cartografiche, 1959), 315, 333, cited arguments in support of a 1377 date. More recently Caraci speculated that the atlas

might have been completed some years after 1377; see his “Viaggi fra Venezia e il levante fino al XIV secolo e relativa produzione cartografica,” in *Venezia e il levante fino al secolo XV*, 2 vols., ed. Agostino Pertusi (Florence: L. S. Olschki, 1973–74), 1:147–84, esp. 178 (footnote). These find no favor with Grosjean or with the various authors of a recent collection of essays: *L'atlas Catalá de Cresques Abraham: Primera edició completa en el sis-cents aniversari de la seva realització* (Barcelona: Diàfora, 1975), also published in Spanish. The 1376 in the center of the wheel diagram was interpreted by Grosjean, *Catalan Atlas* 9 (note 2), as either the year of the atlas's completion or that of the next leap year.

6. Roberto Almagià, *Monumenta cartographica Vaticana*, 4 vols. (Rome: Biblioteca Apostolica Vaticana, 1944–55), vol. 1, *Planisferi, carte nautiche e affini dal secolo XIV al XVII esistenti nella Biblioteca Apostolica Vaticana*, 43a.

Faced with tables and calendars offering, in almost equal measure, dates that either confirm or contradict those of the works they accompany, we should obviously approach with caution those atlases whose dating has depended entirely on their calendars. The Medici and Pinelli-Walckenaer atlases are the most important of these. Their calendars start in 1351 and 1384 respectively, and many past commentators have, with insufficient justification, assumed those to be the dates of construction.

The world map at the beginning of the Medici atlas has attracted considerable interest because of its possible hint of South Africa. Many writers believed this map was reworked later, but opinion as to the date of its initial construction was strongly divided, with some supporting the calendar's date of 1351. However, as has been remarked, calendars often started in the first year of the century or half-century.⁷ Anyway, in Wieser's opinion, 1351 was referred to as a year that had already passed.⁸ Other scholars followed Wieser in proposing an early fifteenth-century date for the atlas. Since no one has suggested that the work is in more than one hand (except for the possible redrawing of southern Africa) it follows that these dates for the world map would have to be applied also to the portolan atlas that accompanies it. One way to test the validity of the 1351 date derived from the calendar would be to look for dating indications in the regional charts.

Cortesão—one of the few to have considered the charts in the Medici atlas—proposed a date about 1370, purely because of the relative sophistication of the Canary and Madeira archipelagoes.⁹ Using the place-name analysis, it can now be shown that Santarém was nearest the mark when he asserted in 1852 that the Medici atlas comprised a “collection of marine charts of different periods.”¹⁰

Besides the calendar and world map, the atlas contains three small-scale overlapping charts covering the Mediterranean and larger-scale sheets for the Adriatic, Aegean, and Black seas. There is also an important half-sheet devoted to the Caspian. Given that there are no surviving dated charts between the 1339 Dulcert and the 1367 Pizigani, it cannot be predicted what place-names a chart of 1351 might be expected to contain. Nevertheless, the three general sheets of the Mediterranean include none of the “significant” additional names first encountered in 1367 or later.¹¹ A date about 1351 is therefore quite plausible for these on strictly toponymic grounds. It is probably applicable as well to the enlarged drafts of the Aegean and Black seas. Despite having a handful of extra names, these include between them only three significant additions from 1367 onward—not an indication of any notable input of new names. But when the detailed Adriatic sheet is compared with the two similar, but smaller-scale versions, it is clear that quite different toponymic generations are involved.

Separate entries for the two elements of the Medici atlas in table 19.3, pp. 416–20, show how the toponymic profile of the larger-scale Adriatic sheet suggests a date in the first half of the fifteenth century. The strictly numerical relationship of the three Medici atlas treatments of the Adriatic is considered in table 19.4. The large-scale sheet has some 50 percent more names than the other two. Lest this be interpreted as merely a result of its increased size, it should be noted that 20 percent of the names on one of the smaller versions were ignored by

the larger. When these sheets are considered as part of the broader analysis of Adriatic names, they are found to reflect the widespread differences between the patterns current in the mid-fourteenth and the early fifteenth centuries.

If the sheets of the Medici atlas were all drawn at the same time (though some would be copies of earlier work), it must follow from the toponymic evidence that the often accepted date of 1351 has to be abandoned (for its charts and world map alike) in favor of one from the first half of the fifteenth century. Similarly, the analysis of the Pinelli-Walckenaer atlas's names in table 19.3 indicates that its calendar-inspired date of 1384 should be replaced by one from that same general period.

TABLE 19.4 Adriatic Names between Otranto and Vlorë (Valona) on the Three Relevant Sheets of the Medici Atlas (see fig. 19.19)

	Larger-Scale Adriatic (1)	Smaller-Scale Northwestern Europe (2)	Smaller-Scale Eastern Mediterranean (3)
Totals	151	106	91 ^a
Not on (1)		22	15
Not on (2)	66		4
Not on (3)	74 ^a	14	
Not on the other two sheets	63	6	0

^aA small section around Venice is excluded, with the omission of perhaps six names.

7. Biblioteca Nazionale Marciana and Archivio di Stato, Venice, *Mostra dei navigatori veneti del quattrocento e del cinquecento*, exhibition catalog (Venice, 1957), 91–92.

8. Franz R. von Wieser, *Die Weltkarte des Albertin de Virga aus dem Anfange des XV. Jahrhunderts in der Sammlung Figdor in Wien* (Innsbruck: Schurich, 1912), 12; reprinted in *Acta Cartographica* 24 (1976): 427–40.

9. Armando Cortesão, *History of Portuguese Cartography*, 2 vols. (Coimbra: Junta de Investigações do Ultramar-Lisboa, 1969–71), 2:58.

10. 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), 3:LXIX (author's translation).

