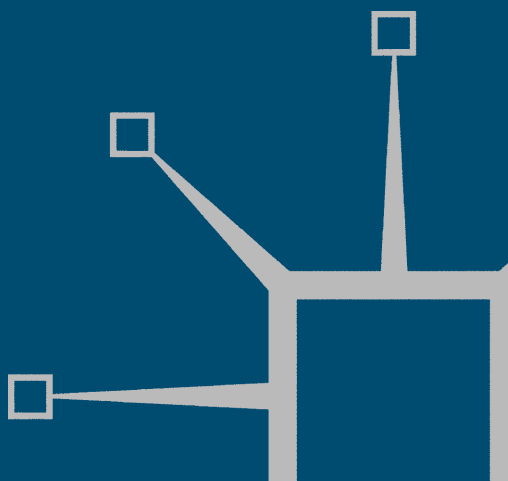# Ships on Maps

Pictures of Power in Renaissance Europe

Richard W. Unger

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Pictures of Power in Renaissance Europe

Richard W. Unger
Professor of History, University of British Columbia, Canada

For my late long-time companions with roots in Newfoundland

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Preface

The goal here is a simple one: to explain why ships appeared as decoration on European maps beginning in the Renaissance. The understanding of maps and, with it, the history of cartography have undergone a transformation in the last four decades. The distinguished historian David Buisseret has identified three significant ways in which the field has changed. First, the definition of what is a map has become more extensive and more precise. Second, there is now an effort and even a requirement to put maps in their social and economic framework. Third, work of both historians and anthropologists has shown that there is a mapping impulse which is universal among human societies.[1] The first and last have meant a new understanding of mapping and demonstrated that there are many aspects to the ways in which people conceive of and then give graphic representation to what they know about the physical world.

'There is a paradox at the heart of modern cartography. The more it aims to furnish a precise and comprehensive representation of reality, the less true to life this representation appears.'[2] Maps are still and silent and static. They represent a point in time rather than existing in the unfolding of human actions. They are not true to life since people experience the world not statically but through motion. While modern human beings have been trained by the cartography that emerged from the Renaissance to think in terms of coordinates, to locate sites in a mental map, that is not the only way to deal with comprehending the physical environment. It may well be that rather than using mapping in that post-Renaissance sense that people in the past typically found their way by remembering the history of a place, by knowing a story of how to get from one place to the next.[3] Way-finding existed before maps and continued and still continues even with the electronic aids to creating maps in the twenty-first century. GPS which becomes ever more common is in a sense a restoration of way-finding with routes understood and presented on an electronic grid but with a disembodied voice reporting landmarks and giving directions on how to get to a destination. Way-finding lay at the heart of new forms of cartography in the Renaissance as did classical scientific efforts at mapping which reached fifteenth century map makers through rediscovered second century texts. The combination of forces at work on the artists and scientists of the period all had an effect on their products which took on many new features. It was a period of uncertainty which opened the door to constant discovery.

In what follows here there is little novel in the discussion of the evolution of maps from the classical world to and through the first half of the sixteenth century. Much of that development has been tracked in the past and with care by

excellent historians, always with an eye to gathering the most comprehensive information possible. The pattern of change created the framework for choices made about what went on maps and so that history is necessary to understanding any aspect of what medieval map makers did. Existing histories of cartography tend to repeat the same information, especially since the concentration has invariably been on the maps. What is of interest to everyone from scholar to reader is the maps themselves. Books and articles concentrate rightly on reproductions and on illustration and so descriptive text is often limited. What historians say is then restricted and, logically, covers the essentials which in turn means the text often covers the same ground as others have covered in the past. This essay does not escape that pattern.

Putting maps in their social and economic context was certainly a break with past practice when it was first emphatically urged some 40 years ago. That approach, as Buisseret said, is now common. What had been a dramatic departure is now an ordinary part of the task of anyone looking at the history of cartography. Many aspects of the other changes in work in the field have also become ordinary. The process of looking at ships on maps, the genesis of this book, has of necessity meant rehearsing the techniques of the past. The additions made to both the methods and results are small. While the canvas may be broad the questions asked are narrow.

To come to any understanding of why ships appeared on maps in the Renaissance all the varied methods and approaches of the history of cartography, including those that have recently emerged, should be brought to bear on the issue. That is attempted in the following pages. In dealing with the late Middle Ages and the Renaissance the precision so treasured by natural and social scientists is extremely difficult to achieve. Simple matters such as determining the numbers of maps made, the numbers of copies, and the frequency of production are beyond knowing. The size of the sample or any sample cannot be stated with any more than vague accuracy. There are variants to every case. Exceptions to almost any statement about the maps abound. At best what can be attempted is to identify, trace, and perhaps also isolate tendencies.

The search for an answer to the central question about ships has been a long sojourn through new and strange sources and ways of dealing with them. The voyage over what were and remain largely uncharted waters has taken all too much time. One result is massive debts. Those debts to individuals for their help with research, with supplying materials for illustrations, and with advice as well as inspiration are extensive. Tony Campbell and Gillian Hutchinson showed me the way through collections of manuscript and secondary sources in England. Willem Moyzer Bruyns and Kees Zandvliet in the Netherlands and Albrecht Sauer in Germany supplied me with valuable information about navigation. Only limited contact with René Tebel prevented me from taking advantage of his extensive knowledge of the topic. Corradino Astengo in Italy

was an excellent host and source of advice. Francisco Contente Domingues in Portugal has long showed an interest in the process. Robin Ward in England proved tireless in efforts to explain fifteenth century sailing practices. Ray Clemens introduced me to new sources and Mark Vessey at the University of British Columbia brought his extensive knowledge of Erasmus to bear on a central problem. James Muldoon proved a great help with matters canonical. Norman Fiering was a consistent supporter of the project. Richard Talbert and Leanne Bablitz joined me in organizing a conference on classical and medieval cartography which proved valuable in placing my own work in a larger framework. Neil Safier helped with books and a map of Brazil and Ronnie Lakowski with Thomas More. Rachel Poliquin assisted the research using her knowledge of the rhetoric of the late Renaissance and her technical skills. Carol Matheson in a graduate seminar raised pertinent questions based on her own work and supplemented the catalogue of relevant maps. David Buisseret piqued interest in the history of cartography some years ago in a lecture on a visit to the University of British Columbia and, as with so many other historians, he redirected thinking and research because of his own ability to make so much of maps and do so sensibly. Susan Danforth at the John Carter Brown Library contributed to the final result through her knowledge of the history of cartography, her bibliographical skills, her knowledge of illustrative material, her willingness to comment on various aspects of the project and her good humour. Anne Taylor not only helped with the ways of research in the history of cartography and with advice about sources but also was a source of support in the closing stages of producing the final work. The editors of the series, Rab Houston and Ed Muir, offered encouragement and sage advice about necessary changes in the closing stages of the process. I am grateful to all of them in helping to bring this all-too-drawn-out exercise to a conclusion.

Audiences at conferences of the Medieval Association of the Pacific and the Medieval Academy of America were patient and offered suggestions and probing questions. The same was true of audiences at the John Carter Brown Library. The members of the International Commission for the History of Technology allowed me to air some ideas at an early stage of the work. Jaap Bruijn and Elizabeth Archibald among a number of friends patiently listened to my hopes and frustrations about the project. The staff at the National Humanities Center, the New York Public Library, the Yale University Library, the Harvard University Library, the Huntington Library in San Marino, California, USA, the James Ford Bell Library of the University of Minnesota, the Leiden University Library, the Biblioteca Medicea Laurenziana in Florence, Italy, the British Library in London, The University of Cambridge Library, the library of the National Maritime Museum in Greenwich, England, the University of British Columbia Library, and of course the John Carter Brown Library all have been extremely helpful and often unfailing in their efforts to assist the work. Dealing with

maps and the users of maps requires special skills among librarians and it is certainly the case that this book could not have been produced without the assistance of those talented and patient people. I am indebted to them, most especially William Stoneman and Mary Haegert at the Houghton Library, Harvard University, Diederick Wildeman at the Nederlands Scheepvaartmuseum Amsterdam and Auste Mickunaite at the British Library, as well as the staffs of the Bibliothèque nationale de France in Paris and the Newberry Library in Chicago for their assistance and prompt action in making available some illustrations included in the book.

The Netherlands Institute of Advanced Study and the University of British Columbia, the latter only at the beginning, provided financial support. Completion relied heavily on a period as the Jeannette D. Black Memorial Fellow at the John Carter Brown Library in Providence, Rhode Island, USA. The last part of the enterprise which brought this all-too-much delayed book to fruition owed much to the Donnelley Family Fellowship, endowed by Strachan Donnelley, held at the National Humanities Center in Research Triangle Park, North Carolina, USA where the staff provided what was necessary to eliminate the last hurdles. Friends and colleagues have for some time tolerated my talking about maps and ships. Their willingness to listen and their interest have sustained the endeavour. The result may not answer all the relevant questions. The effort in the end possibly adds little to what is known but may, with luck, supplement ideas and understanding about broader trends in European science, technology, and society in the years from 1350 to 1550.

Acknowledgements

Abbreviations

BL   British Library, London, England
BnF   Bibliothèque nationale de France
NMM   National Maritime Museum, Greenwich, England
NAH   Nationaal Archief, The Hague, The Netherlands

Glossary of Shipbuilding Terms

Barcha
A single-masted sailing ship descended from the Viking longship with a length-to-breadth ratio of more than 4:1 and with curved posts at bow and stern. It was used for trading and fishing along the coast of the Bay of Biscay in the high Middle Ages and was employed extensively in fourteenth and early fifteenth century Spanish and Portuguese voyages of exploration.

Bonnet
A rectangular piece of canvas sewed on to the bottom of a square sail or on to the bottom of another bonnet to increase the total area. The two pieces to be fit together were similarly marked so there was no confusion when joining them. Stitching was such that in case of strong winds sailors could easily and quickly take off the bonnets.

Bowsprit
A yard extending forward from the bow serving as a base for stays which held the foremast in place. Often a yard was slung under the bowsprit and a sail fixed to it. A piece of canvas placed there proved very useful in controlling the course of the ship.

Boyer
A type of small ship in use in the North Sea in the sixteenth and seventeenth centuries with high levels of carrying capacity for each crewman. The efficiency was made possible by a complex rig involving a large spritsail as well as square sails and forestaysails, all on one mast, and a small lateen sail on a mizzenmast.

Caravel
A fishing boat with north African roots which was modified for use in the Atlantic and became popular for fifteenth century Portuguese voyages of exploration. It was long relative to its width and had little or no upperworks. Beginning with one or two lateen rigged masts by the sixteenth century bigger caravels came from Iberian shipyards with three masts, all with lateen sails, or with four masts, three with lateen sails and the foremast with a square sail.

Carrack
A large sailing ship developed in the fourteenth century originally with two masts, the main carrying a single square sail and the mizzen carrying a lateen sail. With a deep and capacious hull it was suited for voyages between northern and southern Europe. The version with full-rig was probably first

built in Iberia around 1400. It was more efficient and reliable and served the same routes as well as new ones between Europe and the Indian Ocean, that into the seventeenth century. It had a deep hold, a length-to-breadth ratio around 3:1, and often high castles.

Carvel built Form of construction where hull planks are pinned to an internal frame, the strength coming from the frame and watertightness from abutting the planks and caulking the seams.

Forecastle Raised structure at the bow of a ship, originally as a platform but by the fifteenth century a fully integrated part of the hull and of varying heights. It came over time to be a place for housing crew members.

After- or summer-castle Raised structure at the stern of a ship, originally as a platform but by the fifteenth century a fully integrated part of the hull and of varying heights and lengths, sometime reaching the mainmast. The aftercastle offered a vantage point for pilots and more comfortable accommodation than the forecastle.

Clinker built Form of construction where hull planks overlap and are nailed one to the other. Strength comes from the hull itself with internal ribs offering some reinforcement.

Cocha Name given to the cog when it entered the Mediterranean and also to the earliest two-masted carracks in southern Europe.

Cog A flat-bottomed coastal vessel with Celtic roots which, with the addition of a keel in the twelfth century, became a sea going ship and over time the principal bulk carrier of goods in northern Europe. It was tubby with a length-to-breadth ratio of 3:1 or less. It had a single mast with a single square sail, sharply angled posts at the bow and stern, and a deep hold which gave it considerable carrying capacity.

Falua A single-masted or possibly two-masted lateen rigged boat with a low profile, straight gunwales, a raised platform at the stern where a helmsman or helmsmen stood controlling the steering oars, one on each side.

Full-rigged Ship with at least three masts, two of which carry square sails and a mizzen toward the stern with a lateen sail, the combination increasing flexibility in deploying canvas and making it possible for ships to be relatively large and still manoeuvrable even in contrary winds.

Galleass   A large sailing ship of the sixteenth century equipped with oars and with a length-to-breadth ratio of around 5:1. Well-armed, it was more manoeuvrable than sailing ships and better armed than galleys though the type proved cumbersome, required a very large crew, and was not a good sailor on the open ocean.

Galley   An oared vessel with a low profile and relatively high length-to-beam ratio, usually 6:1 or higher. Propulsion came from oars on either side of the hull and, alternately, from sails. The arrangement of oarsmen took on varied configurations over time with one of more banks of oars and with one or multiple rowers per oar. Used extensively in the Mediterranean from classical Greece to the nineteenth century, the low freeboard made the type vulnerable to the high seas of the open ocean.

Gunwale   The highest strake or plank on the hull.

Hulk   A river and coastal vessel with Celtic roots used in the estuaries of the Rhine and on the North Sea in the early Middle Ages. It carried a single sail on a single mast and had a length-to-breadth ratio of around 3:1 or somewhat more. With the addition of a keel and changes to the way the planking was brought together at the bow, that in the fourteenth century, the hulk became a deep sea sailor and very similar to the cog from which it borrowed many of those design features. Adopting full rig by the sixteenth century the term came to apply to large, slow moving bulk carrying sailing ships.

Mast:

  bonaventure mizzen   The pole set furthest to the stern on a four-masted vessel.

  fore   The pole for carrying yards set forward of the main mast in a ship of three or more masts.

  main   The principal and largest and tallest pole for carrying yards, usually stepped about half way between bow and stern and often composite on larger ships, that is made up of parts of more than one tree.

  mizzen   The first pole set astern of the mainmast.

Outlicker   A spar fixed high in the stern and projecting outward to take lines running from a sail rigged on a mast set far astern, usually a bonaventure mizzenmast.

Rig:

lll
fore-and-aft Sail or sails which operate in the same plane as the forward and aft line of the ship.

full A combination of square sails on the main- and foremasts and a fore-and-aft or triangular sail on the third or mizzenmast. First developed around 1400 the presence of different types of sails gave captains much greater control over the vessel without losing power to drive the ship. It also offered potential for reduction in crew size.

una The combination on a single mast of a fore-and-aft sail, usually a sprit sail, and a forestaysail. Developed probably in the fourteenth century it was used on small boats and could be handled by two people and even one person alone.

Rudder:

side A flat piece of wood, fixed near the stern of the ship and controlled by a steersman using a tiller fixed to the upper, narrow end of the oar. The methods of attachment to the hull varied but such rudders in general proved highly effective especially on boats and ships with low freeboard.

sternpost A flat piece of wood fixed on hinges to the stern post of a ship and controlled by a tiller which passed over the top of the post or by a lever fixed at right angles to that tiller. Developed for use on the cog it became the common method for steering on larger vessels by the end of the Middle Ages.

Sail:

lateen A triangular piece of canvas hanging down from a long yard, first used in the classical Mediterranean and the common source of propulsion for vessels there in the high Middle Ages. It made possible sailing closer to the wind than with a square sail. The lateen sail had the disadvantage that changing it from one side of the mast to the other required carrying the yard over the top and around to the other side of the mast, a complex, time and personnel consuming as well as dangerous task.

lug A trapezoidal piece of canvas stretched between yards with 60–80% of the sail on one side of the mast. It was the typical rig of junks and also appeared on vessels in various parts of the Indian Ocean.

sprit A square or nearly square piece of canvas set in the fore-and-aft line of the ship and held up by a boom in the same plane

at a 45° or similar angle to the mast. It could be adjusted easily and required only limited manpower to handle, at least in smaller variants.

square   A rectangular piece of canvas set at a right angle or nearly right angle to the fore-and-aft line of the ship, hung down from a yard and sometimes stretched between two yards.

stay   A piece of canvas hanging down from one of the stays which were lines stretched from the deck to the masts in order to hold those poles in place.

top   A rectangular piece of canvas set on a yard or stretched between two yards above the mainsail on a mast. It added potential driving power and, being smaller than the mainsail below it, required less effort to handle, an advantage since it was high in the rigging and so hard to reach. Over time topsails grew in size as mainsails got smaller. By the eighteenth century topsails could be as large or larger than mainsails.

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Introduction: Maps and Mapping

Ships virtually never appeared on maps before 1375. By 1550 they filled oceans, seas, estuaries, rivers, and lakes on all kinds of maps from the most extensive to the most particular. The explanation for the dramatic transformation is to be found in the general changes in map making, in the explosion of geographical knowledge and in the thinking of Europeans about themselves and their place in the world as it evolved during the Renaissance. Trying to make sense of the disappearance of ships from maps in the eighteenth century leads to similar sources for a turnaround with roots in changes in fashion, in technology, in ideas about Europe and in ideas about the physical world. To identify and appreciate the reasons for the rise and decline of decorative vessels on maps requires an understanding of the prevailing ideas, the problems of representation and the structures of work and rewards that set the parameters for the makers of the maps. The process also requires a long voyage through many different images from small, simple sketches representing the world around the maker of the map all the way to some of the most grand and beautiful products of Renaissance art. The explanations serve to indicate and to illustrate the revolution in cartography in the fifteenth and sixteenth centuries as well as changing perceptions among thinkers, writers and politicians. They serve equally to show how the immediate practical demands of new knowledge and the needs of maps users shaped art and representation.

Maps always treat a complicated world as uncomplicated. They are external, physical representations of the geographical environment. They are multifaceted. They are always a misrepresentation of the physical world since it is impossible to recreate the reality of land. They are automatically portrayals, likenesses, simplified models of the environment. The exact duplication of any geographical setting is impossible so maps, like all other forms of communication, purposefully fragment and simplify reality. Every map is automatically and of necessity, '...a record of mistranslation, hence a major confrontation with the limits of representation.'[1] 'Art, said Picasso, is a lie

which makes us realize the truth. So is a map….And like any work of art, it requires imaginative reading.'[2] Maps are made by people with definite purposes in mind so examining any map from any period becomes an exercise in understanding the purpose of the maker. 'The map is simultaneously an instrument of communication…and an instrument of persuasion…'.[3] Twenty-first century maps are made on scientific principles and enjoy many conventions and standards well-known to both makers and users of cartographers' products so they still depend on tradition in order to transmit information. Even under the most modern of circumstances maps are still tied to the cultural context in which they are produced and very much to the motives of their creators.[4]

A Renaissance map was both a work of art and a scientific product. As late as the seventeenth century Dutch Republic a distinction between art and science made little if any sense to map makers. In the Renaissance maps were a form of decorative art.[5] Map making and landscape painting were similar activities and often done by the same people. In the two there were similar problems of selecting what to show of the earth and how to represent those things on a plane surface. There was no terminology to distinguish between making maps and painting. In fact cartography is not about explaining nature but, '…a means of describing graphically certain categories of knowledge.'[6] So the similarity with painting should not be surprising. Artists of the highest stature including, for example, Leonardo Da Vinci and Albrecht Dürer did not shy away from making maps. Cartography in the Renaissance was closely related to scientific illustration, and like efforts to represent machines and the internal features of the human body, map making went through a significant change in the period.[7] The connection to scientific illustration by the mid sixteenth century helped to give maps a new and different sort of intellectual authority.