11. For explanation of the toponymic analysis, see appendix 19.5.

APPENDIX 19.2 BIOGRAPHICAL INDEX TO THE ATLASES AND CHARTS PRODUCED UP TO 1500

	Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
ABENZARA. See under Jehuda ben Zara						
AGUIAR, Jorge de (Portuguese)	1492	C	Lisbon	New Haven, Beinecke Library, Yale University		Corteseão, <i>History of Portuguese Cartography</i> , vol. 1, frontispiece; vol. 2, fig. 90 ^b
BECCARI, Batista ^c (misread as Beclario, Bedrazius, Bescario) (of Genoa)	1426	C		Munich, Bayerische Staats- bibliothek, Codex Icon. 130	4.4:1453	De La Roncière, <i>Afrique</i> , vol. 6, pl. XXII ^d
	1435	C ^c		Parma, Biblioteca Palatina, II, 21, 1613		Frabetti, <i>Carte nautiche italiane</i> , pl. 2 (note e)
<i>Attributed^f</i>		C		[London, Christie's, 2 De- cember 1964, lot 77, ex Rex Beaumont]		
		C		[Genoa, Amedeo Dallai—in 1951]		Revelli, "Beccari," 162– 63 ^g
BECCARI, Francesco (Bechaa, Ircharius) (of Genoa) working in Barcelona, 1399– 1400	1403	C	Savona	New Haven, Beinecke Li- brary, Yale University		
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		
BENINCASA, Andrea (of Ancona), son of Grazioso	1476	A5 ^h		Geneva, Bibliothèque Pub- lique et Universitaire, MS. Lat. 81		Atlantic: Corteseão, <i>Nautical Chart of 1424</i> , pl. XV; Lelewel, <i>Géo- graphie</i> , pls. 34–35 ⁱ
	1490	C		Ancona, Museo Nazionale, 253		Revelli, <i>Partecipazione italiana</i> , no. 35 ⁱ
	1508	C	Ancona	Rome, Biblioteca Apostolica Vaticana, Borgiano VIII		Almagià, <i>Vaticana</i> , vol. 1, pl. XX ^k
BENINCASA, Grazioso (of Ancona)	[1461?]	C	Genoa	Florence, Archivio di Stato, CN6		
	1461	C	Genoa	Florence, Archivio di Stato, CN5		
	1463	A5	Venice	London, British Library, Add. MS. 18454		Atlantic: Corteseão, <i>Nautical Chart of 1424</i> , pl. XII (note i)
	1463	A4	Venice	London (Royal Army Medi- cal Corps—stolen 1930)		
	1465	A5	Venice	Vicenza, Biblioteca Civica Bertoliana, 598b		
	1466	A5	Venice	Paris, Bibliothèque Nation- ale, Rés. Ge. DD 2779		
	1467	A5	Rome	London, British Library, Add. MS. 11547		Eastern Mediterranean: Stylianou and Stylianou, <i>Cyprus</i> , 177–78 ^l

APPENDIX 19.2—*continued*

Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
				Kamal ^a	Selected Accessible Works
1467	A5	Rome	Nogent-sur-Marne, Bibliothèque Nationale Annexe		Nordenskiöld, <i>Periplus</i> , pls. XXXIII, XL ^m
1467	A5	Rome	Paris, Bibliothèque Nationale, Rés. Ge. DD 1988	5.1:1497 [Atlantic]	
1468	A7	Venice	Great Britain, private collection—ex Lanza di Trabia and Kraus		
1468	A6	[Genoa]	London, British Library, Add. MS. 6390		Atlantic: Cortesão, <i>History of Portuguese Cartography</i> , vol. 2, fig. 83 (note b)
1468	C	Venice	Palma de Mallorca, Fundación Bartolomé March Servera		Caraci, “Grazioso Benincasa,” 18 ⁿ
1469	A6	Venice	London, British Library, Add. MS. 31315		
1469	A6	Venice	Milan, Biblioteca Ambrosiana, S.P., 2, 35		Atlantic: Cortesão, <i>History of Portuguese Cartography</i> , vol. 1, fig. 84 (note b)
1470	C	Ancona	London, British Library, Add. MS. 31318A		Atlantic: Cortesão, <i>Nautical Chart of 1424</i> , pl. XIII (note i)
1471	A6	Venice	Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 9016		Almagià, <i>Vaticana</i> , vol. 1, pl. XVII–XVIII (note k); Santarém, <i>Atlas</i> , pls. VIII–IX ^o
1472	A8		[Milan, Luigi Bossi—before 1882]		
1472	C	Venice	Venice, Museo Civico Collezione Correr, Port. 5		Salinari, “Notizie,” 40 ^p
1473	A6	Venice	Bologna, Biblioteca Universitaria, MS. 280		North Atlantic: Frabetti, <i>Carte nautiche italiane</i> , pl. III (note e)
1473	A6	Venice	London, British Library, Egerton MS. 2855		
1474	A6	Venice	Budapest, Magyar Nemzeti Múzeum, Codex Lat. M.A. 353		
1480	A6	Ancona	Vienna, Österreichische Nationalbibliothek, MS. 355		
1482	C	Ancona	Bologna, Biblioteca Universitaria, Rot. 3		Frabetti, <i>Carte nautiche italiane</i> , pl. IV (note e)
<i>Acknowledged copies</i> [1489]	C2		London, British Library, Egerton MS. 73		
<i>Attributed</i>	C	[Venice?]	Florence, Archivio di Stato, CN9		Western section: Cortesão, <i>Nautical Chart of 1424</i> , pl. XIV (note i)

	Date	Atlas (A) or Chart (C)	Where	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
		A5		Milan, Biblioteca Trivulziana, Codex 2295		
BERTRAN, Jaime (of Barcelona), Jewish	1456	C	Barcelona	Greenwich, National Maritime Museum, G230:1/7 MS—co-signed with Ripoll		Howse and Sanderson, <i>Sea Chart</i> , 18 ^q
	1482	C	Majorca	Florence, Archivio di Stato, CN7	5.1:1503	Western section: Cortesão, <i>Nautical Chart of 1424</i> , pl. XVII (note i); Winter, “Catalan Portolan Maps,” 4 ^r
	1489	C	Majorca	Florence, Biblioteca Marucelliana		
BIANCO, Andrea (of Venice), galley officer	1436	A7		Venice, Biblioteca Nazionale Marciana, It. Z.76		Nordenskiöld, <i>Periplus</i> , 19, pls. XX–XXI (note m)
	1448	C	London	Milan, Biblioteca Ambrosiana, F.260, inf. (1)	5.1:1492	Cortesão, <i>History of Portuguese Cartography</i> , 2:143 (note b)
BOSCAINO, Ponent ^s BRIATICO, Cola de	1430	A3		Siena, Biblioteca Comunale, SV2	4.4:1460–61	Atlantic: Cortesão, <i>Nautical Chart of 1424</i> , pl. IV (note i)
BUONDELMONTI (see pp. 379–80)						
CANEPA, Albino da (of Genoa)	1480	C	Genoa	Rome, Società Geografica Italiana		Revelli, <i>Colombo</i> , pl. 80 ^f
	1489	C	Genoa	Minneapolis, University of Minnesota, James Ford Bell Collection, B1489mCa		Cortesão, <i>Nautical Chart of 1424</i> , pl. XVI—wrongly captioned as 1480 (note i)
CARIGNANO, Giovanni da (of Genoa), priest	Early 14th century	Map	Genoa	Florence, Archivio di Stato, CN2—destroyed 1943	4.1:1138–39	Nordenskiöld, <i>Periplus</i> , pl. V. (note m)
CESANIS, Alvixe (Aloyse, Luigi) (Cexano)						
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		
CESANIS, Francesco de (Cexano) (of Venice)	1421	C		Venice, Museo Civico, Collezione Correr, Port. 13	4.4:1417	
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton, MS. 73		
<i>Attributed</i>		A8		Genoa, Biblioteca Civica Berio—the Luxoro atlas	4.2:1245	(See p. 420 and notes 273, 363, and 364) and under “Luxoro atlas” in appendix 19.3

APPENDIX 19.2—*continued*

	Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
COLUMBUS, Christopher <i>Attributed</i> (but not generally accepted)	Late 15th or early 16th century	C		Paris, Bibliothèque Nationale, Rés. Ge. AA 562		Bagrow, <i>History of Cartography</i> , pl. LIV; ¹ de La Roncière, <i>Afrique</i> , vol. 13, pl. XXXVIII (note d)
CONPIMENTO DEL- CEXANO ^v CRESQUES ABRAHAM (of Majorca), Jewish <i>Attributed</i> ^w	[1375]	6 panels		Paris, Bibliothèque Nationale, MS. Esp. 30—the Catalan atlas	4.3:1301–3	(See under “Catalan atlas” in appendix 19.3)
DALORTO, Angelino de—possibly the same as Dulcert	1325/30	C		Florence, Prince Filippo Corsini	4.2:1197–98	Hinks, <i>Dalorto</i> ^x
DOMENECH, Arnaldo (Guide to weights and measures, not a chart)	[148–] 1484	C	Naples	Greenwich, National Maritime Museum, G230:1/9 MS Washington, D.C., Library of Congress, vellum chart 4		Ristow and Skelton, <i>Nautical Charts on Vellum in the Library of Congress</i> , 3 ^y
DULCERT, Angelino (misread as Dolcedo)—possibly the same as Dalorto <i>Attributed</i>	1339	C	Palma	Paris, Bibliothèque Nationale, Rés. Ge. B 696	4.2:1222	Nordenskiöld, <i>Periplus</i> , pls. VIII–IX (note m); Putman, <i>Early Sea Charts</i> , pl. 1 ^z
FLORINO, Nicolo (of Venice) <i>Acknowledged copy</i>	1462 [1489]	A2 C		London, British Library, Add. MS. 25691 Vienna, Österreichische Nationalbibliothek, K.II. 100.725	4.3:1334	Winter, “Das katalanische Problem” ^{aa}
FREDUCCI, Conte Hectomano ^{bb} (of Ancona) <i>Attributed</i>	1497	C		Wolfenbüttel, Herzog August Bibliothek, Codex Guelf 99 Weimar, Zentralbibliothek der Deutschen Klassik		Nordenskiöld, <i>Periplus</i> , pl. XXII (note m) Bagrow, <i>History of Cartography</i> , pl. XLV (note u); Cortesão, <i>Nautical Chart of 1424</i> , pl. VIII (note i)
GIOVANNI, Giorgio (of Venice) GIROLDI, Giacomo (Zeroldi) (of Venice)	1494 1422	C C	Venice	Parma, Biblioteca Palatina, II, 30, 1622 Paris, Bibliothèque Nationale, Rés. Ge. C 5088	4.4:1420	Frabetti, <i>Carte nautiche italiane</i> , pl. 5 (note e)

	Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
	1426 ^{cc}	A6		Venice, Biblioteca Nazionale Marciana, It. VI, 212	4.4:1452	Nordenskiöld, <i>Periplus</i> , pl. IV (note m)
	1443	A6		Milan, Biblioteca Ambrosiana, S.P., 2, 38		
	1446	A6		Florence, Accademia Toscana di Scienze e Lettere "La Colombaria," 229		
<i>Attributed</i>		A6		Chicago, Newberry Library, Ayer Collection, MS. Map 2		
		A5		London, British Library, Add. MS. 18665		
		A6		Milan, Biblioteca Ambrosiana, S.P., 2, 39		
		C		New York, Hispanic Society of America, K4		Stevenson, <i>Facsimiles</i> , pl. 1 ^{dd}
		A5		Rome, Biblioteca Apostolica Vaticana, Rossiano 676		Almagià, <i>Vaticana</i> , vol. 1, pl. XVI (note k)
	1452	A3		Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 9015		
JEHUDA BEN ZARA (Abenzara, Ichidabruzara)	1497	C	Alexandria	Rome, Biblioteca Apostolica Vaticana, Borgiano VII		Almagià, <i>Vaticana</i> , vol. 1, pl. XIX (note k)
	1500	C	Alexandria	Cincinnati, Klau Library, Hebrew Union College		Dürst, <i>Iehuda ben Zara</i> , 11; Kraus, <i>Remarkable Manuscripts</i> , 83; Roth, "Judah Abenzara" ^{see}
	1505	C	Safed, Galilee	New Haven, Beinecke Library, Yale University		
KĀTIBĪ, Tunuslu Ibrāhīm ^{ff} MARCH/MARE, Nicolo ^{gg} MARTELLUS GERMANUS, Henricus See pp. 379–80 MIRARO ^{hh}	[1413]	C		Istanbul, Topkapi Sarayı		
AL-MURSĪ, Ibrāhīm (of Tripoli), physician	[1461]	C	Tripoli (Libya?)	Istanbul, Deniz Muzesi		Rossi, "Carta nautica araba" ⁱⁱ
NICOLO, Nicolo de	1470	C		New York, Hispanic Society of America, K6		
NOLI, Agostino (of Genoa), see pp. 430 and 434						
PARETO, Bartolomeo de (of Genoa), priest	1455	C	Genoa	Rome, Biblioteca Nazionale, CN1		Revelli, <i>Colombo</i> , pl. 79 (note t)