Maps In the late Middle Ages and the Renaissance were always reflections of contemporary thought about science, philosophy and theology. Whether the interest in incorporating in maps greater and more accurate detail was a product of a rise in neoPlatonism or of the resurgent nominalism of the *via moderna* associated with the English Franciscan William of Occam, the fact remained that even before the great geographical discoveries changes were underway in cartography.[8] Those changes were only accelerated by the spread of Renaissance thought and aesthetics from Italy and by the long term economic growth which started in the first half of the fifteenth century. The use of maps increased for various reasons, some demographic, some economic, some political but whatever the source the process continued through the sixteenth century. In 1400 few Europeans used maps but by 1600 they were essential in many professions. Whereas maps were rare in 1500 they were familiar objects of everyday life by 1600. Their numbers grew exponentially.[9] The reasons for

the transformation include the Renaissance interest in Antiquity and so in classical mapping; the growing interest in quantification and measurement; rising literacy so maps could be and were used, for example, in court cases to do with land ownership; after 1517 the Protestant Reformation which gave an impetus to the mapping of Biblical events; the ability to reproduce consistent copies with the potential for widespread distribution through print and the expanding role of the state which found, starting with Italian city-states in the fifteenth century, more uses for maps in military enterprises and for administration.[10] The voyages of discovery and the need to represent additions to geographical knowledge along with the need for states to assert their status relative to other states in the new found lands promoted the production, use, and preservation of maps.[11] The new uses of maps meant changes in their character, in some cases in unexpected ways. It is the changes which were beyond or different from the scientific aspects, beyond the drive for accuracy and consistency, which have recently and correctly become principal topics for historians.

The earliest writers who examined the history of maps may have realized that the exercise of making such images had many dimensions but they paid little or no attention to decoration. Ships on maps did not interest them. Those writers had to create a new vocabulary. The word cartography, that is *cartographia* in Portuguese, was invented by the Viscount de Santarém (1791–1856), '...the creator of the systematic history of cartography.' He said in a letter in 1839 that he was making up the word. It first appeared in print in 1840.[12] Another invention, the word *géographe* appeared for the first time much earlier, that in French in 1557. For map makers *cartographe* did not appear in French until 1877. Before that the word was *géographe* for someone who made maps. English followed the same pattern with geography not appearing until 1542. The first English writer to commit cartography to print appears to have been the explorer Richard Burton, that in an article in the *Journal of the Geographical Society* in 1859. He was following the newest and best scientific trends of his day. The Viscount de Santarém based his study of the evolution of European cartography on the examination of some 180 maps found through searching 300 libraries.[13] His atlas published in Paris in three volumes, the first edition of which came out in 1841, was made up of what he called cartographic monuments. In each new volume he moved back further in time, reaching the sixth century, since he felt compelled to look for the origins of modern map making.[14]

The Viscount de Santarém and those who followed after him were heavily influenced by contemporary visions of science. They saw themselves as scientists too and so, just like the cartographers they described, sought accuracy. Their measure of the quality and value of any map was how well it reflected physical reality, how well it conformed to the maps of their own day and to

future maps which would only improve as the field of cartography continued to march forward toward ever greater precision. For those historians the progress of geography was the successive correction which led maps to approach the truth more closely. Such an approach was not surprising for the mid nineteenth century but as late as the mid twentieth century the history of cartography was still largely about the increase in accuracy.[15] In 1953 the distinguished English map scholar, G. R. Crone said, 'The history of cartography is largely that of the increase in the accuracy with which…elements of distance and direction are determined…'.[16] Certainly it would be wrong to condemn such an approach as trivial or unimportant. It still enjoys a measure of acceptance and will presumably always remain a part of the study of maps. Questions of accuracy are not nor should they be ignored, that despite disparaging remarks about such exercises which often populate recent work on the history of maps.[17] However '…historians of cartographic representation should not be engaged in a discussion of progress; indeed, the very notion of progress hampers them in understanding the true course of events.'[18] The goal of outlining the march of progress gave the history of cartography in the past a certain bias, often to the exclusion of other considerations. The principal items of interest to historians of maps, logically, were questions of what lands were on the maps, how accurately they were depicted and how maps were made. Historians worried about the mathematics and geometry, the methods used to create the representations. Only secondarily if at all did the artistic components or approaches receive any consideration. The decoration, no matter how extensive or original or sumptuous, got little if any attention.

In the last years of the twentieth century the study of maps and their history took on new aspects. Inspired by developments in other forms of historical study, by concern over concepts of accuracy, and by the relationship of political power to various types of human expression, those studying maps began to discuss a broader range of questions. Sociological approaches to science had a critical influence. Study was not just about form and content of maps but also about the rate and direction of change and about what social and cultural changes lay behind developments in maps. John Brian Harley (1932–91) took the lead in criticising those who ignored the context of maps and principally the political discourse embedded in maps but he was soon not alone.[19]

Harley was an impassioned champion of transforming and extending the field. Ultimately his view was '…that an alternative epistemology, rooted in social theory rather than in scientific positivism, is more appropriate to the history of cartography'.[20] The recasting of the language of historians of cartography is a sign of his success. As early as 1968 he worried in print about uncovering the intention of the map maker. Harley knew that would be difficult since often goals were not singular and with pre modern cartography

difficulties of interpretation, he noted, are multiplied by the freedom carto-graphers had to exercise their imaginations. Twenty years later Harley was calling for understanding any map as, '...a socially constructed form of knowledge.'[21] He wanted his colleagues to escape the standard map criticism of accuracy-inaccuracy. He borrowed from the study of images, that is the iconology of art historians, and from the sociology of knowledge, and espe-cially from the observations of Michel Foucault (1926–84) about the rela-tionship of seekers after truth to power. Maps were to Harley about an elusive and subtle process of domination where subliminal geometries, silences, and representational hierarchies act as agents of the imposition of authority or ideas about authority. He concluded that '...the symbolic treatment of power is a neglected aspect of cartographic history. In grasping its importance we move away from a history of maps as a record of the cartographer's intention and technical acts to one which locates the cartographic image in a social world'.[22] For him people, and especially people in positions of power who tried and succeeded in gaining control over knowledge, dictated what went on maps. They also dictated the exclusion of certain aspects of life and of land-scape, imposing silences on representations of the earth. Measurement and classification did, he acknowledged, give some sense of objectivity but maps did not in the process lose their subjective aspect. By 1989 he was pleased with the expansion in the scope of cartographic studies to include ideas from information theory, linguistics, semiotics, structuralism, phenomeno-logy, developmental theory, hermeneutics, iconology, Marxism and ideology. But he did note that there was no escape from past practice. Harley's influence on the history of cartography since the 1960s has been impressive, an influence enhanced especially through the massive multi-volume *History of Cartography* which up to his untimely death he co-edited with David Woodward.[23]

While not universal among those who look at maps there is now often as much or more concern with the mental map that lay behind the presentation than with the appearance of the map itself. The history of map making is made a sub category of the more general study of long term developments in spatial representation. While there may be an apparent conflict between old and new schools in the history of cartography, worthy of debate among those in the field at international meetings, there were even before Harley's calls for examining the purpose of the history of cartography signs of concern and some broader discussion of what maps were about. The symbolic importance of certain illustrations like flags long bothered historians. Medievalists, who had to deal with maps that were obviously inaccurate, regularly addressed questions about the function of maps and the goals of map makers. A fas-cination with measurement that was reflected in maps in the fifteenth and sixteenth centuries was a phenomenon noticed well before Harley pointed to it as part of a drive toward expansion of their political authority by princes.[24]

The goal of the history of cartography is now to see beyond the obvious, to try to appreciate the whole function and purpose of graphic representations of the physical world. The history of maps is then not about progress or about an evolution in methods toward ever greater accuracy but rather a saga of ups and downs, of different directions taken, and of choices about what to include and what to exclude and about the reasons at any time for the choices map makers made. In some cases the goal was to show routes, in others to express images, and in many the goals were mixed with numerous influences at work. That was especially true of representations of the discoveries made by European explorers.[25] Rather than look to the Renaissance for some sharp break between a medieval period when maps were decorative and a modern period where maps were scientific representations of reality, the need is to look at who made maps and for whom and why. To do that maps should be exposed to the same type of analysis long known for literary texts. Like them maps present problems of translation with the language difficult to interpret for anyone not comfortable with it, and maps do have their own languages. Like literary works maps present problems of reception, of the varied reactions elicited by them in different places and at different times. Maps, however, are often more complex and richer and with added dimensions so the task of analysing them can be daunting.

Above all recent work on maps has forced a fuller and more careful consideration of the political elements in them. That concentration does raise the possibility of overemphasis on just one of the many features of maps and the possibility of ignoring some of the other ideas embedded in the representations of the world. The concentration on maps as instruments of power and domination and legitimations of violence, as part of an imperial project, is most prevalent among but not exclusive to those examining the history of the New World and especially the USA where the tortured history of relations with the peoples that Europeans encountered hangs over any discussion of space. As with environmental historians, caught up in the myth of a pristine America before that name was imposed on the continents, so too historians of cartography both lose sight of the world before 1492 and lose sight of a world beyond the borders with which they are familiar. In addition in concentrating on map making as appropriation historians can enjoy the satisfaction of uncovering a conspiracy, of exposing a plot to obscure the exploitation of land and people. While it may be true that, '*There is nothing in the map that fails to signify*.' the statement is trivial or at least inflated if what is signified is something mundane rather than a grand political process.[26] States and their interests were not the only forces at work in shaping mapping. The search for an overarching theory of the development of human society may obscure the more immediate and purely practical needs of the buyers and makers of maps. There were other groups and individuals whose interests diverged from those

of growing centralizing governments who could and did influence what was put on and what was left off maps.[27]

While it would be difficult to dispute that, 'The map is a silent arbiter of power'[28] it is doubtful that the Renaissance map makers saw using maps for political purposes as original with them. While it may be difficult to dispute that, 'As much as guns and warships, maps have been the weapons of imperialism',[29] it is doubtful that such was their principal purpose or even an important one for the people who made them or had them made. While governments have been instrumental in the promotion and use of maps to say that, 'The history of the map is inextricably linked to the rise of the nation state in the modern world'[30] is to obscure many other influences on map making, especially in the later years of the Middle Ages and the Renaissance when the nation state did not yet exist nor had even been imagined. Medieval maps do show the size of towns or castles in proportion to perceived importance rather than actual size and use various symbols such as flags to indicate political identity,[31] so there were connections to power in what cartographers put on maps before the Renaissance. That fact only increases the danger of finding the authority of the state seeping into every symbol on every map all the time. Seeing the map as, '…a social tool, a tool of power that helps to impose a vision of the world upon a society at a given time and in a given place, embedding values, ideology, and subliminal meanings into what seems to be an objective statement of the real world',[32] may describe the effect of those representations but at the same time may say little about the intentions or the thinking of the people who created the surviving examples of Renaissance cartography.

If the emphasis in the history of cartography has shifted in recent years away from the outline of the physical world to the many other features of maps then the ships that appeared on them in the fifteenth and sixteenth centuries become a proper and even important matter for consideration. The evolution of graphic depiction, one of the most obvious and important features of Renaissance cartography, included not just shorelines or mountains. The fuller and more frequent and more accurate representation of many features of the world were all a part of the development of map making. Ships were among those features. Map makers, directed by their patrons or potential customers or following their own independent notions, chose to adopt ships as a part of maps. Map makers did not, at least in the late Middle Ages, blindly follow some standard or convention. It was a matter of choice and their choice to put ships on the waters of their maps indicates that there was a purpose in including vessels. '…the map is not just one image among others: the writing and language on its surface are of preponderant importance. The map's modes of inscription and graphic choices are as fundamental as the content of these textual fragments.'[33] To the same or greater degree the decoration on maps,

which by the sixteenth century included ships, was fundamental to the mediation between people and space.

Finding out what lay behind the inclusion of ships is made difficult by the failure of any people at the time involved in the process of making maps to articulate their goals and desires. The task is also made more difficult by what has survived from the workshops of those same cartographers. Because maps had varied functions they had varied survival rates, the ability to find a place in modern collections depending on a broad range of causes. What now exists must be a very small fraction of the total map output of the fourteenth, fifteenth, and sixteenth centuries. That raises the obvious question of how representative the existing sample may in fact be. Wall maps for example did not fare well because of their use and exposure. Maps made increasing inroads into the court room in the years after 1500 and those from legal disputes have a much better chance of survival because of their specific purpose and their association with the actions of government. The same can be said of plans with a military function such as maps of defensive positions. The sense of the value of maps for administrative purposes may have yielded an increase not as much in production as in the preservation of maps starting early in the sixteenth century.[34] With nautical charts those used at sea would have deteriorated rapidly and typically been discarded after a short, active life. Few if any working charts could have survived for long. The charts that did not get destroyed from use probably in most cases never saw the deck of a ship. While a few may have made trips to act as a catalogue of ports or other landmarks, the majority of depictions of the seas that can still be seen were made as presentation copies. They were designed and made to impress the new owners with knowledge and with artistic skill. They were made with an eye not to the immediate needs of sailors at sea but of people on land. Though their ornamental function was critical, the degree of compromise cartographers made to satisfy those land bound owners is uncertain. Even if they were of little value to sailors and even if there were problems with the geometry they still enjoyed considerable authority. The grandest of maps that have made it to the twenty-first century may be impressive works but they were not the ordinary products of the Renaissance. Not only do the survivors among the charts made in the period possibly mislead as to the total number and use, they also may mislead as to the influence of one style or practice over other options. The stock of surviving charts is small. Other maps, deemed important by contemporaries, were produced but are only known from tantalizing mention. High ranking nobles could and did decorate their floors and walls with maps but those disappeared when castles and palaces were razed. If a prominent artist produced a map or globe record of the act might survive but the object itself was more likely a casualty.[35] Any efforts to reconstruct such missing items or to assess the influences of those missing works on surviving items

will always be inadequate. At best such efforts may establish what the missing maps dealt with but rarely is there an indication of what was not on the map and without the image itself the absences are elusive.

Cartographers were typically practical men. They were not necessarily articulate nor did they have reason to be. The sharp divide of the modern world between skilled artisans and learned theoreticians existed only partially in the late Middle Ages and '…men and women without formal education often had access to, and could express in their own way, the same sorts of concepts and images that put order into the universe, the past, and the diversities of the human race for scholars.'[36] Though that was the case the makers of maps virtually never expressed their understanding in words but did so graphically. Even in the rare instance when map makers went to court on matters to do with their contracts to supply patrons they offered facts rather than justification for their actions. They were skilled craftsmen working on contract or producing maps in the hope that someone would want them once completed. Contract disputes indicate they were at the mercy of their patrons, the buyers of their products.[37] So it is not possible to turn to the men who made the maps to find explanations of why they made certain choices. The influences on them were many and often varied, the origins of those influences lodged in traditions and practices much removed in time and space coming from other parts of Europe and even other parts of the world. The ideas about national schools and the debates over national primacy in one form of mapping or another are now largely discredited. International borrowing was common and in the Renaissance national borders did not form effective barriers to cartographic knowledge or practice. While map makers may have worried about what buyers wanted or may have tried to conform to emerging standards of practice they did not see themselves as defenders of an anachronistic national interest.

Maps '…are simultaneously unique and polyfunctional. While each map embodies knowledge, ideas and values that are place-, time- and culture-specific, and each was intended to be used in a particular way, each type of map can serve a plurality of purposes.'[38] Dealing with such multivalent images at such a remove of time can never be simple. Yet perhaps with care it may be possible from what survives to infer some of the intentions of map makers and their patrons, and in those intentions find indications about how Renaissance Europeans perceived the dramatic and transforming contemporary changes in geographical knowledge and how Europeans articulated, in at least one form, their expanding and novel relationship to the rest of the world. No matter how antiquarian or antiquated the methods of some historians of cartography, no matter how revolutionary the methods of others, all try and continue to try to understand the varied images of the surface of maps in their chronological and geographical and political context. As with any historical

source, be it graphic or literary, it is necessary to use what has survived in combination with other sources, similar and dissimilar, to try to gain some sense of the circumstances of production and what the item meant to those who made it and those who used it. The changes in the study of maps in recent years have forced an appreciation of more of their aspects, forced a consideration of not only every sign and symbol on the surface but also how the creators conceived their goals. It is easy to make dramatic and even excessive claims about what is on maps and, even more, what is not on maps. That danger should not prevent asking why objects were depicted and in the ways they were depicted. Such questions, when applied to ships on Renaissance maps reveal a good deal about ships, something about maps, and perhaps a bit about the European understanding of the voyages of exploration which were in the long run to transform the relationships to their environments of virtually all human beings on the earth.

1
Making Maps without Ships, with Ships

To the mid fifteenth century putting a ship on a map was a radical act. By the mid sixteenth century it was still a conscious act but no longer unusual. Starting as far back as about 1300 map makers generated an expanding range of pictorial signals which became more stylized, artistically economical and, therefore, more conventional and standard.[1] Over time they developed a complex and ingenious vocabulary of signs and symbols. After 1375 the vocabulary included ships. While ships might share many of the same trends toward standardization of representation of other map features they stand out from all those objects because of their numbers, their variety, their accurate depiction, their ubiquity and their rapid disappearance in the eighteenth century. The many examples of the efforts of cartographers stretching from the Middle Ages down through the sixteenth century show an increasingly obvious tendency toward more consistent signs and symbols, ones that might be generally recognized by users. By the late sixteenth century map makers had generated some homogeneity in lettering styles but also in symbols for things at sea like wave patterns or sea monsters or fish and – ships.[2] In the Renaissance European cartographers created the ideas about maps, what they should look like and what they should do, that have dominated practice ever since. Even the definition and use of the word geography went through a process of clarification in the sixteenth century. The inclusion of ships as decoration and illustration was part of that process of standardization and definition of what made a map but it proved to be temporary, lasting from the fifteenth to the eighteenth centuries, which makes all the more informative the pattern of the appearance of ships on maps.

The profusion of vessels on late Renaissance cartographic products of all types and their absence before the early Renaissance is rarely noticed. Historians of maps have in recent years sharply increased their scrutiny of many aspects of medieval and early modern cartography but they have had little or nothing to say about why decoration changed and why ships became

not only standard but virtually required features of the waters on maps. The potential explanations for the novel phenomenon run from the practical to the political. While the latter may be more intriguing the former can not be ignored. The reasons cartographers chose to add ships to their maps must be indicative of Europeans' understanding of an era when explorers rapidly added a vast range of novel geographic information to what people knew about the world. Those maps must also be indicative of how Europeans understood themselves at the time. Ships appeared on maps because Renaissance Europeans thought ships were important. Examination and analysis of the vessels or the lack of them and their increasing numbers over time do give some sense of what map makers and, equally important their patrons, clients and customers were trying to say and do in the composition of the complex surfaces that were Renaissance maps. Looking at the maps, the ships and the background to Renaissance map making is the basis for teasing out the varying forces which led to all those ships decorating all those different kinds of images.

The ships that turn up on maps represented a major technological breakthrough of the period. Cartographers typically drew the ships accurately, at least as best as it is possible to tell based on comparison with other sources such as the rare shipbuilding treatise and the now expanding range of evidence from underwater archeology. That map makers tried to represent ships consistent with life suggests something about what they thought they were doing. One result is that images of ships on maps form a valuable source for understanding the development of European ship design in the Renaissance. They are especially crucial for their depictions of rigging, not a topic for contemporary writers on ships and not something left in the shipwrecks examined by maritime archeologists. The Renaissance was, after all, a period when a series of revolutionary changes created vessels capable of unprecedented voyages. The changes in maps mirrored the revolution in ship design. The types of ships map makers included on world maps, nautical charts and just about any other kind of map were often of the latest designs, impressive for their size or capabilities as well as for their novelty. The tendency seems to have been to put on maps, where possible, a variety of ships and ships with designs which had only relatively recently emerged. While the artists who decorated maps do appear to have joined in a trend toward showing archetypes, not accidents or particulars of the specific specimen but the type, the ideal,[3] that did not come until after 1550 nor did it stop them through the mid sixteenth century from presenting ships in a number of variants. That fact makes even more tantalizing the question of why map makers included the ships they did as one part of the varied decoration and why, for centuries up to the Renaissance they chose not to include ships. The new illustration post 1375 suggests that European map makers, artists and buyers had a change of mind.

The ships were certainly more than just amusing play things. Admittedly there was some entertainment value in putting various objects on the seas and the expanses of land. Large animals and plants on land were symbols that were more than just pictorial. The animals also reflected what travellers saw, what impressed them and what they reported back to Europe.[4] Whatever the objects the illustration did offer something to divert the eye, something to impress the viewer. The decoration, following the tradition and practice of book illumination of the late Middle Ages, offered a sense of luxury and made the maps more desirable. There was no pressing need to show ships or animals or plants or people. They were not like coastlines or mountain ranges but the very incidental nature of the information which such illustration embodied contributed to the value of the map. Cities and physical features continued to find places but in the sixteenth century peoples, animals and plants unknown before joined them. Maps in the Renaissance became a place to show things exotic and reflected a rising interest in collecting data about the world and especially the world on the other side of the Atlantic that was new to Europeans. Ships as decoration for maps were not quite like other objects. Exotic vessels were rare. There were few flirtations with ethnography when it came to ships. The vessels that populated maps were almost invariably European in design, drawn by Europeans and placed not just in home waters but all over the world. The ships were drawn by Europeans for Europeans to transmit information about Europe.

Patterns of change in decoration with ships are harder to discern after about 1550 because by that time having vessels on maps was the norm. The mid sixteenth century is not a hard and fast dividing line though the era of dramatic changes was over and map makers found themselves formalizing and standardizing practices that had evolved in the previous 200 years. The evidence from before the mid sixteenth century suggests that map makers were driven by the practical need to fill the great expanses of ocean on large maps. By then smaller maps got ships too so the shift in decoration must be attributed to general changes in the way people created maps in the period. There were also changes in ideas about cartographic knowledge. In the Renaissance that type of information came to be revered and so showing interest and showing off interest in the physical world and its representation was considered a positive attribute for people. That change in thinking coincided with and probably was caused by the increase in the world known to Europeans thanks to the voyages of exploration.

Ultimately there lurked a political message behind the ships. In addition to commercial and technical and artistic reasons artists were responding to political circumstances when they included ships on maps. In the age of exploration J. B. Harley argued, 'In atlases and wall maps decoration serves to symbolize the acquisition of overseas territory.'[5] For him compasses or

dividers in maps of unknown lands were indications of men poised to discover, explore, conquer and exploit those lands. The castles, forts, and military figures on the coast of Africa and other parts of the world on seventeenth century maps were striking examples of reinforcement of the ideology of domination through decoration.[6] For Harley the ships added by cartographers were just another part of the array of signs of the power of kings. Whether that was true in the early period of the expansion of European geographical knowledge is difficult to say with any level of certainty. Whether some artists had their own ideas or whether they were influenced by existing and growing practice or whether they were responding to the demands of their masters, which were often agents or agencies of the increasingly powerful governments of western Europe, is difficult if not impossible to discern. However, if maps were more and more used for political purposes from the Renaissance on then it would be logical that there was something political, possibly though not necessarily sinister, lurking behind the choices of map makers.

The first step in finding out why ships became a requirement of cartography by the mid sixteenth century is to examine the roots of Renaissance cartography in classical and medieval ideas about maps and in the maps those ideas generated. The summary and survey of pre-Renaissance cartography is not to add to existing work. Rather the goal is to generate a frame for the examination of maps that did get ships as decoration. The background aids in understanding how and why ships were left off maps up to 1375. More important it also shows what sort of decoration existed before ships became ubiquitous and so how ships fit into existing schemes of illustration. There were various forces at work in shaping Renaissance map making and so a number of them have to be considered. Maps evolved and changed in the Middle Ages and through the Renaissance because of shifts in general intellectual currents in science and theology. The new learning of the twelfth century had an impact but not on a scale of the impact of new learning in the fourteenth and fifteenth centuries which fed whole new concepts of the purposes and uses for maps.

The second step following the exploration of the background to changes in map making in the Renaissance is matched by an examination of maps which did get ships as decoration through the fifteenth and first half of the sixteenth century. For convenience, and only for convenience, the maps are discussed geographically, that is by their place of origin, and then chronologically, that is the sequence in which they were produced. The distinctions made are along vaguely national lines but those are understood to reflect the way historians have worked in the past two centuries and not to reflect necessarily intellectual or technical differences among the map makers themselves. The false distinction among nations does offer a simple method of organizing a broad

range of specific cases. The sum of those examples form the basis for conclusions about how and why ships ended up on maps in profusion by the second half of the sixteenth century. They illustrate the variety and exceptions to the general trends as well as commonality in decoration.

The diverse data adds up to an argument about why ships were on maps. The explanations are not many and they do not all have equal weight. The series of cases from the Byzantine Empire to Portugal to England to Poland is lengthy and takes on something of the form of a catalogue with one example following after another following after yet another. Many of the maps are intrinsically interesting because of their value as works of science or of art, however, in this list what makes them important is the ships, what kinds of ships the map maker drew and where he placed them. Even if the descriptions of so many maps and even more ships of many types in different views may seem tiresome the whole is greater than the sum of the parts. The argument and explanation for all those vessels finding their way on to Renaissance maps is built squarely on the many examples. At least the maps are generally technically interesting and often beautiful.

The glossary of shipbuilding terms which precedes the cataloguing of cases and the explanations for those cases is designed to help with the mysteries of technical terms. The glossary includes short descriptions of ship types mentioned in the text, the names in italics there to distinguish them. The illustrations are directed at showing the evolution of mapping as well as the evolution of decoration and therefore are often well known monuments of the period. The illustrations are chosen more for their role in the development of decoration so many of the important features of the maps are slighted. That does not diminish the importance of the maps as works of art or as sources of other information or as indicators of greater knowledge about how to represent the world. The concentration here must be on the ships artists put on the maps, where they appear and what they looked like.

The ideas about map decoration, expressed in various ways in often specific pictorial language, are the necessary starting point and end point for examining issues raised about European maps and mapping before and in the Renaissance. The latter was a period of voyages into waters touching on lands unknown to Europeans before. The idea of the often used terms 'age of discovery' or 'the discoveries' has been under attack if for no other reason than it ignored the vantage point of the people 'discovered'. Discovery it was to the European travellers and the term is taken here entirely from their point of view. What was important to them at the time was what they had found. It was the novelty which had an impact on the cartography of the day and in many forms. Ships on maps were an expression of some novel ideas in Renaissance Europe, ideas with a complex background but in the end a somewhat straightforward expression. The decision to put ships on maps and in

profusion was part of a large range of trends in the Renaissance imbedded in the economic, intellectual, artistic, social and cultural change of the four-teenth through the sixteenth century. Understanding one small piece of that complexity may help in understanding the larger society that was Renaissance Europe. No matter attempts at comprehension of a complex past the fact remains that maps made in Europe, with the rarest of exceptions, did not have ships on them until the fifteenth century. By the mid sixteenth century the ship population on all sorts of charts, whether for use by men at sea or for people on land, whether designed to show the world or a limited closed region, had grown dramatically. The process that created that new cultural norm produced some fine works of art and also produced the question of why Renaissance Europeans put many ships on many of those maps.

2
Mapping before the Renaissance

The transformation to covering waterways with ships came at a time of a revolution in mapping. Between the late fourteenth and the mid sixteenth century medieval philosophical traditions merged with newly discovered, or rediscovered, classical knowledge and with empirically derived practices to create a confusing and varied array of types of maps. The sharp divergence from past practice in decoration and the appearance of ships was part of a more general development in cartography. Maps changed at the same time as European sailors were making voyages across the world's oceans to places previously unknown over distances Europeans had never covered at sea before. The short period from 1492 to 1522, a time of a concentrated series of geographic discoveries, fall in the middle of a golden age of Western cartography when maps were subject to highly volatile and rapidly changing perspectives and when they took on new functions and purposes. Modern cartography was born in the early sixteenth century when progress in mathematics and the diffusion of new techniques of engraving combined with the great discoveries to create very different ways of representing the world.[1] The simultaneous changes in knowledge and in symbolizing knowledge leave the compelling impression that the two were more than just coincidental. The mid sixteenth century too marks something of a watershed in the history of maps. In the course of the 1500s maps came into common use as governments especially but also individuals began to see their value. Around 1550 for the first time printers started to produce cartographic information in some volume for a growing and wider audience.[2] So it was not only the appearance of ships in quantity on maps or the more general standardization of various marks and signifiers or the proliferation and repetition of decoration or even the increasing consistency of presentation which marked the years around 1550. There was as a shift in the character of maps and of map making. A combination of forces pushed map makers toward ever greater efforts to make their products conform to the physical world. The new form and the new decoration of maps which

emerged between 1375 and 1550 reflected changes in art, science, philosophy, politics, and technology. The maps, however, still carried many markers of their roots in the past.

The forms, patterns, and topics of maps in the Renaissance were deeply influenced by the traditions of the Middle Ages and Classical Antiquity. The practices of Greek and Roman map makers were an essential part of the context of cartographic production and maps with ships as decoration can only be understood within the framework of their predecessors that had no ships on them. Knowledge of the classical past reached Renaissance map makers either through the prism of medieval developments or directly through known and newly discovered texts. The varied traditions of mapping as well as theories of geography had both a visible and invisible effect on the products of the age of exploration when map makers were called on to integrate expanding knowledge of the globe into the received vision of the earth. The great majority of maps made before the fourteenth century have disappeared. The minority that have survived have been filtered by the methods of transmission, by where and when the existing copies were produced and how they survived. The copies like the originals were shaped to fit the time and place of production. The cartographer conformed to the demands of the day which often meant a consistency with the immediate past as well as finding ways to introduce novelty and so in the process create new traditions. Though knowledge of the way Greeks and Romans attacked cartographic problems both in a practical and in a theoretical way is somewhat clouded, enough is known to contrast their approach with that which predominated in the early and high Middle Ages. Up to the thirteenth century map makers were typically enlisted in a general intellectual programme which dated from the last years of what could be described as classical culture in the fourth, fifth and sixth centuries. That gave medieval maps a very different form and a very different purpose from their predecessors and their successors.

In the classical world, in the Roman Empire and in the preceding era in Greece, geography was a valid topic of study and contemplation. A wide range of authors took it up either directly or, more often, incidentally. Among Greek writers discussions of people and places were familiar in works of men like Herodotus (c. 484–c. 30 BCE) who found it valuable to include such detail in his descriptions of past events. Strabo (64/3 BCE–c. 21) produced a *Geography* in 17 books which established the validity of such studies and which also served as a valuable source for subsequent writers. He did include a few thoughts on map making though they were somewhat confused and confusing and had much less effect than did his stories of miraculous peoples and wonders. Pliny the Elder (23–79 CE) relied heavily on Strabo but on others as well for the collection of geographical information that he included in his *Historia naturalis*. The information from Strabo and other writers on the

physical world was most likely to make its way into the body of medieval knowledge through the derivative writings of Pomponius Mela (fl. c. 50).[3] The work of those classical writers was overwhelmingly descriptive. They told stories of strange beasts and equally strange variants on the human beings living in places on the edge of the known world. However, embedded in such works there were discussions, sometimes explicit, about the nature of the world and its physical configuration. In some cases their sources can be traced back to the Greek scientist Erastosthenes (c. 276–196 BCE) who was concerned with the shape and size of the globe. Map making was not divorced from the study of geography as it developed in the Roman Empire but it was different in goals and in form. The extent of map production in classical antiquity is hard to measure. Certainly Greeks and, as much or more, Romans knew about maps and how to use them for varied purposes. The degree to which classical society was oriented to graphic representations of the physical world, however, is impossible to assess given what little is now known about production and use of maps. The survivals from the classical world are rare and, because of the forces at work which destroy cartographic products, the survivals in some cases have unfamiliar and very possibly exceptional forms.

Theories of maps and map making did exist in the Roman Empire and those theories were influential, in part because such theorizing was thought to be a branch of physics or astronomy or of both. For map makers of Renaissance Europe the source of knowledge about classical theorizing on how to make maps was the *Geography* of Claudius Ptolemy of Alexandria (fl. c. 140). A more accurate translation of the title of the work would be something like a guide to drawing a world map. Ptolemy, who wrote extensively on various aspects of physics, optics, and astronomy, for his study of geography relied heavily if not exclusively on earlier work by Marinus of Tyre. Since the source for Ptolemy's book has not survived and since Marinus is only known from what Ptolemy reports it is impossible to establish how much Ptolemy repeated his predecessor. The *Geography* does not contain a map but rather information on how to make maps using measures of latitude and longitude. Indeed, one of Ptolemy's accomplishments he thought was to make possible the recreation of a map simply from text which had nothing more than precise locations for various places. Instructions on the way to generate a projection and ways to establish position on the face of the earth are a small part of the work compared to the catalogue of 8,000 locations listed in Books 2 through 7. The data was geared not for making topographical maps but ones covering much larger areas, and especially for generating a map of the known world. The *Geography* was about how to make maps rather than a book of maps.[4] Ptolemy's work on geography, written in Greek, was not known directly to the Latin Christian West until the fifteenth century and hardly known in the Greek-speaking Byzantine Empire until the late thirteenth. His discussion of

how to draw maps and even more his conception of a way to present the known world in a consistent manner did, however, influence late classical cartography and so in turn what types of maps formed the tradition passed on by Classical Antiquity to the Middle Ages.

Early medieval European cartographers knew three types of maps, each based on classical precedent. World maps made in the spirit, rather than in imitation, of Ptolemy embodied classical theory about the land masses, about the continents. A second form, also intended to show the world, were zonal maps which embodied theories about variations in climate in different parts of the globe and the differing types of human behaviour which prevailed in those regions because of the differing climates. The third form was not strictly speaking a map but rather a list of distances from point to point, an *itinerarium*, with users expected to know the general direction to take to make their way along the routes. Though it might not be a map the itinerary was a form of cartography and could easily be transformed into a graphic representation.[5] Those guides to roads to take were simple and highly practical. Cartographers of the early and high Middle Ages borrowed from those classical precedents but they were as much or more influenced by the strong philosophical and theological currents of late Antiquity than by classical maps.

First the toleration and then the acceptance of Christianity as the religion of the Roman Empire in the fourth century created a very different context for cartography. Suddenly changed from a persecuted eastern mystery cult to the faith of the emperors, Christianity faced a whole range of questions about what it was and how it should function. A few prominent thinkers and administrators through the fourth and early fifth century set out to establish what in fact Christian beliefs, Christian sacred texts and the Christian church were and, in the process, what they were not. Part of the task was to develop methods of representing the world. For Christians, contrary to Jews or classical Pagans, the location of events did not count or counted for much less than in other sets of beliefs. Since Christianity, according to the Church Fathers, was not attached to the Holy Land in the way Judaism was the requirement of showing where places were disappeared.[6] The need for specificity of knowledge about the physical world and its transmission evaporated, replaced by the need to transmit sacred knowledge. The change in thinking about the place of humans in the world was not complete by any means but the effect on map making was profound. The products of Christian cartographers took on new forms. The combination and integration of Christian thinking about space with classical mapping traditions created a limited number of different and, in many instances, novel types of maps up to and through the high Middle Ages.

Modern authors have often condemned medieval maps for their failure to reflect accurately the physical attributes of the world. Those criticisms have

been typically based on a misunderstanding of the purpose of early and high medieval cartography. Hugh of Saint Victor (c. 1097–1141), writing on Noah's Ark and its form and mystical function, offered the single discussion from the Middle Ages of what it meant to make a map. He repeated existing conventions on what was to be included and how the relative importance to Christian history of events or places was to be shown by their size, a tradition which dated back to illustrations for works of the seventh century Spanish thinker and religious official, Isidore of Seville (c. 560–636). Hugh said a world map should be in the shape of the Ark, '…his instructions clearly being more related to the mystical functions of the map than to any geographical use.'[7] The map, imbedded in what was a work of contemplation placed in a cosmic diagram, was to offer readers or anyone who heard or saw the work an aid to the study of Scripture. It was a container of knowledge with everything important, everything worth remembering.[8] Hugh articulated and demonstrated the function of a map commonly understood among makers and users alike: passing on sacred knowledge visually.

Many surviving medieval maps appeared in books. Often the purpose was to illustrate the text and so project history and typically Christian history, onto the image, to make a static surface tell a dynamic story. All maps showed only places of interest, which meant almost invariably religious interest, and that further reinforced their primary didactic function.[9] With such an ambitious programme it would seem churlish for critics to complain that the rich surfaces that typify many medieval world maps do not reflect in a recognizable way the contours of the earth. It would be wrong to claim that it was a matter of '…medieval otherworldliness taken to the point of indifference to the realities of the physical world.'[10] and to condemn the results as some artefact of a non-existent 'medieval mind.' The artists who made maps in the Middle Ages had a purpose different from their modern counterparts and their products had different functions. Their goals affected what they put on maps.