APPENDIX 19.2—*continued*

	Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
PASQUALINI, C. ^{jj} Father of Nicolo de Pasqualini						
PASQUALINI, Nicolo de (Pasqualin, G.—mistake for Nicolo Pasqualini)	1408	A6		Vienna, Österreichische Nationalbibliothek, Codex 410*	4.3:1349	
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		
PELECHAN, Antonio (<i>Armiralò</i> of Rethymnon, Crete)	1459	C	Rethymnon	Venice, Archivio di Stato, LXXXV no. 1		
PESINA, Benedetto	1489	C	Venice	London, British Library, Egerton MS. 73		
PIZIGANO, Domenico or Marco	1367	C	Venice	Parma, Biblioteca Palatina, Parm. 1612—signed with Francesco	4.2:1285–86; 4.4:1483	
PIZIGANO, Francesco (Piçegany) (of Venice)	1367	C	Venice	Parma, Biblioteca Palatina, Parm. 1612—signed with Domenico or Marco	4.4:1483	
	1373	A5	Venice	Milan, Biblioteca Ambrosiana, S.P., 10, 29	4.2:1289	Nordenskiöld, <i>Periplus</i> , 29, 31, 51, 55 (note m)
[PIZZIGANO, Zuane]	1424	C		Minneapolis, University of Minnesota, James Ford Bell Collection, B1424mPi		Corteseo, <i>Nautical Chart of 1424</i> (note i); Corteseo, <i>History of Portuguese Cartography</i> , 2:126–27 (note b)
PONGETO, Sentuzo	1404	C		[Munich, Weiss und Co., in 1926—see p. 396 and note 215]		(Partial) in Weiss und Co., <i>Codices</i> ^{kk}
REINEL, Pedro (Portuguese)	[1483?]	C		Bordeaux, Archives Départementales de Gironde, 2 Z 1582 bis.		Corteseo, <i>History of Portuguese Cartography</i> , vol. 2, frontispiece (note b); Corteseo and Teixeira de Mota, <i>Portugaliae monumenta cartographica</i> , 5:521 ^{ll}
RIPOLL, Berenguer	1456	C	Barcelona	Greenwich, National Maritime Museum, G230:1/7 MS—co-signed with Bertran		Howse and Sanderson, <i>Sea Chart</i> , 18 (note q)
ROSELLI, Petrus (Pere Rossell)	1447	C	Majorca	North America, private collection—ex Nebenzahl, Chicago		Nebenzahl, <i>Rare Americana</i> ^{mmm}
	1447	C	Palma	Volterra, Museo e Biblioteca Guarnacciana, MS. C.N. 1BG		Revelli, <i>Colombo</i> , pl. 35 (note t)
	1449	C	Palma	Karlsruhe, Badische Landesbibliothek, S6		
	1456	C	Palma	Chicago, Newberry Library, Ayer Collection, MS. Map 3		
	1462	C	Palma	Paris, Bibliothèque Nationale, Rés. Ge. C 5090		

	Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
	1464	C	Palma	Nuremberg, Germanisches Nationalmuseum, Codex La. 4017		Corteseão, <i>Nautical Chart of 1424</i> , pl. X (note i); Winter, "Ros- selli," 1 ⁿⁿ
	1465	C	Palma	London, British Library, Egerton MS. 2712		
	1466	C	Palma	Minneapolis, University of Minnesota, James Ford Bell Collection		Corteseão, <i>Nautical Chart of 1424</i> , pl. XI (note i)
	1468	C	Palma	New York, Hispanic Society of America, K35		Stevenson, <i>Facsimiles</i> , pl. 2 (note dd)
	1469	C	Majorca	[Washington, D.C., Otto H. F. Vollbehr—in 1935]		
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		
<i>Attributed</i>		C		Modena, Biblioteca Estense e Universitaria, C.G.A. 5b		
		C		[Munich, Ludwig Rosen- thal, catalog 167]		
		C		Paris, Bibliothèque Nation- ale, Rés. Ge. C 5096		
RUSO, Pietro ^{oo}						
SOLER, Guilermo	1385	C		Florence, Archivio di Stato, CN3	4.3:1320	Nordenskiöld, <i>Periplus</i> , pl. XVIII (note m)
		C		Paris, Bibliothèque Nation- ale, Rés. Ge. B 1131	4.3:1322	
SOLIGO, Cristoforo						
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73	5.1:1510	
SOLIGO, Zuane						
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		
VALSECA, Gabriel de (of Majorca), con- verted Jew	1439	C	Majorca	Barcelona, Museo Marí- timo, inv. no. 3236	5.1:1491	De La Roncière, <i>Afrique</i> , vol. 5, pl. XII (note d)
	1447	C	Majorca	Paris, Bibliothèque Nation- ale, Rés. Ge. C 4607		Kish, <i>Carte</i> , pl. 43 ^{pp} ; Putman, <i>Early Sea Charts</i> , pl. 2 (note z)
	1449	C	Majorca	Florence, Archivio di Stato, CN22		
VESCONTE, Perrino (of Genoa), possibly the same as Pietro	1321	A4	Venice	Zurich, Zentralbibliothek, R.P.4		
	1327	C	Venice	Florence, Biblioteca Medi- cea Laurenziana, Med. Pal. 248	4.2:1205	Nordenskiöld, <i>Periplus</i> , pl. VIIA (note m)
<i>Attributed</i>		C		Amsterdam, Nico Israel— but see note 274		Sotheby's <i>Highly Impor- tant Maps and Atlases</i> ; N. Israel, <i>Interesting Books</i> ^{9a}