Hugh's ideas had their origins in the fifth to the seventh century when the Church Fathers exerted significant influence on the direction taken in the transition from classical to medieval and Christian mapping. Depictions of the world were put to work explaining and elaborating what Christians knew. Subsequently, from the eighth through to the beginning of the twelfth century there appears to have been a dramatic increase in map production. It began with the revival of learning in the reign of Charlemagne. The newly crowned Roman emperor apparently commissioned a large world map, probably never completed and now lost. As in other aspects of culture, in cartography the Carolingians served as preservers of various aspects of late classical thinking and practice. Carolingians connected the making of world maps with the proper calculation of the date of Easter and so with astronomy and proper Christian practice.[11] That association of finding the date of the most

important Christian festival with making maps continued into the high Middle Ages. In the twelfth and thirteenth centuries, as part of a general flowering of learning, map making expanded even more, swept along in a more general cultural stream and heavily effected by contemporary thinking about science in its various forms. The fourteenth, fifteenth, and early sixteenth centuries, the Renaissance, formed yet again another period in the history of cartography, a distinctive one with dramatic effects.[12] It was that late medieval or Renaissance transitional period that saw the change in illumination of maps and the arrival of ships as a proper topic for cartographic representation.

The classification of medieval maps has been a subject of discussion among historians of cartography since the second half of the nineteenth century. Efforts to catalogue the more than 1,100 maps that have survived created the necessity of establishing categories if only to handle the variety and quantity. Some level of agreement about groupings has emerged in recent years thanks to more careful examination of those diverse images. No universally accepted solution is yet in hand. The categories that have come up are generally based on both the intellectual roots of the maps and the classical examples that formed the basis for their designs.[13] In summarizing medieval European carto-
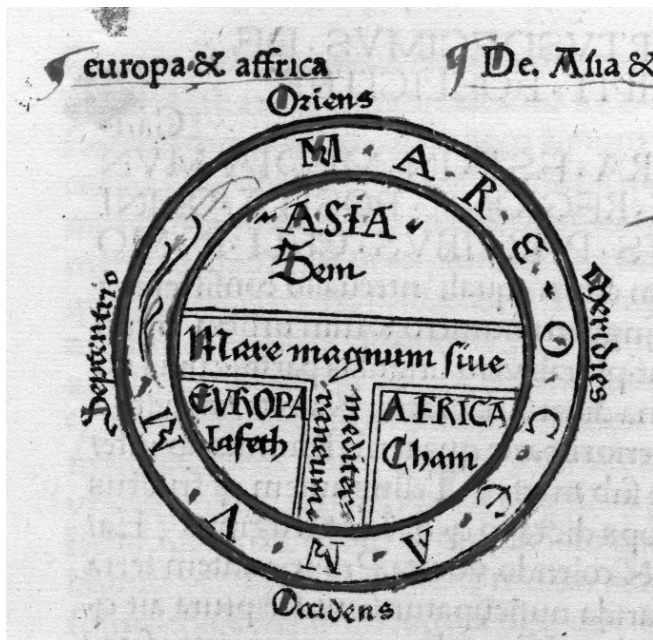
Figure 2.1   Leaf [177] verso, T-O map, from Isidore of Seville, *Isidori, Iunioris, Hispalensis, Episcopi liber, Etimologiarum, ad Braulionem, Cesaraugustanum, Episcopum, Scriptus, incipit, foeliciter* [Augsburg: Günter Zainer, 19 November 1472]. Houghton Library, Inc 1532.

graphy David Woodward in 1987 identified at least four types of the most frequently produced medieval maps. The classes were, first tripartite maps which divided the world into three continents [Figure 2.1]; second zonal maps which divided the known world into different climate zones depending on latitude [Figure 2.2]; third quadripartite maps which divided the world into four continents;[14] and fourth and last, transitional maps which incorporated features of one of the earlier types with attributes of sea charts. Among those four large categories, schematic tripartite maps dominated representing more than 50% of surviving medieval examples. Each of the categories had sub categories, defined by which tradition took hold or which specific map became a prototype to be copied in style and general layout if not in detail. The total number of surviving maps is much greater for the later centuries than the earlier ones of the Middle Ages, creating questions about levels of production and of how representative the sample may be. For example, only some 11 maps exist from the eighth century but about 250 are known from the thirteenth.[15] The close relationship, the similarities in appearance and in conception, between tripartite and quadripartite maps make it possible to discuss them together. Transitional maps only appeared in the fourteenth and fifteenth centuries and represented a marked deviation from previous practice.

Figure 2.2 The Macrobian model of zones, 1485, from Macrobius, *In Somnium Scipionis Expositio*, Brescia, 1472. The John Carter Brown Library at Brown University.

That category, therefore, deserves separate treatment. The two large early and high medieval categories left, then, are zonal maps and maps showing the world as separate continents, either three or four.

The forms inherited from the classical past shaped and even dictated the essential outline of medieval maps. People committed to holding on to classical culture selected specific texts for preservation and the works among them which had maps or descriptions of maps, even if only incidentally or accidentally, offered prototypes for early medieval cartographers. The copying of manuscripts in the Middle Ages was considered a valued and necessary service for the transmission of knowledge. The reproduction of existing texts was an act of devotion as well as one of preservation. Most texts were intended for school use and so it was in educational institutions and notably in monasteries that most copying was done. Books were the normal products of copyists and along with those books in some cases came maps. Copying invariably meant some variation in detail from one version to the next since extremely rare was the copyist who precisely reproduced the original. In some cases scribes were left not with maps but with imprecise or inadequate text descriptions of maps and so had to recreate or create the maps. That yielded significant variation, the text often being hard to interpret.[16] It was not only the difficulty of copying maps which made for inconsistencies, even within the same tradition, but also the choices open to the copyist or artist. While the sources might be the same for map makers and the Biblical precedent may have been uniform, what to include and what to leave out was still up to the cartographer. The reliance on precedent, the lack of geographical awareness among most copyists, desires to maintain quality and to execute maps in a timely fashion and to transmit the correct information created a reliance on past practice and over the long term created a series of similar maps that fell within broad cartographic traditions. Those traditions might not be straitjackets for map makers but they did decide what types of illustration were warranted. The early medieval prototypes did not include ships as elements in maps.

One obvious case of a model yielding many imitations and variations came from Sallust's *Bellum Jugurthinum* written around 45 BCE. The book included a discussion of the geography of Africa and with that some thoughts on the divisions of the world. The text or some classical efforts to illustrate the text yielded a model map, signs of which turn up especially in the early Middle Ages.[17] Perhaps the most extreme example of a single tripartite map which led to extensive imitation came from the work of Isidore of Seville. He made a lasting impression on western Christian thought through the eleventh century and beyond and on cartography as well since two of the 20 books of his major work, *Etymologies,* were devoted to geography. Isidore was the heir to writers and thinkers of the fifth and sixth centuries who had worked on

questions of defining Christianity and on the relationship between Christian and pagan knowledge. His catalogue of useful learning for Christian purposes formed something of an encyclopaedia for the early Middle Ages. The debate over how to deal with classical philosophy, with the thought of pagans who lived both after and before Jesus lived, was a thorny problem in early Christianity. Practitioners of the new religion wanted to separate themselves from other religious groups and certainly from the predominant and, in the view of Christians, clearly wrong pagan beliefs. While pagan ideas and ritual were in error and needed to be suppressed the extensive learning of classical civilization was another matter. Latin Christian writers of the fifth and sixth centuries such as St. Augustine of Hippo (354–430), Boethius (c. 475–524), and Cassiodorus (c. 480–c. 575) took the issue very seriously. In the end their answer, and especially so in the case of Cassiodorus, was a resoundingly positive endorsement of the exploitation of pagan learning, but always for Christian purposes. Cassiodorus argued for the contemplation of maps and of geographical knowledge in general as a good thing for the study of the Bible. The critical issue for all of them, and especially for Isidore of Seville, was what pagan knowledge was acceptable and how Christians should exploit that useful knowledge. Isidore's work, transmitted through among others the English monk Bede (673–735), influenced much of the Latin Christian writing of the early Middle Ages and shaped map making.[18] The depiction of the world had a different purpose, different from what existed in the Roman Empire and different from that in the Renaissance and beyond. The form maps took was part of the answer to the question of the role of classical knowledge and indeed of all learning for Christians.

The simpler tripartite and quadripartite maps that illustrated works like those of Isidore or Sallust fell into a recognizable pattern already at the beginning of the Middle Ages. The same was true with other world maps where certain traditions emerged and then were elaborated and changed in the high Middle Ages. Beatus (c. 711–800), a Benedictine monk from Saint Martin, now Santo Toribio, at Liebana in northern Spain, wrote a commentary on the Apocalypse in the late eighth century. Included were some 75 illustrations, supplemented with even more in some of the total of 34 surviving manuscripts of the text from the tenth to the thirteenth centuries. Included was a world map which took on different shapes in variants in the many reproductions [Figure 2.3]. The map included four continents and though the map maker may have been influenced by Arabic learning, that is not a likely explanation for the presence of the land mass in a southern hemisphere. Connections to maps in works of Isidore of Seville are possible. So is some inspiration from the work of the sixth century anonymous Alexandrian author of a *Christian Topography*, called Cosmas Indicopleustes and best known for his claims that the world was flat.[19] The Beatus map included offshore islands of
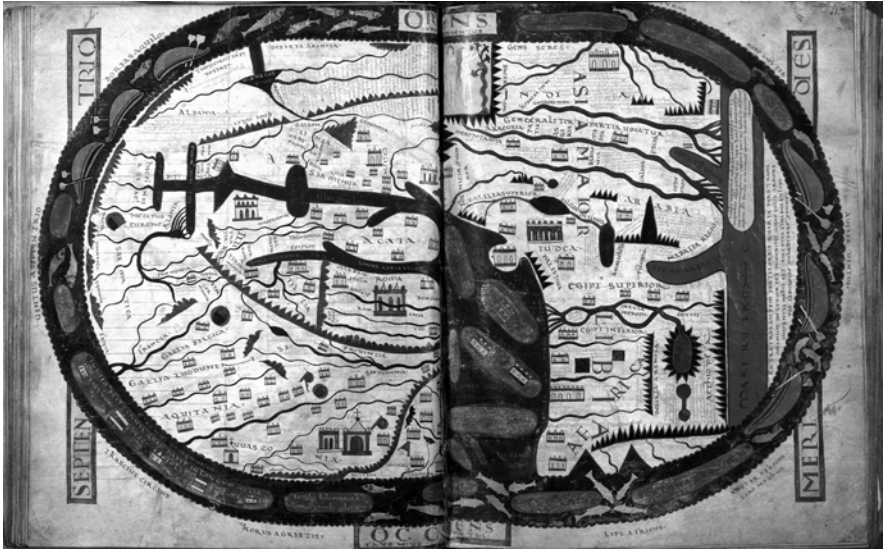
Figure 2.3 World Map of Beatus of Liebana, from *Commentarius in Apocalypsim*, Saint-Sever, C. 1060, The Saint-Sever family of the maps have small open boats joining the fish in the surrounding ocean. Bibliothèque nationale de France, Latin 8878, Folio 45bisv – folio 45ter.

Europe but only the largest.[20] The oceans surrounding the continents and those islands were not left empty as was common among other early medieval maps. The map maker decorated the seas with fish, something which often recurred in later versions and possibly offered artists the option of incorporating items on and in the waters.[21] In one tradition the fish were even accompanied by a small number of open boats, steered with an oar on each side. There are few manuscripts, from the eleventh and twelfth centuries, which have that remarkable addition. The decoration of ships had no influence on later cartography other than in one minor branch of one tradition. The Beatus map in its different iterations showed both the classical roots of early medieval cartography and the greater concern for general and symbolic representation in world maps. The rare appearance of ships was an isolated example of that larger and more important trend.

Zonal maps, with latitudinal regions set apart on the basis of prevailing climate, had roots in the ideas of Parmenides (fl. c. 515 BCE). Hipparchus (second century BCE) and Ptolemy passed on his theory and it reached medieval textbooks through late classical writers, especially Macrobius (fl. c. 430) and Martianus Capella (fl. 410–39). The former put a zonal map in his commentary on Cicero's *Dream of Scipio* and it was through that book illustration that medieval readers and map makers came to know about the five zones

with frigid and uninhabitable polar zones, two temperate zones, and a torrid zone around the equator between the two temperate ones. Each zone had a precise size. A variant to the theory added two more zones, also based on latitude. If surviving climate maps are any indication the type was more popular in Arabic-speaking regions. Still over 150 zonal maps have been found from Christian Europe in manuscripts of Macrobius' commentary from the ninth through the fifteenth century. They continued to appear into the sixteenth. The theory enjoyed some degree of popularity even into the modern era.[22] The maps showing climate zones were highly stylized, their purpose to transmit one critical piece of information. They rarely ventured beyond depicting the major divisions and as a result rarely enjoyed the embellishment or the evolution of the more common maps which showed the world divided into continents.

Tripartite maps had Asia, Africa, and Europe with Asia as large as the other two combined and usually at the top. The lands, surrounded by water were placed inside a circle so such representations took on a T-O shape, the T inside an O. The form gave the map the appearance of a cross, a symbol not lost on cartographers. Quadripartite maps added a fourth continent in a southern hemisphere. In both cases the theoretical basis for the form and format was classical. The maps were simple and almost stylized and the simplicity of a disc with three or later four large and in many cases indistinguishable bodies of land indicate that the maps were made first and foremost to represent a theory about the shape of the world. Often quite small, that is with a diameter of less than two centimetres, their function was symbolic. Their roots lay in the description of the world in St. Augustine's *City of God* and transmitted to medieval readers and cartographers through the work of Isidore of Seville. The T-O map was the most common type of world map and possibly the most common type of map produced in the Middle Ages with some 660 examples surviving. While many examples retained the simplicity of early T-O maps the addition of winds and then place names and other details and then text and illustration enhanced the value of such diagrams.[23] The T-O outline fostered at the height of the tradition in the thirteenth century the most impressive of medieval maps, the large and impressive *mappaemundi*.

The word in the early Middle Ages for a map was *tabula* but that was slowly replaced by *mappa* which meant tablecloth or napkin, a word combined with *mundi* to described a map of the world. 'The primary purpose of these *mappaemundi*…was to instruct the faithful about the significant events in Christian history rather than to record their precise locations.'[24] The meaning of *mappamundi* expanded over time but the examples always included textual descriptions as well as graphic ones. *Mappaemundi* were almost invariably tripartite maps. The quantity and quality of illustration on them increased dramatically over time. They appeared in various media through the early and

high Middle Ages from stained-glass windows to floor mosaics to frescoes to a number of others, that is alongside the work of artists on parchment. They even appeared on walls, in some cases as visual aids for lectures by learned men from the third century through the fifteenth. Those representations of the world and of Christian knowledge about the world depended on the work of theologians and the transmitters of classical knowledge and rarely was anything from contemporary sources or from other mapping traditions incorporated into them.[25] *Mappaemundi* carried all kinds of information with geographical data never the most important. Zoological and anthropological knowledge also played a secondary role to historical and, above all, to moral and theological. A *mappamundi* was in a sense an *imago mundi*, the simultaneous representation of a world view, of myth and of religion. It is true that the Bible was the inspiration for medieval world maps but to see that as some plot by churchmen or to call the results laughable is to miss the point. *Mappaemundi* were intended to represent the history of the world from the Creation to the Last Judgement, describing time as well as space. They were virtual history paintings.[26] The maps became, in the hands of medieval artists, syncretic pictorial chronicles parallel to textual ones. The artists put history into a geographical framework, and did so with text and with pictures. Telling the story of the past in both time and space was done through text on the map itself with explanations and captions often spread around them in the learned language of Latin.[27] Some maps did show signs of an interest in travel but the travel was always for religious purposes. Maps were not designed to show pilgrims exactly which roads to follow but rather to give them some idea of relative location and of the religious function of pilgrimage. It was the significance of places as much or more than their location that interested cartographers. As compilations of knowledge, as transmitters of the learning of the classical past, as chronicles of Christian history, as sources of meditation and inspiration, *mappaemundi* were highly valued. They may not have been necessary to Christian devotion but they did offer a significant supplement. That is why prominent figures in and outside the church continued to commission their production and artists continued to make them through the fourteenth century.[28]

   It was not only the increase in production of world maps in the twelfth and thirteenth centuries but also the commitment on the part of cartographers to have their products more fully serve the central didactic function of medieval maps that created the grand compilations which decorated books and, more impressively, the walls of churches and palaces. In England alone there were wall maps, all now lost, in the king's palaces at Westminster and at Winchester, another in the monastery at Waltham and presumably more in other places for which records have not survived.[29] Such big wall maps may have had their origins in Antiquity though more likely is that such gigantic

works, similar to those that appeared in manuscripts, were considered proper decoration because of their devotional purposes, their encyclopaedic qualities, and their embodiment of artistic work of high calibre. The two best known, justly, of such masterpieces were giants made for monasteries, the first in Ebstorf in north Germany and the other for Hereford in the west of England.

The Ebstorf map was destroyed in a bombing raid on Hanover in the Second World War but not before copies had been made and not before it had been studied by a number of scholars [Figure 2.4]. The map was completed certainly in the first four decades of the thirteenth century. Intended to hang behind the altar in the convent, it was made up of 30 parchment sheets and measured 358 × 356 cms. Gervase of Tilbury, an Englishman who taught canon law in

Die Ebstorfer Weltkarte
Digitale Rekonstruktion
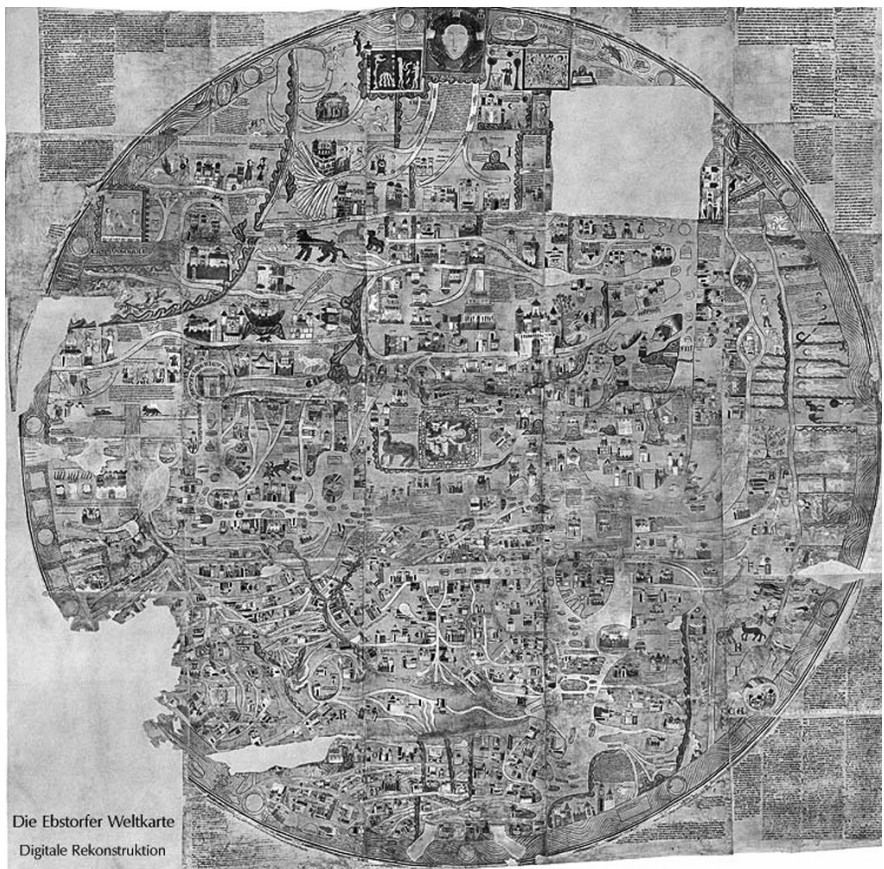
Figure 2.4   The Ebstorf Map, a giant *mappamundi* from the early thirteenth century, lost in Hanover during an air raid in the Second World War. Digital Reconstruction Thomas Zapf, courtesy of Harmut Kügler.

Bologna and was provost in Ebstorf from 1223 to 1234, is often suggested as the author but that claim is certainly in doubt. The map showed an expanding knowledge of the geography of Europe, most notably of northern and eastern Europe, and was based to a very limited degree on local maps, something almost unheard of to that point in medieval cartography. The giant *mappamundi* included a mass of information, classical and Biblical, but it also had a function for pilgrims or so the author explained in one short statement in upper-right. He said the map was to give directions and as much or more to illustrate things of interests the traveler or rather pilgrim might see along the way.[30] The world and the body of Christ coincide in the map with His head at the top and His hands extending beyond the circle of the world at the sides.

The Hereford map, probably designed at Lincoln by a prebendary of the cathedral, Richard of Haldingham and Lafford, and moved across England at a later date, was completed in the 1280s. At 159 × 130 cms. It is considerably smaller and less detailed than the Ebstorf map. The Hereford map, like all such large works, had predecessors and even prototypes, now lost. 'Compiled at a time when the witness of established authority was valued and protected, the map is an elegant tapestry of inherited, and thus honoured knowledge.'[31] The sources included a number of classical and early medieval authors. There is even a reference on the map to a massive mapping project undertaken in Rome under Julius Caesar. The author of the Hereford Map called it an '*estorie*', a chronicle of the history of the world or at least the most important events of that history. The goal was, among other things, to put the history into some geographical framework, to give it more immediacy and possibly make it easier to remember. Learning in the thirteenth century did rely heavily both in theory and in practice on the use of mnemonic devices so it is not odd that a map should have been made to serve such a purpose.[32] The map was based in part on earlier itineraries and the prominence of two Alpine passes among other indications suggests the goal was to point out major pilgrimage routes to Santiago da Compostela, Rome and ultimately to the Holy Land. What contemporary geographical information there was on the map was not only to inform but more important to inspire the potential pilgrim to southern Europe.[33]

Though the typically greater survival rate of medieval materials in England does prejudice any effort to weigh relative importance still it does seem that there was a special interest in map making and especially in the production of world maps in the kingdom in the late twelfth and thirteenth centuries. The strong *mappamundi* tradition may have dated back to the Norman Conquest in 1066 but it certainly did enjoy royal interest if not royal patronage in the thirteenth century. A map fragment from the second half of the thirteenth century suggests an elaborately decorated surface about 164 cms. in circumference and so about as large as the more or less contemporary Here-

ford map. In fact there are some obvious similarities between the two maps and there are indications of other thirteenth century maps large and small with the same sorts of decoration.[34] The *mappamundi* tradition carried on into the fourteenth century, different strains or varieties emerging and incorporating new information in maps of varying size and complexity. The Evesham world map, completed later around 1390, at 94 × 46 cms. was considerably smaller than the giants of the previous century. Probably intended to decorate a wall, it shows signs of a drift away from the inclusion of Biblical knowledge and toward a greater interest in contemporary geographical knowledge, a general tendency of the closing years of the Middle Ages. Still it was deeply rooted in the established *mappamundi* tradition. There are indications of an Anglo-centrism, a possible product of the more lively interest in such maps in the island kingdom. 'In their essentials – and despite the modernisms and innovations that most contained – world maps had become standardised in their contents, and their general image was conventionalised by the fourteenth century.'[35]

The greatest accomplishments of high medieval cartography, *mappaemundi* from those in small hand-held psalters to giant wall maps, had lavish and complex illustration. Decoration was an essential element of those maps. Biblical scenes were the most popular choice but classical gods and Roman rulers could turn up as well. Evangelists or their symbols and the sites of the burials of prominent saints also populated maps.[36] While there might be some practical purpose, such as to indicate the direction of a pilgrimage route, all the items selected for inclusion had some symbolic value, contributing with the rarest of exceptions to retelling Christian history. Symbols abounded but ships put in only the rarest of appearances.

Though the goal of *mappaemundi* was to promote religious contemplation the influence of classical geographical knowledge remained strong and was only slowly if at all supplanted. The centre of T-O maps was always in the eastern Mediterranean but it was not until the thirteenth century that cartographers began to identify the centre of the map with Jerusalem as the centre of the world. While the site of the Resurrection rarely took the most prominent place on *mappaemundi* it did in the very large Ebstorf and Hereford and in other well known maps. That has led to overemphasis of the idea of the importance of the city in the minds of western Europeans and been taken as more evidence that people in the Middle Ages knew nothing about geography. The world map dedicated to the Empress Mathilda by the cathedral canon Henry of Mainz from around 1110, for example, is centred on the area surrounding the sacred, at least for pagans, island of Delos. The over 300 zonal maps based on Macrobius are centred on the equator, so on many maps the focal point was not even in the eastern Mediterranean. The first map to put Jerusalem in the geometric centre was not produced until the twelfth century.

It is possible that the Crusades, the increase in the number of Latin Christians traveling to the Holy Land, and the propaganda promoting participation in military efforts in the Levant led to Jerusalem appearing in the centre of maps. The error of thinking that people in the Middle Ages believed that Jerusalem was the centre of the world and that medieval maps were the expression of that belief, despite abundant evidence to the contrary, has not prevented the repetition of that misconception.[37]

The maps that cartographers produced down through the high Middle Ages were not dominated by one exclusive tradition. The twelfth and thirteenth centuries saw great strides in the variety and scope and scale of the maps of the continents, whether it was three or four. Those maps embodied the encyclopedic tradition going back to late Antiquity, to the work of Isidore of Seville transmitted through Bede and other writers. That body of ideas survived, at least on *mappaemundi*, the ferment that typified western European learning starting in the late eleventh century and intensifying as more and more of the work of Aristotle became available and began to influence ideas about science and religion. Among many other things the Aristotelian impulse led to a search for a greater understanding of the natural world. Theologically, understanding God's creation was a way to understand God and so the study of science became an act of devotion in the minds of many thinkers as well as practitioners. The new ways of thinking had a significant impact on physics and astronomy and natural history but seem to have had a limited impact on maps or on map makers. Still *mappaemundi* could not escape completely and it is possible that they, and indeed all maps, reflected the spread of Aristotelianism in a greater value placed on observation and the gathering of data from the natural world. In the fourteenth century, possibly as a result of the challenge to the predominant understanding of scientific thinking by the English Franciscan, William of Occam (c. 1285–1349), or because of the appreciation of nature as God's creation, there was a greater interest in showing specific manifestations of the natural world in more detail and with an increasing degree of accuracy.[38]

The apparent lack of impact of the new learning may obscure other influences on map making which, though subtle, became more prominent over time. Some Europeans knew about Arabic maps, especially in those regions where Christian and Islamic cultures intermingled. The Norman king of Sicily, Roger II (1097–1154), employed a Muslim cartographer, al-Idrisi (b. 1099), to produce world maps for him. A large map on a table of silver is lost but a descriptive work associated with it has survived as has a manuscript world map. Though the latter relied on Ptolemy there was certainly some novelty, some advances on classical geographical knowledge. al-Idrisi's own travels to England and France as well as Central Asia seem to have had only a moderate effect on his maps. His geographical work did not get translated into Latin

until 1619 so its impact in Europe was muted. He did have followers and his work did generate some response in southern Italy with scattered signs of influence noticeable in later cartography done in the peninsula.[39] Arab map makers offered examples for the depiction of Africa but the old Roman provinces there remained the norm for European maps. As to the Arab practice of orienting maps with south at the top there was virtually no effect in western Europe. There maps had east at the top, as was the practice in T-O maps, or north following Greek practice as was the case with al-Idrisi. While having east at the top was typical in Latin Christian Europe it was not exclusive to that region or religious affiliation and, in any case, there were Hebrew and Roman precedents.[40] The large *mappaemundi* for the walls of northern Europe, as with T-O maps, had east at the top.

Mappaemundi did not have ships as part of their repertoire of illumination. Now and again but by no means universally Noah's Ark did turn up, perched often on Mount Ararat where it had come to rest after the Flood. Even the story of Noah which was well known and a common source of inspiration for illustration in churches in early and high medieval Europe and which was anchored to a specific geographical site rarely inspired the artists who illuminated the various entries in the visual encyclopedias that were the *mappaemundi*.[41] Ships did not figure in those large maps or for that matter on any maps of medieval Europe. There was, however, one notable exception in the work of one highly exceptional map maker of thirteenth century England.

Matthew Paris was a rather precocious character who holds a unique place in the history of cartography. A Benedictine monk at St. Albans north of London from 1217, he served as historian of the monastery and produced a universal history of the world, his *Cronica majora,* between 1237 and his death in 1259. It is the first medieval historical text to be provided with an abundant body of pertinent illustration. 'Executed by a largely self-taught chronicler-turned-artist, this massive corpus of innovative secular drawings stands outside the artistic conventions of the monastic workshop tradition as the creation of a uniquely gifted individual.'[42] While it is possible that he was part of a cartographic tradition, now lost, and connected to other map makers doing similar work there is no way to confirm that speculation. Though doubt has been raised about who actually drew the maps and the illustrations for them it seems all but certain that the work was entirely Matthew's own.[43] He experimented with many different types of cartographic representation. At least 15 maps of his on seven different subjects survive. Among them is a strip map, converting an itinerary in the classical tradition into a graphic illustration of a trip by land from London to Apulia in southern Italy. The inspiration may have been the offer of the crown of Sicily to Richard of Cornwall, the brother of the king of England, which suggests that Matthew Paris had a connection with the royal house. Political developments as well as greater

travel to Rome in general in the thirteenth century almost surely increased English interest in southern Italy. Matthew Paris was an innovator in many ways, for example, in identifying Poland by name on a map, the first person to do that even though the name and the kingdom had existed for about 200 years.[44] There are also two different maps of Palestine by him, connected to the crusade of Louis IX, king of France, and showing a great deal of detail. His maps were often intended to illustrate the chronicle and that, along with his curiosity, may help to explain why he populated his work with such a variety of animals, places and people. Since he made maps which seem to have no place among the rest of medieval products it suggests he knew something others did not. In some ways his most novel work was a map of Britain which gave a better visual impression of the island than any previous depiction. It was apparently based on itineraries as possibly were his maps of the Holy Land. That reliance on written descriptions of routes may be the reason for the dramatically different results which he achieved. On the other hand there is a remote possibility that he did have knowledge of contemporary sea charts.[45] Such knowledge of another way to make a map might help to explain why his works were different.

Matthew Paris did produce a map with ships. It was one of his maps of the Holy Land, showing the siege of Acre [Figure 2.5]. There are different versions
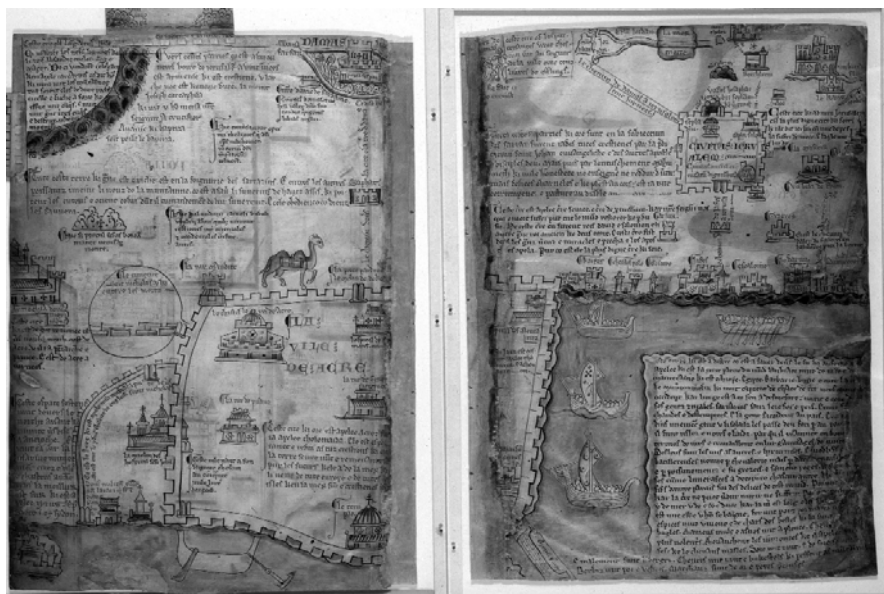
Figure 2.5   Matthew Paris, map of Acre with a camel on land and ships off the coast.
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of the map but in all of them the place chosen for the map in the text suggests that it was to indicate the end point of a journey, a pilgrimage from England to the Holy Land. The journey may have been only a spiritual, contemplative and pious one but the illustration shows knowledge of the physical destination. Next to Acre is a camel suggesting the town as the terminus of overland trade to Asia. The depiction of the town is reminiscent of the stylized Jerusalem on the Ebstorf map. There is more detail in some versions, including the fortifications added to the port by Louis IX on his Crusade in the 1250s.[46] Off the coast there are six ships, three of them sailing ships and of unquestionably northern European type. They are similar to contemporary keels, descendants of Viking cargo ships that were common cargo and people carriers as well as warships in the waters around Britain in the thirteenth century. The dragon heads on the foreposts and the decoration of the sails also indicate their origins. The hulls have overlapping planking and the sails are square, set on single yards, features that were virtually unknown among contemporary Mediterranean vessels. Such types might have made it to the eastern Mediterranean as part of flotillas bringing Crusaders from the North though the numbers of such ships were small and their survival rate in the worm-infested warm waters off the Holy Land was low.[47] Whatever the origins of the ships on the map they are involved in naval activity in support of a Christian cause. Matthew Paris was an unknowing precursor of a new kind of mapping or at the least he anticipated a number of trends which would take cartography away from long standing and increasingly standardized practice. That is not to say his work was divorced completely from the practices of makers of *mappaemundi*. The opposite was the case, the camel near Acre being only the most obvious sign of his reliance on his predecessors' work. The unique English monk with a strange career which, with rare exceptions, kept him at home in his monastery for most of his life somehow sensed and found and followed the emerging trends in map making. Among a number of features that he prefigured and one which alone would have singled him out was the inclusion of ships on maps.

Mappaemundi got bigger and grander in the thirteenth century. Just at the point that they attained their greatest importance, value, and intellectual achievement they were about to disappear from the list of the products of European cartographers. The '…curious mélange of both Christian and secular legendary history'[48] that was the *mappamundi* was increasingly restricted to smaller forms and increasingly subject to influences from other types of maps which changed their appearance and drew them away from their original purpose. The drift of maps toward transmitting information about the contemporary world undermined the underlying didactic and moralizing function, the focus, and the format of those monuments of medieval cartography. T-O or tripartite, and quadripartite types were not the only forms of medieval

maps with roots in the classical Latin past which were to decline in importance and to change in the late Middle Ages. They did not disappear entirely and zonal and T-O maps certainly survived into the sixteenth century. They were copied and their features repeated for both good and bad reasons. Examples showing three continents, each with a son of Noah, a common medieval picturing of the world, appeared in the fifteenth century even sumptuously decorated to illustrate histories.[49] Established traditions and practices faced new and powerful forces set to sweep away what had been normal thinking about the functions of maps through the thirteenth century. The injection of two new forces created the transitional maps and the transition in mapping which marked the years from around 1300 to the mid sixteenth century. First, the revival of knowledge of classical cartographic theories starting in the early years of the fifteenth century would give not only a new appearance and new orientation but also a new conceptual framework to maps. That combined with a growing interest in representations of the physical world allowed maps to migrate from their much more common role as book illustrations to free standing artefacts valued and viewed on their own and independent of any text.[50] Second, and in the end more critically, the transition to new forms of mapping came from the practical representations of the world created by and for sailors. The charts which showed how to get from port to port not only made for a new type of map and map of the world but also changed decoration on maps and led to their being populated with ships at sea.

3
Portolans and the Late Medieval Transition

> …the so-called portolan charts – are technological marvels whose origin has still not been fully explained.[1]

The inability to understand the roots of those unique maps makes them even more mysterious as well as marvellous. They were also the first maps illustrated with ships, at first a few and then many and then very many. The *portolano* was no more than a list of sailing instructions. It stated simply the directions and distances between ports or prominent landmarks. There were no pretensions to detail or to literary quality. They were highly if not exclusively descriptive. Ancient Greece knew a very similar work. Few examples of the *periplus* have survived, the oldest being from the fifth century BCE and the latest from the fifth century. The last, by Marcianus Heraclensis, covered Europe to the mouth of the Vistula and was a compilation of earlier works, the typical pattern with all such books. The best known was the fourth century BCE compilation attributed to Scylax of Caryanda which covered the Mediterranean and adjacent seas. Though the material existed in such *periploi* to make a chart there is no evidence that one was ever made. The oldest surviving version of the book by Scylax is from the twelfth century so copies continued to be made. There seems to have been less of a Latin than a Greek tradition of writing such coast pilots.[2]

Though *periploi* certainly existed in high medieval Europe and though they and *portolani* were in essence compilations of memorized sea routes there is no obvious or direct connection between the two. It is conceivable that the medieval books took their data from classical predecessors but the extent and variety of information in the former type suggests development beyond the products of Antiquity. There was a difference in style. The classical *periplus* had commercial information while the portolan recorded nothing but navigational knowledge. Medieval *portolani* might possibly be related to the Arab *sakifa* which served similar purposes. The surviving portolans are all in Italian.[3] Whatever their roots those *portolani* were major advances on sea

itineraries which were accounts of voyages offering little more than a general impression of how the traveller got from one place to the other. The *Il Comopasso da navigare*, for example, which appeared in 1296 and was probably based on a similar book from earlier in the thirteenth century, had sailing directions for all of the Mediterranean and Black Sea coasts with bearings, distances in Italian miles, guides to entering harbours and the location of dangers such as shoals and reefs along with facts on safe harbours and anchorages and directions for open-sea crossings of up to 1,200 kilometres. Pilots, according to Castilian law of the second half of the thirteenth century, were to know the winds and the routes, to know the ports and how to get in and out of them. Portolans supplied exactly that information. Such books, as in the case of an anonymous portolan of the Adriatic and Mediterranean of around 1300, listed distances and directions one after another in the same very careful and precise hand.[4] The luxuries of title pages or dedications or any publishing information were absent and presumably deemed unnecessary.[5] What took medieval sailing directions well beyond any predecessors was the addition of graphic representation of the data in the books.