APPENDIX 19.2—*continued*

	Date	Atlas (A) or Chart (C)	Where Made	Where Preserved	Reproductions	
					Kamal ^a	Selected Accessible Works
VESCONTE, Pietro (of Genoa), possibly the same as Perrino	1311	C		Florence, Archivio di Stato, CN1	4.1:1140	Nordenskiöld, <i>Periplus</i> , pl. V (note m)
	1313	A6		Paris, Bibliothèque Nation- ale, Rés. Ge. DD 687	4.1:1147–49	
	1318	A6	Venice	Venice, Museo Civico, Col- lezione Correr, Port. 28	4.1:1154	
	1318	A10		Vienna, Österreichische Na- tionalbibliothek MS. 594		Nordenskiöld, <i>Periplus</i> , pl. VI (note m); Pagani, <i>Vesconte</i> ^{tr}
	[1320?]	A5		Rome, Biblioteca Apostolica Vaticana, Pal. Lat. 1362A	4.1:1160–61	Almagià, <i>Vaticana</i> , vol. 1, pls. IV–VIII (note k)
<i>Attributed</i> (possibly by Perrino)	ca. 1322	A7	Venice	Lyons, Bibliothèque de la Ville, MS. 175		De La Roncière, <i>Lyon</i> , pls. I–IX ^{ss}
	[1321]	A5		Rome, Biblioteca Apostolica Vaticana, Vat. Lat. 2972	4.1:1170	Almagià, <i>Vaticana</i> , vol. 1, pls. VIII–IX (note k)
	ca. 1325	A5		London, British Library, Add. MS. 27376*		
VILADESTES, Johan- es de	1428	C	Palma	Istanbul, Topkapi Sarayi, 1826	4.4:1457	Winter, “Catalan Porto- lan Maps,” 1 (note r)
VILADESTES, Mecia de (Matias) (of Ma- jorca), converted Jew	1413	C		Paris, Bibliothèque Nation- ale, Rés. Ge. AA 566	4.3:1368	Western section: Corte- são, <i>Nautical Chart of</i> <i>1424</i> , pl. III (note i)
	1423	C	Palma	Florence, Biblioteca Medi- cea Laurenziana, Ashb. 1802		
VIRGA, Albertin de (of Genoa), author of world map dated 141–. See p. 357 and note 34	1409	C	Venice	Paris, Bibliothèque Nation- ale, Rés. Ge. D 7900	4.3:1350	
ZUANE, Domenico de (Zane, misread as Dezane)						
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		
ZUANE DI NAPOLI						
<i>Acknowledged copy</i>	[1489]	C		London, British Library, Egerton MS. 73		

^aYoussef Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51). For a list of contents by volume, see p. 40.

^bArmando Cortesão, *History of Portuguese Cartography*, 2 vols. (Coimbra: Junta de Investigações do Ultramar-Lisboa, 1969–71).

^cThere is still no consensus on how this and other names should be spelled. The forms used here follow the best recent authority in each case.

^dCharles de La Roncière, *La découverte de l'Afrique au Moyen Age: Cartographes et explorateurs*, Mémoires de la Société Royale de Géographie d'Égypte, vols. 5, 6, 13 (Cairo: Institut Français d'Archéologie Orientale, 1924–27).

^eIn this instance the chartmaker's first name has disappeared, but its final *a* can be read, and the chart is invariably assigned to Batista; see Pietro Frabetti, *Carte nautiche italiane dal XIV al XVII secolo conservate in Emilia-Romagna* (Florence: Leo S. Olschki, 1978), 8.

^fThere have been far more attributions of authorship than are mentioned in this list. Only plausible claims are included here.

^gPaolo Revelli, "Una nuova carta di Batista Beccari ('Batista Becharius')?" *Bollettino della Società Geografica Italiana* 88 (1951): 156–66.

^hThroughout appendixes 19.2, 19.3, and 19.4 the figure denotes the number of sheets containing charts.

ⁱArmando Cortesão, *The Nautical Chart of 1424 and the Early Discovery and Cartographical Representation of America: A Study on the History of Early Navigation and Cartography* (Coimbra: University of Coimbra, 1954); Joachim Lelewel, *Géographie du Moyen Age*, 4 vols. and epilogue (Brussels: J. Pilliet, 1852–57; reprinted Amsterdam: Meridian, 1966).

^jPaolo Revelli, *La partecipazione italiana alla Mostra Oceanografica Internazionale di Siviglia* (1929) (Genoa: Stabilimenti Italiani Arti Grafiche, 1937).

^kRoberto Almagià, *Monumenta cartographica Vaticana*, 4 vols. (Rome: Biblioteca Apostolica Vaticana, 1944–55), vol. 1, *Planisferi, carte nautiche e affini dal secolo XIV al XVII esistenti nella Biblioteca Apostolica Vaticana* (1944).

^lAndreas Stylianou and Judith A. Stylianou, *The History of the Cartography of Cyprus*, Publications of the Cyprus Research Centre, 8 (Nicosia, 1980).

^mA. E. Nordenskiöld, *Periplus: An Essay on the Early History of Charts and Sailing-Directions*, trans. Francis A. Bather (Stockholm: P. A. Norstedt, 1897).

ⁿGiuseppe Caraci, "An Unknown Nautical Chart of Grazioso Benincasa, 1468," *Imago Mundi* 7 (1950): 18–31.

^oManuel Francisco de Barros e Sousa, Viscount of Santarém, *Atlas composé de mappemondes, de portulans et de cartes hydrographiques et historiques depuis le VI^e jusqu'au XVII^e siècle* (Paris, 1849; facsimile reprint Amsterdam: R. Muller, 1985).

^pMarina Salinari (formerly Marina Emiliani), "Notizie su di alcune carte nautiche di Grazioso Benincasa," *Rivista Geografica Italiana* 59 (1952): 36–42.

^qDerek Howse and Michael Sanderson, *The Sea Chart* (Newton Abbot: David and Charles, 1973).

^rHeinrich Winter, "Catalan Portolan Maps and Their Place in the Total View of Cartographic Development," *Imago Mundi* 11 (1954): 1–12.

^sThe title of one sheet in the British Library's Cornaro atlas, interpreted as a personal name.

^tPaolo Revelli, *Cristoforo Colombo e la scuola cartografica genovese* (Genoa: Consiglio Nazionale delle Ricerche, 1937).

^uLeo Bagrow, *History of Cartography*, rev. and enl. R. A. Skelton, trans. D. L. Paisey (Cambridge: Harvard University Press; London: C. A. Watts, 1964).

^vThe title of one sheet in the British Library's Cornaro atlas, this presumably means "complement of Cexano's chart" rather than being a personal name.

^wThough the Catalan atlas is habitually attributed to Cresques Abraham, doubts have been raised. See this author's review of Georges Grosjean, *The Catalan Atlas of the Year 1375*, in *Imago Mundi* 33 (1981): 115–16, esp. 116.

^xArthur R. Hinks, *Portolan Chart of Angellino de Dalorto 1325 in the Collection of Prince Corsini at Florence, with a Note on the Surviving Charts and Atlases of the Fourteenth Century* (London: Royal Geographical Society, 1929).

^yWalter W. Ristow and R. A. Skelton, *Nautical Charts on Vellum in the Library of Congress* (Washington, D.C.: Library of Congress, 1977), 3.

^zRobert Putman, *Early Sea Charts* (New York: Abbeville Press, 1983).

^{aa}Heinrich Winter, "Das katalanische Problem in der älteren Kartographie," *Ibero-Amerikanisches Archiv* 14 (1940/41): 89–126.

^{ab}Most of Freducci's work dates from the sixteenth century. On this see Giuseppe Caraci, "The Italian Cartographers of the Benincasa and Freducci Families and the So-Called Borgiana Map of the Vatican Library," *Imago Mundi* 10 (1953): 23–49, and the further references given there.

^{ac}Though the date is normally read as 1426, Armando Cortesão thought 1427 or 1432 more likely; see *History of Portuguese Cartography*, 2:124, n. 87 (note b).

^{ad}Edward Luther Stevenson, *Facsimiles of Portolan Charts Belonging to the Hispanic Society of America*, Publications of the Hispanic Society of America, no. 104 (New York: Hispanic Society of America, 1916).

^{ae}The contention by Arthur Dürst that there were actually two 1497 charts is unconvincing; see *Seekarte des Iehuda ben Zara: (Borgiano VII) 1497*, pamphlet accompanying a facsimile edition of the chart (Zurich: Belser Verlag, 1983), p. 2 and n. 7. The now untraceable chart found by Santarém (actually Hommaire de Hell) in 1847 in the Collegio di Propaganda Fide is clearly identifiable with Borgiano VII, as was noted by earlier authorities, among them Roberto Almagià, *Vaticana*, 1:47 (note k). It is known that the Borgia material reached the Vatican via the Propaganda Fide. Dürst's other claim—that there were also two 1500 charts—can be swiftly dismissed. Photographs of the "Kraus" and "Cincinnati" charts show them to be one and the same; see H. P. Kraus, *Booksellers, Remarkable Manuscripts, Books and Maps from the IXth to the XVIIIth Century*, catalog 80 (New York: H. P. Kraus, 1956), and Cecil Roth, "Judah Abenzara's Map of the Mediterranean World, 1500," *Studies in Bibliography and Booklore* 9 (1970): 116–20.

^{af}On Arab chartmakers, see also pp. 374–75, the entry under al-Mursī in this appendix, and the entry for the Maghreb chart in appendix 19.3.

^{ag}Attempted decipherment of the illegible author's legend on the 1487 chart in Florence (Archivio di Stato, CN8).

^{ah}Misreading of *aemiralo* in the author's legend to Pelechan's chart; see entry under Pelechan and note 433.

^{ai}Ettore Rossi, "Una carta nautica araba inedita di Ibrāhīm al-Mursī datata 865 Egira = 1461 Dopo Cristo," in *Compte rendu du Congrès Internationale de Géographie* 5 (1926): 90–95 (Eleventh International Congress, Cairo, 1925).

^{aj}The initial C is a misreading of the word *de* in the inscription "Nicollaus fillius de Pasqualini Nicollai . . ." on the 1408 atlas—an indication, perhaps, that there were two chartmakers with the name Nicolo de Pasqualini.

^{ak}Weiss und Co., Antiquariat, *Codices manuscripti incunabula typographica catalogus primus* (Munich: Weiss und Co., 1926), no. 55.

^{al}Armando Cortesão and Avelino Teixeira da Mota, *Portugaliae monumenta cartographica*, 6 vols. (Lisbon, 1960).

^{am}Kenneth Nebenzahl, *Rare Americana*, catalog 20 (Chicago: Kenneth Nebenzahl, 1968), no. 1.

^{an}Heinrich Winter, "Petrus Roselli," *Imago Mundi* 9 (1952): 1–11.

APPENDIX 19.2—*continued*

⁹⁰Pietro Russo of Messina, who, it has been suggested, might have produced charts in the fifteenth century, has been omitted from this census. See Julio Rey Pastor and Ernest García Camarero, *La cartografía mallorquina* (Madrid: Departamento de Historia y Filosofía de la Ciencia, 1960), 92. None of his surviving work is dated before 1508. On his output see Roberto Almagià, “I lavori cartografici di Pietro e Jacopo Russo,” *Atti della Accademia Nazionale dei Lincei* 12 (1957): 301–19.

⁹¹George Kish, *La carte: Image des civilisations* (Paris: Seuil, 1980).

⁹²Sotheby's, *Catalogue of Highly Important Maps and Atlases*, 15

April 1980, lot A. The chart was sold to Nico Israel, antiquarian booksellers, and also appears in their Fall 1980 catalog, *Interesting Books and Manuscripts on Various Subjects: A Selection from Our Stock*, catalog 22 (Amsterdam: N. Israel, 1980), no. 1.

⁹³Lelio Pagani, *Pietro Vesconte: Carte nautiche* (Bergamo: Grafica Gutenberg, 1977).

⁹⁴Charles de La Roncière, *Les portulans de la Bibliothèque de Lyon*, fasc. 8 of *Les Portulans Italiens* in Lyon, Bibliothèque de la Ville, *Documents paléographiques, typographiques, iconographiques* (Lyons, 1929), 793.