Europeans began to use the compass for navigation in the twelfth century. That development had significant implications for shipping and the economy. The bishop of Acre declared in 1218 that the compass was necessary for navigation at sea and by 1269 Petrus Peregrinus de Maricourt in his *Epistola da magnete* discussed exactly how it could be used to establish the position of any place on land or sea.[6] By the mid thirteenth century the compass had moved beyond a needle floating in water to a pivoted indicator often set above a card which showed directions. Use spread beyond the Mediterranean and by the fourteenth century Flanders was a centre for the production and sale of compasses. In the fifteenth northern Europeans were altering the position of compass cards relative to the needle to compensate for the difference between true and magnetic north. The widespread use of the compass probably promoted the development of the nautical chart.[7] The mass of direction or rhumb lines typical of portolan maps which show compass directions give further support for the charts depending on the introduction of the compass. The lines are so prominent that in English portolan charts are at times called compass charts. The existence of long routes in the 1296 version of *Il Compasso da navigare*, routes defined more precisely than the coastal ones, suggests that it like the portolan charts was designed to help captains exploit the potential of the increasingly widely used compass.[8]

The consistent grid on which the outline of the Mediterranean and Black Seas is projected on portolan charts appears to be similar to that in use in the time of Marinus of Tyre, suggesting some classical roots. So do the measures of distance used in constructing the charts.[9] What is more *periploi* were never accompanied by any chart but some students of those ancient works see a strong possibility that the written directions were intended as companions to

now-lost charts. The first medieval charts like the written *portolani* may have been based on examples from Antiquity or intermediary Arab maps. A possible Chinese connection as the root for the thirteenth century cartographic novelty has been suggested as has the emerging scholastic cosmography of the universities in the thirteenth century which borrowed heavily from Arabic learning.[10] Ultimately the collection of rhumb lines combined with the absence of any previous map with the same characteristics as the portolan chart makes it most likely that the experience with compass headings of various captains was brought together in graphic form to match the written form in the *portolani*.

The consistent placement of north at the top also suggests the making of the portolan chart was related to the use of the compass. The rhumb lines were not loxodromes, that is they did not give consistent compass bearings, and exactly how the system of them was built up remains a mystery.[11] It was certainly a mystery to northern Europeans where the geometrical and mathematical skills to produce a sea chart were sparse in the Middle Ages. There the need to deal with tides, not a problem in the Mediterranean, may have led to the greater reliance on more tried and true navigational aids such as the sounding lead, that is along with the compass. While written sailing instructions were produced in the mid fourteenth century at the latest in the North and the compass was in widespread use by the fifteenth, it was probably not until the sixteenth century that pilots in the North and Baltic Seas saw or used sea charts.[12]

'The portolan chart was a pragmatic document, drawn by using compass bearings, but without reference to any larger geographical scheme.'[13] No doubt the charts were compilations of observations and with extremely limited theoretical underpinnings. Their creation by and for seafarers made them different and gave them a critical role in the development of cartography. They did have roots in both practical and learned culture, in the exchange of knowledge between very different intellectual and social spheres which also made them exceptional.[14] The book of sailing instructions was a *portolan* so using the same name for the chart can be a source of confusion. The dual use of the term, which has its origins in the late nineteenth century work of the Scandinavian explorer and scholar A. E. Nordenskiöld, is now common, however, and alternatives such as compass chart or compass map or the Italian *carta nautica* are rare. Chart, because it is a Dutch loan word which arrived rather late, indicates a map of the sea in English so the meaning of portolan chart is clear. In the Middle Ages in northern Europe few people if any would have used 'chart' to describe the maps with all the rhumb lines, at least not before the sixteenth century. In German *kompasskaart* was more common, in Arabic *konbas*, and in Italy makers would have called the product a *comapsso*, *tabula* or *charta*.[15]

While putting sailing directions in graphic form may have been a great step forward in cartography the advantages of the portolan chart to sailors were not immediately obvious. As with most technological changes a period of experimentation, adjustment, and developments in related technologies was needed

before the potential of the new device could be realized. Certainly the makers worried about getting the measures right but just using compass direction and distance guaranteed distortion. Alexandria and Ceuta are at the same latitude but portolan charts invariably show a four degree difference. While the rhumb lines did give directions for courses it was only in the middle of the sixteenth century that John Rotz, a French cartographer, described exactly how to use them and what is more his explanation is not highly transparent.[16] Navigators must have faced a learning barrier, especially in light of well entrenched piloting practices which had proven successful over the long term. To use the charts effectively sailors needed reliable compasses and hourglasses. If the coast or the sun or stars were readily visible then bothering with the complexities of the chart was unnecessary. Pilots could always use what knowledge they had already assembled in their memories. Presumably the old and the new technologies functioned side by side for some time with maps of the sea serving as supplements to the written portolans and to '*kunst in kopf*', what pilots carried in their heads. The portolan chart may have had more important functions than as a practical tool at sea, that as a device for showing how pilots navigated and for showing strategic locations to officials. Whatever their roots or purpose the charts represented a compilation of extensive knowledge and produced a highly accurate picture of the location of major land forms around the Mediterranean and Black Seas.[17] The rich variety of information on those surfaces would only increase over time, enhancing their value for a range of tasks.

Cartographers made the first marine charts possibly as early as the twelfth century. A text written around 1200 is a list of ports and distances, as with other portolans, but the author as much as said he took the data from a map, what he called a *cartula mappe mundi.* The book appears to be an effort to transmit the compilation of practical experience of sailors to learned clerics. The participation of northern Europeans in the Crusades, their need to find the way to the Holy Land by sea and the interest of political and religious figures in the voyages may have been the inspiration for examining and trying to summarize the practical knowledge gained by sailors. The data appears to have been on maps, on charts of limited areas but they like the books generated from them indicated a different approach to gaining and using information.[18] The earliest of charts may date from the mid twelfth century which, along with internal evidence, suggests that there was no need for a compass in order to make a portolan chart. Even so it is likely that more of them appeared and were disseminated as the compass came into wider use. It is also possible that eleventh century maps which have not survived were not charts in the same way later marine charts were.[19] Presumably small portions of coast got graphic treatment and then the limited depictions were brought together to create composites for ever and ever greater areas. The use, in some cases, of out-of-date sketches led to the inclusion of incorrect information, some of it dating from the second half of the twelfth century when pilots may well have contributed to the making of the first charts. Once

embedded it took some time before cartographers recorded an accurate rendition of changes in waterways on larger general charts.[20] The exact process of creating what Nordenskiöld called the normal portolan chart can not be known since none of those original charts of limited areas has survived. If there were written portolans covering the Mediterranean by the mid thirteenth century presumably there were equally extensive portolan charts to accompany them at about the same time though the charts may have preceded the written sailing directions. The first chart was made in the western Mediterranean, the exact location having been a source of some unproductive scholarly discussion.[21] The charts carried on board ship typically were discarded after suffering wear and tear. They were presumably simple with the more elaborate versions being kept on shore, perhaps serving to jar the memories of pilots and prevent their losing the body of necessary knowledge they carried in their heads. What has survived therefore is a small and not representative fraction of the total output of portolan charts.[22]

There are indications that by the second half of the thirteenth century western Mediterranean sailors knew how to navigate with a chart at sea. A chronicler who died in 1300 described a voyage of Louis IX, the king of France, to Tunis in 1270. After a storm when the king asked where they were the pilot showed the saintly monarch on a *mappemonde*. Presumably the chronicler had no other word to describe what was to a visitor from northern Europe a novelty and what almost certainly was a portolan chart.[23] The map was a convenient way to deal with the question and the very important person who presumably knew little or nothing about navigation required an easily accessible answer. The Franciscan philosopher from the island of Majorca, Raymond Llull, who was deeply devoted to the conversion of Muslims to Christianity wrote in his *Arbor scientiaer* of around 1295 that sailors needed both written sailing instructions and charts. An inventory of a Sicilian ship that returned from Tripoli to Tarento in 1293 included on board a *mappamundi*. In 1354 King Peter III of Aragon required that any war *galley* setting sail had to have two charts on board so by that date not only were portolan charts in widespread use but there were workshops set up in ports like Barcelona to meet demand.[24] The historian and philosopher Ibn Khaldûn of Tunis wrote in 1377 that charts gave the exact position of the two shores of the Mediterranean as well as the directions of the principal winds and so were necessary navigational tools for sailors. He explained the absence of shipping in the Atlantic by the lack of charts. While comprehensive portolan charts may have existed as early as the late twelfth century it appears that by the mid fourteenth they were in common use and on both the north and south shores of the Mediterranean and by both Christian and Muslim sailors.[25]

The oldest surviving portolan chart is the so-called *Carte Pisane*. Though found in Pisa it was probably made in Genoa. It is not dated but was made in the closing years of the thirteenth century and most likely before 1291 when Acre fell to Muslim forces [Figure 3.1]. The chart shows a banner decorated with a cross of Malta above the town indicating it was still in Christian hands.

Figure 3.1 The *Carte Pisane*, the oldest surviving portolan chart, from the late thirteenth century. Bibliothèque nationale de France, GE B 1118 RES.

Measuring an impressive 50×100 cms. the map shows many of the features that would prevail for portolan charts even down to the seventeenth century so conventions for portolans were already in place by 1300. Portolan charts usually fell in the range of 45×95 to 75×140 cms., the limitation being the size of the animal which supplied the parchment. The goal appears to have been to make them as large as possible.[26] There was variation in the places named in the maps and in the names used for the places but there was almost no variation in the shape of the coastlines of the Mediterranean and Black Seas. Inconsistencies in the names may have simply been a result of copyist error with the work of writing being delegated to people in the workshops who were less experienced. The names usually took not learned Latin forms but rather vernacular Italian or Catalan ones, presumably reflecting the culture of the users. The names gave a sequence that seamen could follow as they moved along the coast. The goal for the chart maker was to get the headlands and estuaries right since those were the most important features for sailors. The spaces between got filled in. With the *Carte Pisane* in one case the line connecting two points depicts a deep sea sailing direction just like that described in *Il Compasso da navigare* suggesting a strong connection between those written sailing directions and the chart. No matter how cartographers made portolan charts the results were surprisingly accurate.[27]

By the end of the thirteenth century the type of map had already become so normalized that it was common for cartographers to make presentation copies, versions designed for the libraries and offices of merchants, traders, and even politicians. The some 33 charts that have survived from the thirteenth century are luxury productions, not only grand but often sumptuous, elaborately decorated and expensive, much more expensive than the charts pilots might have used on board ship. Though the impressive products that have survived most likely never saw the deck of a ship or ever went to sea there is every reason to believe that they reflect the principal and many of the minor features of the charts pilots had with them on board.[28] Presentation copies were not intended as decoration but they were more likely to be decorated. They often contained illustration and ornamentation and so could be vehicles for expressing ideas about geography and the relationship of people to the land and seas.

The network of rhumb lines on each portolan chart radiated from usually eight centres which were equidistant from two circles of the same radius, one centred in the Aegean and the other in the western Mediterranean off Corsica. Those wind roses where the lines met, though they typically had no decoration on Italian maps, could be embellished and decorated to create compass roses, a practice which began in the second half of the fourteenth century. They could have heads of the Virgin or landscapes. The winds indicated by the lines had names, handed down from ancient Greece. 12 or 24 winds were possible and common through the early Middle Ages but portolan chart makers settled on 32 as the norm.[29]

What changes there were in the charts make it possible to trace the evolution of knowledge and to classify families of maps descended from common

sources. The names of towns were written at right angles to the coast, taking up space inland, while the names of islands were always more or less parallel to the edges of the chart. About 40% of portolans in the fourteenth and fifteenth centuries had flags for certain towns though there is no guarantee that the arms shown on the flags were correct or that the indication of the overlord of any town was up to date or that the information was of any value to sailors.[30] When they were coloured, which was rare, there were normal colours for the sea and the land, for lettering, for lines, and for dots and crosses. Keys and legends on maps were a product of the sixteenth century which was all the more reason for map makers before about 1500 to be consistent and so reduce potential confusion. There was a typology of colours inherited from the Hebrew Bible through which early medieval thinkers had a mixed influence on map makers. There was some colour coding of different climatic zones and some specific colours attached to specific bodies of water such as the Red Sea, however, the colour traditions of individual portolan chart makers were distinctive.[31] The portolans were spotted with vigias, small crosses almost invariably in black to indicate shoals and rocks, shallows and bars among other potential dangers to navigation. Later maps would differentiate rocks with black and shallows with red. The coastlines were in black. Town names were in black, the most important ones getting their names in red. Islands were in red, blue, and gold. Even the lines emanating from the wind roses had specific colours with blue or black reserved for the four cardinal directions, green for the half winds and red for the sixteen quarter winds.[32]

Though standardization left makers of portolan charts with limited scope for novelty one way they could give their works a unique and distinctive character was though illustration, through the addition of information picturing people and places and actions. Only the boundary between land and sea and port names were required so there was a great deal of unused surface. The contrast between the cluttered coastline and the open space was dramatic. The map makers choices of different things to illustrate indicated both their backgrounds and their intentions. In the fourteenth century different schools of portolan map making emerged. By around 1350 maps made in Venice and Genoa had only information of direct interest to navigation while those made in the Balearics included inland features. Catalan charts had rivers and mountains, tents with banners above them and flags to indicate ruling dynasties. Map makers were not concerned with the interior or the open sea, except perhaps as a place to give their imagination some play. Given a free hand some odd animals, people and objects turned up decorating the charts. There were long traditions of illustration in medieval cartography, for example in *mappaemundi*, so the choice of some cartographers to include decorative elements can hardly be a surprise.[33] What is more since buyers of maps wanted impressive objects, and were willing to pay for the work needed to make them impressive, then map makers had every incentive to expand decoration.

A contract from Barcelona in 1399 lays out how buyers commissioned maps from cartographers. Before the sixteenth century there were no chart sellers,

no retail trade and so map makers had to rely on commissions. The buyer, a Florentine merchant, ordered four *mappaemundi* that he planned as gifts to impress certain European kings. There were two map makers, Francesco Becaria who was Genoese and living in Barcelona, and Jacme Ribes who was from Majorca and a converted Jew formerly known as Jafuda Cresques. The 1399 commission led to a lawsuit since Becaria was not paid and the merchant did not get two of the four maps and the ones he did get were, he claimed, defective. Becaria was a specialist, responsible for the decoration, so there was a clear division of labour and even possibly different workshops involved in creating the final products. Becaria claimed he had gone beyond the contract and included 165 figures and animals, 25 ships and *galleys*, 100 fishes large and small, 340 flags on cities and castles, 140 trees, so a total of 770 images. The maps were exceptional since the larger two of the four were to have been 368×368 cms., that is exceptional giants. The cost for the illustration on those big maps was anticipated by the buyer and written into the contract.[34] While the norm may have been much more humble than the contract between an international jewel dealer and two famous map makers, the dispute does indicate that it was buyers seeking decorative and impressive objects as much or more than the sense of the cartographer which determined what went on maps.

For the Venetian school decoration was sparse down through the fifteenth century. Usually on Venetian charts and related ones from Ancona there was nothing inland, no sign of cities or kingdoms or symbolic depictions of them. The waters were equally devoid of decoration. The bareness and simplicity of the charts suggested their roots as object for use on board ship. Grazioso Benincasa in a lengthy career spanning the years 1461 to 1482 produced more than 20 charts including three sea atlases in 1467 which incorporated new information about the coasts of northern Europe and especially about Portuguese exploration along the African coast. While over time there were few changes in the coastlines in the Mediterranean and Black Seas on so-called normal portolans cartographers like Benincasa did add new information about the coasts of the Black Sea, west Africa, Atlantic islands, and northern Europe, even if at a slow pace.[35] Though he was born in Ancona and spent time in both Genoa and Rome and even returned to Ancona for the last years of his life most of his work was consistent with Venetian practices, at least through the 1470s. Venice and Genoa were typically given a prominent place on his maps with big buildings and flags flying. There are no compass roses and while Ireland might be green the maps were otherwise devoid of decoration.[36] Equally or even more typical of the Venetian school is the late fifteenth century so-called Cornaro Atlas. Dated to between 1489 and 1492 it has 34 different charts probably by different cartographers with some consistent and minor decoration around the edges. Otherwise the charts are bare with seas only punctuated by some islands.[37]

Maps from Genoa were similar to those from Venice, in part because of the contact between cartographers working in the two cities. Genoa was in the

fourteenth and fifteenth centuries the other major seaport of the most prosperous trading and shipping region of Europe so the presence of chart makers there is not at all surprising. While Genoese portolan charts tended to have open seas the work of the best cartographers could include some decoration, perhaps thanks to the proximity to the Balearics and potential cross-fertilization in map making. The Genoese Francsco Becaria, who got into legal trouble in 1399, worked with a Catalan map maker in Barcelona on that 1399 commission and so ended up producing a style and scale of map different from the usual product of Genoa. The pattern may have been set as early as c. 1310 when Giovanni da Carignano, the rector of San Marco in Genoa, produced a portolan of Europe, one of the oldest surviving at least down to 1943 when it was lost. It was the earliest map to show Scandinavia, if somewhat inaccurately and did better with the Black Sea than was common at the time. For illustration there were some inscriptions inland as well as escutcheons.[38]

More important for Genoa and for map making was the contemporary work of Pietro Vesconte, called by one scholar the Giotto of cartography and the first named maker of portolan charts [Figure 3.2].[39] He may also have been the first professional chart maker but he apparently had another occupation as a surgeon. Vesconte's portolan of 1311 was the start of an impressive body of work ranging from portolans to atlases to world maps, all of which he usually signed and dated. Though Genoese he did work in Venice as well and his maps show many features of the Venetian school. The 1318 collection of maps suggests propagandistic goals rather than helping navigation. That was even clearer with his world map of about 1320 done for the *Liber secretorum fidelium Crucis* of the Venetian politician Marino Sanudo (d. 1338), a book that was part of an effort to promote a new crusade. That world map showed the influence sea charts had on Vesconte's work. His may be the first attempt to integrate the two traditions of sea charts and *mappaemundi*. There are also indications of the influence of Arabic practice in some of the names he used on the map and in the inclusion of Mecca. Vesconte incorporated new information, most obviously in the depiction of the British Isles in his charts of 1321 and 1327. The latter shows the south coast of England more precisely than previous maps. The way he drew coastlines, as with the case of Ireland, proved to be the model for portolan makers for decades and even centuries.[40]

If maps from Venice and Genoa were largely consistent in matters of decoration in the fourteenth and fifteenth centuries they were certainly different from the charts produced by the quite distinctive Catalan school. The empire created by the kings of Aragon in the thirteenth century was a major political and economic force in the Mediterranean basin. The role of Catalan merchants and shippers along with Catalan naval forces in maritime enterprise of the high and late medieval Mediterranean are often underestimated. Whether a Catalan was the author of the first portolan chart is of little importance. The fact that Catalans were involved by the early fourteenth century in producing distinctive portolan
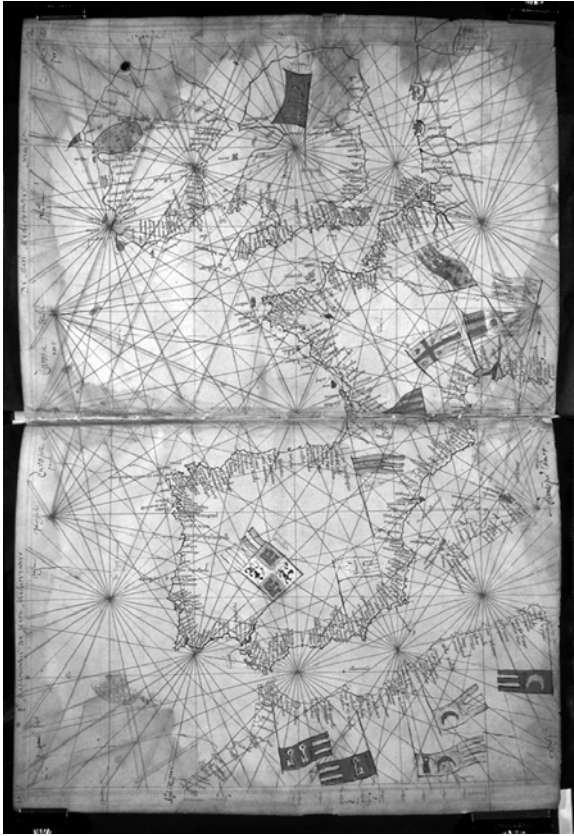
Figure 3.2 Pietro Vesconte, Portolan of western Europe, Venice c. 1325.
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charts is. Though probably related to Genoese cartography originally, Catalan maps quickly took on features which would set them apart and not just in the Middle Ages. After the marriage of the crowned heads of Aragon and Castile in 1469 there was a second golden age of Catalan map making which continued in the Spanish kingdom into the seventeenth century.[41] The abundance of information on Catalan charts gave them value for a broader public. Palma on the island of Majorca was the greatest centre of chart production. The combination of Arab, Jewish and Christian cultures, the connections with North Africa and the presence of Raymond Llull and his promotion of missionary efforts through learning all contributed to the scope and quality of cartography there. After the acquisition of the Balearics by Aragon in 1229 map makers on the islands could and did enjoy the support of the crown.[42] Catalans may have been interested in political information and so included sketches of rulers in the interior. They may have been interested in commercial information and so showed interior topography. The range and scope of illustration developed slowly through the fourteenth

century. For Majorcans the signs, colours, and images on portolan charts always mattered more than with their counterparts in Italy. All kinds of things would in time appear on the sea on their maps: animals, some real and some fanciful, islands, some that may or may not have existed, and even ships, but only in time.