APPENDIX 19.3 ATLASES AND CHARTS KNOWN BY NAME

Name	Atlas (A) or Chart (C)	Where Preserved	Reproductions	
			Kamal ^a	Selected Accessible Works
Atlante Mediceo <i>See Medici atlas</i>				
Carte Pisane/Carta Pisana	C	Paris, Bibliothèque Nationale, Rés. Ge. B 1118	4.1:1137	Bagrow, <i>History of Cartography</i> , pl. XXXII ^b
Catalan atlas	6 panels	Paris, Bibliothèque Nationale, MS. Esp. 30	4.3:1301–3	<i>Atlas Catalá</i> ; Grosjean, <i>Catalan Atlas</i> ; Nordenskiöld, <i>Periplus</i> , pls. XI–XIV; ^c Bagrow, <i>History of Cartography</i> , pls. XXXVII–XL, (note b)
Combitis atlas	A4	Venice, Biblioteca Nazionale Marciana, It. VI 213 [MS. 5982]	4.3:1333	
Cornaro atlas	(A34)	London, British Library, Egerton MS. 73	5.1:1508–12	
Cortona chart	C	Cortona, Biblioteca Comunale e dell'Accademia Etrusca		Armignacco, “Una carta nautica,” pls. I–III ^d
Laurentian portolano/Portolano Laurenziano-Gaddiano <i>See Medici atlas</i>				
Lesina chart	C	Lost?		Goldschmidt, “Lesina Portolan Chart” ^e
(Tammar) Luxoro atlas	A8	Genoa, Biblioteca Civica Berio	4.2:1245	Desimoni and Belgrano, “Atlante idrografico,” pls. I–VIII (reengraved copies); ^f Nordenskiöld, <i>Periplus</i> , pl. XVIII (note c)
Maghreb chart/Carta Mogrebina	C	Milan, Biblioteca Ambrosiana, S.P. II, 259	4.3:1336	Vernet-Ginés, “The Maghreb Chart,” 1 ^g
Medici/Medicean atlas	A6	Florence, Biblioteca Medicea Laurenziana, Gaddi 9	4.2:1246–48	Nordenskiöld, <i>Periplus</i> , 21, 115, pl. X (note c); Bagrow, <i>History of Cartography</i> , pl. XXXVI (world map) (note b)
Pinelli-Walckenaer atlas/Portolano Pinelli	A6	London, British Library, Add. MS. 19510	4.3:1316–19	Nordenskiöld, <i>Periplus</i> , pls. XV–XVII (note c)

^aYoussouf Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51).

^bLeo Bagrow, *History of Cartography*, rev. and enl. R. A. Skelton, trans. D. L. Paisley (Cambridge: Harvard University Press; London: C. A. Watts, 1964).

^c*L'atlas catalá de Cresques Abraham: Primera edició completa en el sis-cents aniversari de la seva realització* (Barcelona: Diáfora, 1975), also published in Spanish; Georges Grosjean, ed., *The Catalan Atlas of the Year 1375* (Dietikon-Zurich: Urs Graf, 1978); A. E. Nordenskiöld, *Periplus: An Essay on the Early History of Charts and Sailing-Directions*, trans. Francis A. Bather (Stockholm: P. A. Norstedt, 1897).

^dVera Armignacco, “Una carta nautica della Biblioteca dell'Accademia Etrusca di Cortona,” *Rivista Geografica Italiana* 64 (1957): 185–223.

^eE. P. Goldschmidt, “The Lesina Portolan Chart of the Caspian Sea” (with a commentary by Gerald R. Crone), *Geographical Journal* 103 (1944): 272–78, reproduction between 274 and 275.

^fCornelio Desimoni and Luigi Tommaso Belgrano, “Atlante idrografico del medio evo,” *Atti della Società Ligure di Storia Patria* 5 (1867): 5–168.

^gJuan Vernet-Ginés, “The Maghreb Chart in the Biblioteca Ambrosiana,” *Imago Mundi* 16 (1962): 1–16.

APPENDIX 19.4
 CHRONOLOGICAL INDEX OF DATED AND
 DATABLE ATLASES AND CHARTS PRODUCED
 UP TO 1500

Date		Atlas (A) or Chart (C)	Where Made	Date		Atlas (A) or Chart (C)	Where Made
1311	Pietro Vesconte	C		1459	Pelechan	C	Rethymnon, Crete
1313	Pietro Vesconte	A6		1461	G. Benincasa	C	Genoa
1318	Pietro Vesconte	A6	Venice ^a	[1461]	al-Mursī	C	Tripoli, [Libya?]
1318	Pietro Vesconte	A10		1462	Florino	A2	
[1320?]	Pietro Vesconte	A5		1462	Roselli	C	Palma
[1321]	[Pietro Vesconte]	A5		1463	G. Benincasa	A5	Venice
1321	Perrino Vesconte	A4	Venice	1463	G. Benincasa	A4	Venice
ca. 1322	Pietro Vesconte	A7	Venice	1464	Roselli	C	Palma
ca. 1325	[Vesconte]	A5		1465	G. Benincasa	A5	Venice
1327	Perrino Vesconte	C	Venice	1465	Roselli	C	Palma
1325/30	Dalorto	C		1466	G. Benincasa	A5	Venice
1339	Dulcert	C	Palma	1466	Roselli	C	Palma
1367	F. Pizigano (with D. or M. Pizi- gano)	C	Venice	1467	G. Benincasa	A5	Rome
1373	F. Pizigano	A5	Venice	1467	G. Benincasa	A5	Rome
[1375]	Catalan atlas	6 panels		1467	G. Benincasa	A5	Rome
1385	Soler	C		1468	G. Benincasa	A6	
1403	F. Beccari	C	Savona	1468	G. Benincasa	A7	Venice
1404	Pongeto	C		1468	G. Benincasa	C	Venice
1408	Pasqualini	A6		1468	Roselli	C	Palma
1409	Virga	C	Venice	1469	G. Benincasa	A6	Venice
1413	M. de Viladestes	C		1469	G. Benincasa	A6	Venice
[1413]	Kâtibî	C		1469	Roselli	C	Majorca
1421	F. de Cesanis	C		1470	G. Benincasa	C	Ancona
1422	Giroldi	C		1470	Nicolo	C	
1423	M. de Viladestes	C	Palma	1471	G. Benincasa	A6	Venice
1424	[Z. Pizzigano]	C		1472	G. Benincasa	A8	
1426	B. Beccari	C		1472	G. Benincasa	C	Venice
1426 ^b	Giroldi	A6		1473	G. Benincasa	A6	Venice
1428	J. de Viladestes	C	Palma	1473	G. Benincasa	A6	Venice
1430	Briatico	A3		1474	G. Benincasa	A6	Venice
1435	[B.] Beccari	C		1476	A. Benincasa	A5	
1436	Bianco	A7		1480	G. Benincasa	A6	Ancona
1439	Valseca	C	Majorca	1480	Canepa	C	Genoa
1443	Giroldi	A6		1482	G. Benincasa	C	Ancona
1446	Giroldi	A6		1482	Bertran	C	Majorca
1447	Roselli	C	Majorca	1487 ^c		C	Majorca
1447	Roselli	C	Palma	1489	Bertran	C	Majorca
1447	Valseca	C	Majorca	1489	Canepa	C	Genoa
1448	Bianco	C	London	1489	Pesina	C	Venice
1449	Roselli	C	Palma	148–	Domenech	C	Naples
1449	Valseca	C	Majorca	1490	A. Benincasa	C	
1452	[Giroldi?]	A3		1492	Aguiar	C	Lisbon
1455	Pareto	C	Genoa	1494	Giovanni	C	Venice
1456	Bertran and Ripoll	C	Barcelona	1497	Freducci	C	
1456	Roselli	C	Palma	1497	Jehuda ben Zara	C	Alexandria
				1500	Jehuda ben Zara	C	Alexandria

Note: For present-day locations and a note of reproductions, see appendixes 19.2 and 19.3.

^aThe Venetian year began on 1 March; some of the charts signed from Venice could therefore actually belong to the following year.

^bThough the date is normally read as 1426, Armando Cortesão thought 1427 or 1432 more likely; see his *History of Portuguese Cartography*, 2 vols. (Coimbra: Junta de Investigações do Ultramar-Lisboa, 1969–71), 2:124 n. 87.

APPENDIX 19.5 METHODOLOGY OF THE TOPONYMIC ANALYSIS

The toponymic analysis set out in table 19.3 (pp. 416–20) has not been published before, nor has its methodology been explained elsewhere. Since its findings underpin many of the new conclusions of this essay, it is necessary that its procedures be briefly explained. Despite the exclusion of all names north of Dunkirk and south of Mogador (areas frequently left off the charts themselves) as well as the omission of islands,¹ there were still twelve hundred names (of varying degrees of legibility) to be considered on a typical chart. If a comparative analysis was to be made of more than a handful of charts, there was a clear need for a research technique that would reduce this mass of place-names to manageable proportions. The method adopted comprised four stages, as follows.

1. Seven works were selected for a pilot study, as representatives of different periods and various centers of production. A complete transcription was made of their mainland names between Dunkirk and Mogador:

	<i>Published transcriptions</i>
a. 1311 Pietro Vesconte chart (substituting the 1313 atlas for the omitted western section)	
b. ca. Vesconte atlas, British Library, 1325 Add. MS. 27376*	
c. 1375 Catalan atlas	Grosjean, <i>Catalan Atlas</i> , 53–77 ²
d. 1426 Giacomo Girolodi atlas	Nordenskiöld, <i>Periplus</i> , 25–44 ³
e. 1468 Grazioso Benincasa atlas, British Library, Add. MS. 6390	
f. 1468 Petrus Roselli chart ⁴	
g. 1512 Vesconte Maggiolo atlas	Grosjean, <i>Maggiolo</i> , ⁵

2. The parallel columns of the pilot study lists were compared and a note was made when names were added or removed or when the name form underwent drastic change. The names first recorded on works (b) to (f) and repeated at least once thereafter were termed “significant.” Including 18 names first discerned on the 1512 Maggiolo atlas, these came to the surprisingly large total of 415. Names that were unique to any work in the pilot study except the last were excluded from this analysis; the concern was with the transmission of infor-

¹Florence, Archivio di Stato, CN8. Reproduced in Youssouf Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51), 5.1:1506, and the western portion in Armando Cortesão, *The Nautical Chart of 1424 and the Early Discovery and Cartographical Representation of America: A Study on the History of Early Navigation and Cartography* (Coimbra: University of Coimbra, 1954), pl. XVIII.

mation, not with individuality. Variations in spelling, which might point to corruption or local dialect, were not considered in this context, and clearly distinct forms were treated as separate names even if they seemed to refer to the same place. Over the same period, about 100 names apparently became obsolete, but a larger time span would be needed to check that they were not revived later, as sometimes happened (for an example of this, see text footnote 379).

3. The significant additions were listed and their presence or absence was checked on the dated and datable charts and atlases produced up to 1430—the approximate point at which the portolan chart reproductions end in Kamal, *Monumenta cartographica*, 4.1–4 and 5.1.⁶ Once this exercise had been completed, each significant name could be paired with the dated work on which it had made its first certain appearance on the portolan charts.

4. The results of (3) were then applied to those undated works that had in the past been realistically assigned to the period up to 1430.⁷ In this way each chart was provided with a “toponymic profile” (as set out in tabulated form in appendix 19.3), which indicated the number of names present out of each group of datable innovations. The toponymic profile, a generalized and quantified record, could then indicate the most likely chronological slot for the chart concerned by means of a comparison with equivalent profiles on dated works.

1. Although islands were not considered in the general toponymic analysis, a special study of Cyprus names considered forty-three charts and atlases from the late thirteenth century to 1497; see Tony Campbell, “Cyprus and the Medieval Portolan Charts,” *Kupriakai Spoudai: Deltion tēs Etaireias Kupriakōn Spoudōn, Brabeuthen upō tēs Akadēmias Athēnōn* 48 (1984): 47–66, esp. 52–58 and the tables.

2. Georges Grosjean, ed., *The Catalan Atlas of the Year 1375* (Dietikon-Zurich: Urs Graf, 1978).

3. A. E. Nordenskiöld, *Periplus: An Essay on the Early History of Charts and Sailing-Directions*, trans. Francis A. Bather (Stockholm: P. A. Norstedt, 1897).

4. Edward Luther Stevenson, *Facsimiles of Portolan Charts Belonging to the Hispanic Society of America*, Publications of the Hispanic Society of America, no. 104 (New York: Hispanic Society of America, 1916), pl. 2.

5. Georges Grosjean, ed., *Vesconte Maggiolo “Atlante Nautico del 1512”*: *Seeatlas vom Jahre 1512* (Dietikon-Zurich: Urs Graf, 1979).

6. Youssouf Kamal, *Monumenta cartographica Africae et Aegypti*, 5 vols. in 16 pts. (Cairo, 1926–51). All but two of the twenty-eight works involved were examined directly or through reproductions—note b to table 19.3, pp. 416–20, explains the omissions.

7. It was possible to consider twenty-one out of the twenty-seven works concerned, see table 19.3, note a, for the details of those that could not be examined.

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