While decoration and filling charts with a variety of images was the norm for Catalan charts, even including the neck of the parchment which was always at the left on portolans, not all Catalan products had illustration. Angelino Dulcert, possibly an immigrant from Italy to the Balearics, was the author of a 1325 chart done at Genoa.[43] Dulcert's latter chart of 1339, while the source of some mis-understandings about northern European geography, was impressive for the inclusion of information about exploration in the Atlantic islands and for a com-plete outline, even if skewed, of the coast of Britain. It was also impressive for its decoration and in various forms. It is the first map to show Mansa Musa, the king of 'Melli', in western Africa, known for a fabled early fourteenth century *hajd* with a large entourage and masses of gold. The interior of Africa also got an ostrich. North Africa got a massive river, presumably the long sought river of gold. The Red Sea is coloured red.[44] Dulcert's maps, while having varied objects and people inland, were sparse in the decoration of the seas. Other fourteenth century Cat-alan maps also carried limited and restricted decoration, such as a 1385 portolan of Guillelmus Solieri and a slightly earlier anonymous chart now in Venice,[45] but they did start the practice of picturing items on land and sea.

The transitional maps, that category of fourteenth and fifteenth century world maps which were separate from T-O tripartite and quadripartite maps and sepa-rate from zonal maps, were a combination of the medieval *maapamundi* tradition and portolan charts. It is difficult to say in which direction the influence flowed but the results showed many features of both with makers of world maps includ-ing the outlines of the Mediterranean and portolan map makers borrowing forms and types of decoration from world maps.[46] The makers of world maps in the third quarter of the fourteenth century already began to use, if somewhat reluc-tantly, information from the sea charts produced in the Mediterranean. Por-tolan charts increasingly incorporated novel information from further afield, pre-sumably to satisfy their patrons. Cross-fertilization of the two types led to a novel and unique type of map and higher standards of illustration.

The finest, most sumptuous and earliest surviving example of a transitional map, one which shows the direct influence from its differing predecessors is the Catalan Atlas [Plate I]. Abraham Cresques (d. 1387) in 1375, under contract to the king of Aragon, made it as a gift for King Charles V of France. King Peter III in the mid fourteenth century appointed Abraham, a Jew, as master of *mappaemu-ndi* and compasses. The father of Jafuda, he was a central figure in Catalan carto-graphy in the period and had a long term influence on European map making. The atlas he made is rectangular, 69 × 390 cms., and consists of 12 panels. The first four have cosmological and navigational information as well as a spectacular lunar calendar. The remaining eight panels form the long rectangular map cover-

ing Eurasia from the islands off the west coast of Africa and Europe to the islands off the coast of China. The Catalan Atlas was the first to use compass roses, clear indications that those looking at the map knew about the use of the magnetized needle to indicate direction. Abraham Cresques quoted the definition of a *mappamundi* from Honorius of Autun's *Imago Mundi,* written in the first half of the twelfth century, so presumably he thought he was producing a *mappamundi*. Although the panels create a rectangular map and although coastlines are like those in contemporary portolan charts the circular coast of China suggests the shape of the large thirteenth century northern European wall maps.[47] The ultimate home of the Catalan Atlas was northern Europe and including illustration reminiscent of German and English *mappaemundi* could indicate that the map maker was conscious of his audience, trying to include some features of northern map making traditions. More likely he was familiar with *mappaemundi* from elsewhere in Europe and above all was familiar with the illustration that was by 1375 presumably common practice with Catalan portolan charts.

The Atlas had as a central feature concentration on travel. Various political configurations and Biblical events found their way onto the map as well, to be expected given the roots in *mappaemundi*. The coastlines, those highways of most medieval travel, were automatically included as with any portolan chart, but in addition there was extensive illustration on land showing routes travelled and prominent people who travelled them.[48] Mansu Musa who went to Mecca is shown in Africa. The Polo family, who made their way to China and back, is shown in the company of camels in Central Asia. Reports of travel through Asia began to appear with the accounts of Franciscan missionaries in the mid thirteenth century and the appearance before his death in 1324 of the very popular and overstated story of the sojourn of Marco Polo in China created an interest in as well as a knowledge of the overland route to the Far East. Even more impressive than the extensive illustration on land included in the Catalan Atlas was the less elaborate but more revolutionary illustration at sea.

Apparently for the first time there were ships on a world map, the only exception being those open boats on a few of the Beatus maps. The ships on the Catalan Atlas themselves indicate the reasons map makers included vessels at sea on maps over the next two centuries and more. The Atlas has depictions of four ships [Figure 3.3]. One is what is probably an effort to describe a Chinese junk off the south coast of Asia. It is near an open boat with pearl fishers diving, as described by Marco Polo who put the fishery off southwest India and claimed it produced most of the pearls in the world. The pearl fishers and the boats are just one aspect of the description of Asia in the *Travels* that finds some representation in the Catalan Atlas.[49] Another ship appears in what is intended to be the Caspian Sea. It too has rectangular sails with what could be battens so the rig is similar to the one on the inaccurate junk.[50]

The last ship is off the west coast of Africa just south of the Canaries. While scale, as always, is a problem the major features of the vessel are discernible. A
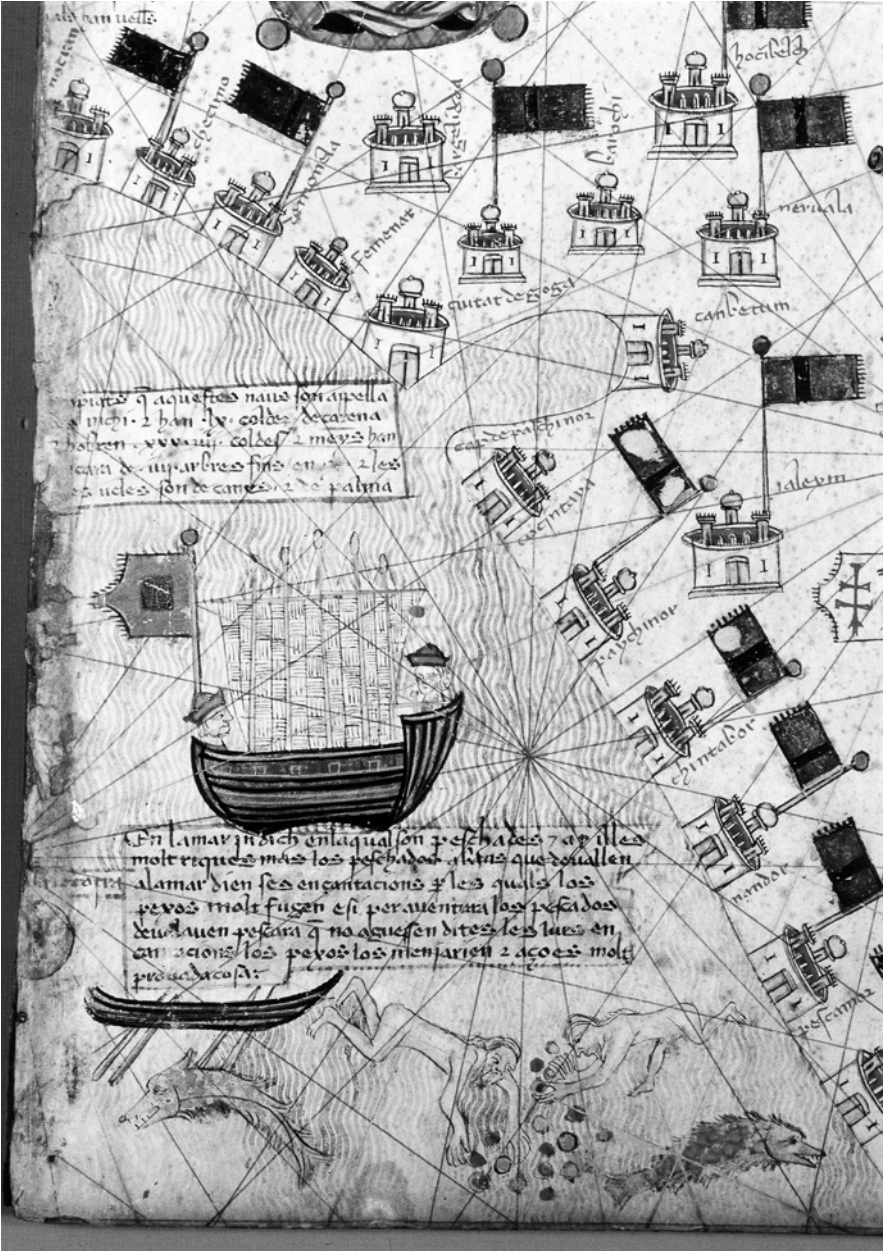
Figure 3.3   Abraham Cresques, Catalan Atlas, 1375. Map of the Coast of Asia with possibly a junk and a boat and pearl fishers in the Indian Ocean. Bibliothèque nationale de France, Espagnol 30, Planche V.

caption identifies the captain as Jacme Ferrer, a Catalan who left on 10 August, 1346, to find the fabled River of Gold which was said to flow somewhere in Senegal [Figure 3.4]. He and his crew were never seen again. It was not the first expedition to west Africa. The Vivaldi brothers sailed from Genoa in 1291 on board two *galleys*, taking Franciscan friars along with them to convert people they met along the way. They sailed through the Strait of Gibraltar and were never heard from again, though through the fifteenth century travellers along the coast searched for signs of survivors from that ill-fated effort to circumnavigate Africa. It is possible that the Ferrer expedition was intended to follow their path, at least in part.[51] The *galley* on the Catalan Atlas has four men with hats and there is an Aragonese flag flying prominently from the stern. The long low vessel shows no signs of oars but the hull shape and the single triangular or lateen sail suggest a *galley* or at least a relative of the *galley*. Some sources called the ship a *uxer* but a *galley* is also suggested and the map certainly indicates a *galley*. Ferrer was on a voyage of exploration and presumably Abraham Cresques included that ship, as he did those described by Marco Polo in the Indian Ocean to commemorate Europeans sailing into unknown waters and to show the exotic that the voyagers found there. 'The Catalan World Atlas…shows an impressive attempt to integrate new cartographic knowledge with the old format. From this point forward…the cartographic mainstream flowed into other channels, more
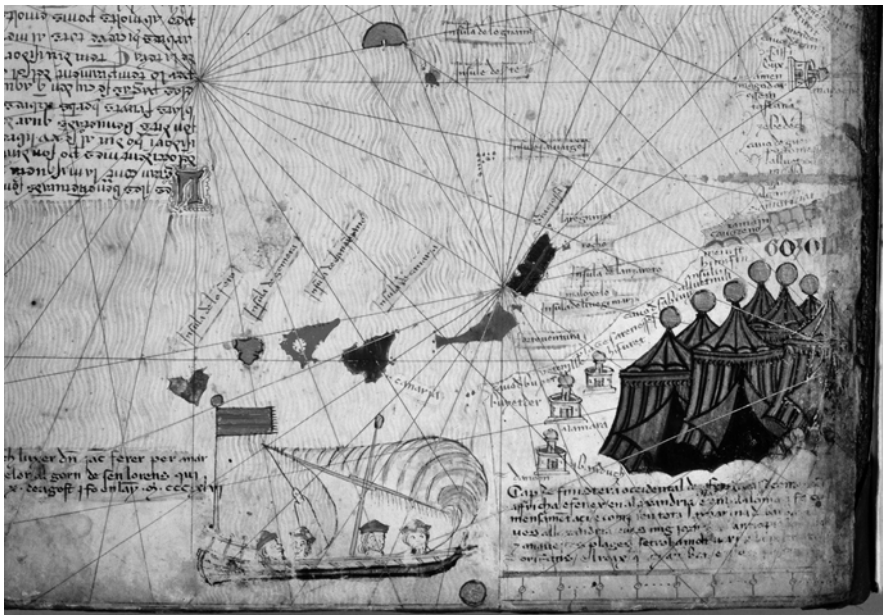
Figure 3.4   Abraham Cresques, Catalan Atlas, 1375. The ship of the explorer Jacme Ferrer off the coast of west Africa. Bibliothèque nationale de France, Espagnol 30, Planche III.

devoted to the present than the past.'[52] The depiction of ships in the Atlas was a clear case of a new purpose and direction for cartography.

While Abraham Cresques marked a new departure for map decoration it may be that a very few years before an artist added a ship to the Gough Map, a depiction of the whole of Britain. The map was large, about 60 × 120 cms., on two pieces of vellum. Though done with royal patronage around 1280 the oldest surviving copy is from around 1360 so it is not clear when the single-masted *hulk* shown aground on an oversized Orkney became part of the map. In front of the ship are two biers, one with a figure with long hair stretched out. The standard explanation is that the body is that of Margaret of Norway, lost on her way to Scotland to take up the throne and to marry the son of the king of England. Her death precipitated a succession crisis which in turn led to English efforts to add Scotland to the recently conquered Wales and so create a unified Britain under one monarch. The Gough Map itself was based on itineraries, a compilation of information about major routes radiating from London. It seems to be connected to the way Matthew Paris made his maps of the island. Whether or not the original map maker relied on portolan techniques, the illustrator who added decoration some decades later was interested in reporting an event critical to English politics of the intervening years. It is possible that the artist added a second ship but only an imprecise and possibly unfinished outline remains. The specific goal, as with the Catalan Atlas, was to remind the viewer of some event of great significance, in the English case political and in the Catalan one a voyage of exploration.[53]

Despite the breakthrough with the Catalan Atlas many Mediterranean portolan charts, even large and well decorated ones like the Petrus Roselli maps (c. 1450) [Figure 3.5] and of 1466 or the 1489 one by the Genoese Albini de Canepa show no sign of a ship. Catalan maps could also be done without ships like the 1447 Gabriel de Vallsecha chart done on Majorca.[54] The long standing practice of ignoring ships as decoration for the seas was strong enough to affect a wide range of work from local maps to portolan charts to world maps. The reluctance to include ships had a permanent effect on a new and popular type of map book that appeared in the fifteenth century, the *Isolario*.

The Florentine traveller Cristoforo Buondelmonti produced the first book of islands in 1430. He wrote it to entertain his patron who had sent him off to the eastern Mediterranean in search of Greek manuscripts. In his book Buondelmonti included about 100 plans of islands and harbours to go with text for each island. The information showed his classical interests and learning. Some of it was myth and fantasy, some fact and practical information. The maps themselves were apparently not based on sailing instructions but rather were designed to indicate the general shape of each island. New editions appeared and in 1485 Bartolomeo da li Sonetti and subsequently in 1528 Benedetto Bordone expanded the work, including new islands and more information in the text, the former in sonnet form. At first authors described only Greek islands but by the early sixteenth century islands in Asia and the Americas joined those in European waters. The
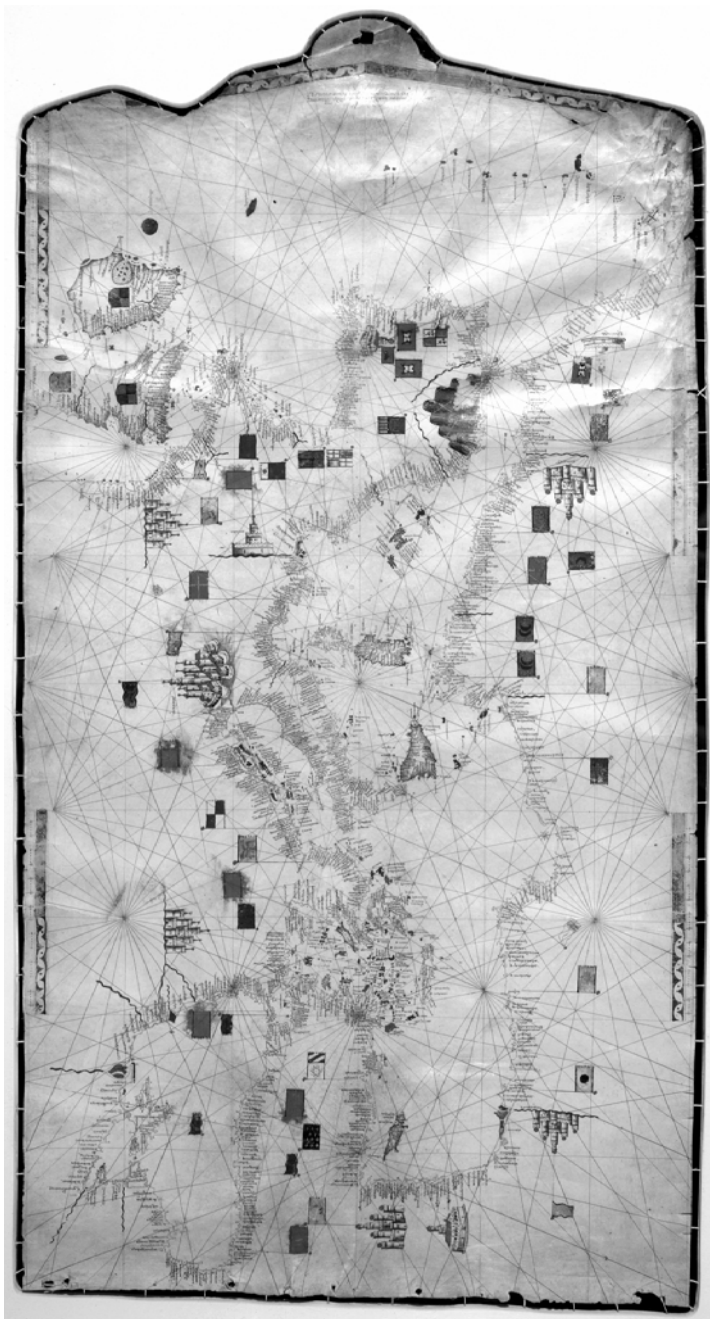
island book proved to be durable, the last example turning up as late as 1696 in Venice.[55] Despite the great variety and the number of editions produced in various places around the Mediterranean and in Iberia from the fifteenth to the late seventeenth century there was virtually never a ship on any of the maps in any of the books of islands. While ships might appear as decoration in the text, as they did in one 1489 example and one from around 1500, there were still no ships in the waters around the islands.[56] Though the opportunities for including vessels were legion very few cartographers ever chose to put a ship on any of the maps in the many such books. Since the islands were known and the concentration was on the islands themselves there was apparently no point in disturbing the images with ships. Even when newly discovered islands in the New World were added in the course of the sixteenth century, giving the books more of a sense of novelty and of contemporary change, they as much or more than ever produced a sense of isolation.[57] There were still no ships.

Some cartographers in the fourteenth and fifteenth centuries on the other hand included ships on what were generally unique maps of some significance. The Francesco and Domenico Pizzigani chart of 1367 showed many features on land in the pattern of the Catalan Atlas. There were cities and coats of arms of rulers along with animals such as an elephant and a camel in Africa. At sea there were ships. Two of the earliest depictions of *cochas*, or *carracks*, turn up on the map.[58] Those novel vessels of the second half of the fourteenth century combined the hull shape of the northern *cog* with the hull construction techniques of the Mediterranean where instead of overlapping planks ships had planks abutting. Long the pattern for deep sea sailing craft in the Mediterranean that building style gradually became standard for sea going ships throughout Europe from the fifteenth century on. Also the square sail of the North is joined on the mainmast by a triangular lateen sail of the South on a second or mizzenmast. The combination of sails was the remarkable innovation that created the *carrack*. The new type was a considerable technological breakthrough. A later map by Francesco Pizzigani alone of 1373, also produced in the Balearics, included a ship. In that case it was a northern European *cog* with a prominent bowsprit and a typical large square sail. The brothers were clearly familiar with northern European ship types as well as with hybrids which incorporated features of the two major shipbuilding traditions, those of the Mediterranean and of the North and Baltic Seas. The choice of vessels of the latest design for map decoration in 1367 suggest their inclusion was not incidental but had some purpose. The choice of showing revolutionary technology was one made by many of the Pizziganis' successors.[59]

The Catalan world map of about 1450 now in the Biblioteca Estense in Modena, Italy, has a ship off the west African coast but somewhat south of the location of the Ferrer ship that appears on the 1375 Catalan Atlas. What is more the ship is different. It is still low slung but carries a single square sail and has a sternpost rudder, more reminiscent of the types of vessels common to northwest Europe than to the Mediterranean. The second ship on the map, in the Arabian Sea, is

similar but seen from the stern. The goal may have been to show a *barcha*, the ship used by Portuguese sailors in early voyages of exploration along the African coast. Most likely that type had roots in Scandinavian sailing ships of the Viking Age which explains the hull form.[60]

Another Catalan map maker, Mecia de Viladestes, a Jewish convert to Christianity, included ships on a large portolan, 85 × 115 cms., but put the two ships in seemingly odd places [Plate II]. There are standard features on his map such as a River of Gold running across west Africa and a red Red Sea, common for such maps for a century by the time he produced his. One of the two ships, involved in whaling not far from Iceland, has many of the features of a *cog*. The second, placed off the west African coast, is very possibly a *falua*, a single-masted lateen rigged ship with a low profile, straight gunwale, a raised platform at the stern, and a steering oar on each side. It could be that the cartographer was trying to show the *uxer* of Jacme Ferrer but simply did not know much about the technical details of its construction and instead drew a contemporary type. An Aragonese flag is prominently displayed.[61] The ships are distinguished by the quality of the drawing which makes it possible to make out some details, for example, of the rigging. The ships are also technically unique and located well out to sea, involved in novel activities for European sailors. They seem to have a purpose beyond simply filling the ocean off the west coast of Europe and Africa, a portion of portolans that, with the inclusion of new information, was becoming increasingly long and more detailed by the early fifteenth century.

Though the practice of decorating portolan charts began with Catalan map makers and though Catalans used the most decoration, by the fifteenth century Genoese and Venetian cartographers also began to include ships at sea on their works. The Genoese Battista Beccario in a 1426 portolan put *cogs* of northern European design in the Mediterranean. On at least one of the ships he might have put, in addition to the big square sail, a lateen mizzen but it is extremely difficult to tell.[62] Even Grazioso Benincasa, long one to leave the seas empty, in 1482 made a chart very much in the Catalan style. He included, delicately and finely drawn in colour, two ships, a three-masted sailing ship with a very small foresail and only the mainsail set, and a *galley* with a large lateen sail and not one but multiple oars to a bench. In that he depicted a design common for more than two centuries but one which was soon to disappear as the multiple rowers on each bench dropped their individual oars and took on pulling together on the same single large oar. Benincasa's vessels are off in the Atlantic among what could be intended as the Cape Verde Islands.[63] The sailing ship he drew is remarkable for its detail but also for its design.

The combination of a lateen sail on the mizzen and two masts, a fore- and main-, with square sails on each created the *full-rigged ship*, a critical development in ship design of around 1400. Exactly where or when shipbuilders arrived at the combined rig which gave ships greater manoeuverability and reliability and gave captains more options in handling vessels is not clear. Battista Beccario

in that 1426 portolan included not only mountains inland and islands in the Atlantic but also ships at sea. One of the three ships in the Atlantic is a good example of a large three-masted vessel, one of the earliest illustrations of a *full-rigged ship*. It has a relatively small foremast which was probably common among early versions of the type. A second example, though drawn smaller, has a similar rig but an even deeper waist. The third ship has a single mast and single square sail but like the others has impressive castles both fore and aft. All the ships appear to be cargo ships of relatively large capacity. Though Genoese by birth Beccario clearly worked in the Catalan style and the insignia of the king of Castile-Leon on the map suggests that not only did he make maps in Iberian style but also worked there for one of the rulers of the peninsula.[64] It seems strange that it took so long for cartographers to include the new *full-rigged ship*. Part of the explanation presumably has to do with the infrequency with which maps had ships as decoration. At least the ship that appeared in the 1482 Benincasa map was rather detailed with clear indications of abutting planking rather than overlapping, reinforcements of the hull, a sharply angled bowsprit, and a large composite mainmast put together from multiple pieces of wood. By the time Benincasa made the map the ship type must have been widely known and the implications of its greater effectiveness as a cargo carrier making an impression on people throughout the ports of Europe.

Ships began to creep onto *mappaemundi*. World maps with no ships were still common as was the case with the one made by Giovanni Leardo in 1442.[65] A 1457 Genoese world map had ships not on the sea but in the ovals at the borders. The vessels looked much like northern European ones in construction, even having square sails on each of three masts though that was not a common rig and used only rarely and almost exclusively in the fifteenth century.[66] The much more and justly famous map of Fra Mauro of 1459 on the other hand did include ships in its decoration. The surviving version is a copy of one made by the monk in a house in Venice on order for Alfonso V of Portugal. The king wanted to have a visual summary of the state of geographical knowledge, including recent Portuguese findings along the west coast of Africa, and he chose a centre of map making and a distinguished cartographer for the map. Not surprisingly there are signs that new information about Asia and northern Europe made its way onto the map and the ships may have fit into the larger category of up-to-date data that deserved recognition. There was an effort to draw on the traditions of sea charts as well as the making of world maps, travel accounts like those of Marco Polo and on classical scholarship. The result was a remarkable image which became something of a tourist attraction.[67] The Fra Mauro map was produced with the help of Andrea Bianco, a master in the Venetian *galley* trade to Flanders and England. He had already in a 1436 world map included a single-masted ship off the southeast coast of Africa and two *galleys* not far away. Though not all of Bianco's maps had ships as decoration, he did show an interest in incorporating more accurate knowledge of, for example, northern Europe into them.[68] In the tradition of *map-

paemundi the Fra Mauro map was circular, about 196 cms. in diameter, and in the Arab tradition south was at the top. There are ships off the coasts of Asia and of Africa but they are small and difficult to distinguish. The ones off southern Africa are single-masted and are probably intended to be *hulks* with sharply curved bows but also curved sterns. That feature made it hard to fit a sternpost rudder, a problem solved by Mediterranean shipcarpenters by fitting some deadwood between the curve of the stern and the straight rudder. The artist who drew the ships did not include that small but essential addition suggesting lack of knowledge of how ships functioned.[69]

The same problem with making out features of ships exists with the slightly earlier and equally well-known Borgia map made between 1410 and 1458. Etched onto two metal plates, it was round as well, about 63 cms. in diameter. It showed signs of Catalan influence and in turn would influence Fra Mauro in the making of his world map. The Borgia plates are probably south German in origin and though the artist included a number of exotic animals his interest was more in the peoples who inhabited the land masses.[70] There are some 20 vessels in the sea all around the periphery of the land mass which fills the centre of the map. The unique medium made depiction of the ships even more imprecise. The most prominent vessels are at the bottom. The various craft are almost all but not exclusively single masted and come in different types. There are generally two variants of the single-masted sailing ship, one being long with a high built-up platform, or aftercastle, at the stern and a lower built-up platform at the bow, or forecastle, a top or platform high up on the main mast, and a prominent and obvious sternpost rudder. It is probably a *hulk* and so closely related to the northern European *cog*. Another variant is drawn up at bow and stern with a much more curved profile and almost double ended. There is also an open vessel with five rowers and a captain placed in an enclosed area at the stern and that might have been intended to be a *galley*. There is one single-masted sailing ship which is low and open with no castles and a rudder with a tiller that passes over the sternpost so it is more like a river boat than a deep sea sailing ship. One of the ships possibly has overlapping planking.[71] The presence of such ships and in such variety as those on the Borgia map combined with the fact that variants of the *cog* design found their way onto other southern European maps in the fifteenth century strongly suggests that vessels from the North were well known in the Mediterranean and respected there for their sailing qualities and capacity. It also suggests once again that map makers wanted to include signs of novelty at sea.

By the second half of the fifteenth century buyers and makers of maps had established that it was allowed to include ships in waters on their maps but that there was no necessity of having them. When ships did appear they were typically distinctive and not just because of their rarity but because cartographers chose to place certain kinds of vessels, typically of the latest design, in prominent places. Not surprisingly the inclusion of ships as decoration on all kinds of maps increased over time. Even humble fishing boats with a man handling oars began

to appear as in the case of a mid fifteenth century anonymous Italian map.[72] By late in the century ships also became part of the literature of voyages to the Holy Land.

The 1486 publication of another description of a pilgrimage to sacred Christian sites in the eastern Mediterranean was not unusual. What set Bernhard Breydenbach's *Bevaerden tot dat heilighe grafft* apart was that it was the first printed illustrated travel book. The woodcut images by Erhard Reuwich from Utrecht showed six ports visited along the way, complete with ships. The work was popular with editions in Latin, French, and Spanish following the German one [Figure 3.6]. The final image in the book was a map of the Holy Land with in the left foreground the *galley* that carried the pilgrims from Venice to Jaffa. The drawing is the finest and most detailed surviving depiction of the great *galley*, a combination sailing ship and oared vessel first built in Venice around 1300. Intended originally as a warship, it proved effective in carrying high value cargo over considerable distances where the ability to predict departure and arrival mattered. Regular service extended to England and the Low Countries as well as to various ports in the Mediterranean and Black Seas but one of the most durable of the routes was the one from Italy to the Holy Land. Great *galleys* carried two or three lateen sails and they were the principal source of propulsion. Crewmen disliked the hard labour of manning the oars but having the auxiliary source of power made manoeuvring easier and the *galleys* did not have to wait for a favourable wind to get in and out of port. That great *galley* also showed up in Breydenbach's book on the depictions of the ports of Corfu, Rhodes, and Venice itself. There were other ships and the most impressive among them was a two-masted *carrack* with both the large square sail and the lateen mizzen prominently and clearly shown. Docks with ships at them are a common feature of the harbour views and in the case of Venice there is even an illustration of a ship tied up and having the seams caulked, possibly another first in illustration.[73]

Breydenbach's work was part of a rapidly evolving pattern and was by no means alone in showing ships. The *Pilgerfahrt ins Heilige Land* of Konrad von Grünemberg which also appeared in 1486 had a *galley* as well as a *carrack*.[74] A Franciscan handbook, the *Rudimentum Novitiorum* printed at Lübeck in 1475, had a number of bird's-eye views and the one of the Holy Land has ships, one a *galley* off the coast very similar to that of the later Breydenbach book, and another five ships which are single-masted sailing vessels all more or less the same and with heavy reinforcement for the sides of the hulls typical of northern European and not Mediterranean ships [Figure 3.7]. Subsequent versions, in French for example, made changes in the details of the illustration but the ships remained. The book included a world map but that was very much in the high medieval style of northern Europe and the only novelty seems to have been the inclusion of Moscow. There were no ships on the world map.[75]

By the end of the fifteenth century at least in illustrations of travel books and for city views ships were acceptable as decoration. Italian artists first discussed and
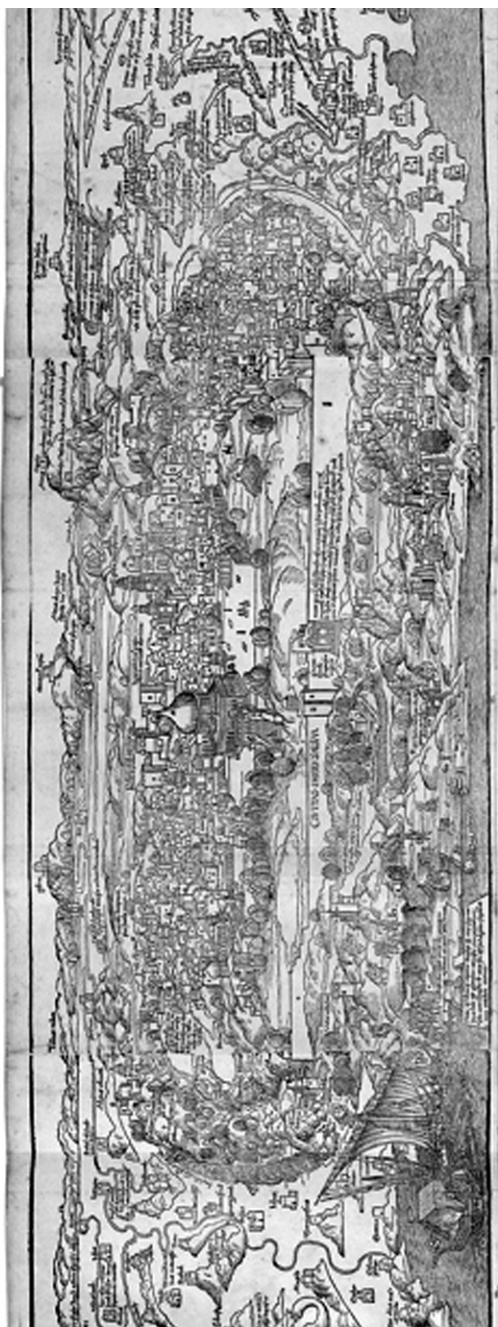
Figure 3.6 Erhard Reuwich, Map of the Holy Land, drawn to illustrate Bernhard Breydenbach's *Peregrinatio in Terram Sanctum* in a version published at Lyons in 1489. The ship is at the lower left. © British Library Board. All Rights Reserved. IB.41612.

Figure 3.7   Left half of a Map of the Holy Land from the *Rudimentum Novitiorum*, Lübeck, 1475, with ships including a great *galley* off shore. Houghton Library, Typ Inc 2610 F.

then tried out bird's-eye views of towns in the fifteenth and early sixteenth century, presumably part of the general drive to use perspective in art. Cartographers later borrowed from their practices even though strictly speaking such views were not maps despite a strong resemblance.[76] The massive depiction of Venice from 1500 by Jacopo de' Barbari was an aerial view but also a fully developed wall map. The start of what would be a long term trend, that woodcut was designed to show the power and wealth of the city and so had to have not only details of buildings but also of docks and quays and of ships at them or under construction. With the view surrounded by depiction of the winds in the style of a some *mappaemundi* Venice was made to look like the centre of the world.[77] The work was unique for the expanse covered but also for the large number of vessels and of various types. It was perhaps to be expected in a work from 1500 for what was probably the busiest port in Europe of the day.

   One problem with the increasing number of bird's-eye views which turned up in the novel and newly fashionable printed books at the time was that

artists populated them with stereotypes. Many of the towns in those books look like each other. A principal example of the trend is the world chronicle of Hartmann Schedel published in 1493. In his *Liber chronicarum* he included ships in a number of city views, though often the vessels were the same one and types not logically found where he put them. Certainly those town views were both more novel and informative than the world map which he felt obliged to include in the work.[78] In Schedel's book major ports such as Venice, Genoa, and Constantinople had ships in front of docks. In the case of Genoa there are only two vessels, one a *galley* and the other a sailing ship, the latter obscured by a tower. The four or five sailing ships in the harbour of Venice are also obscured in part by two lateen rigged ships. The ship in one view of Constantinople is single masted and much like a northern European ship while in a second there is a *full-rigged ship*, presumably more like ships that would have sailed the Mediterranean at the time. In the port of Lübeck, presumably known as an important shipping centre in Schedel's Nuremberg, only the masts of five ships appear. In fact, what is most impressive is the lack of ships in many of his city views. With Pisa as with many port cities there is not a boat of any type or shape in sight.[79]

'Ornamental features were an important part of [marine] charts, which were designed for a public of aristocrats, prelates, merchants, scholars, and rich bibliophiles.'[80] That is especially true of the charts which have survived. Even with town views and even at the end of the fifteenth century while using ships as decoration was certainly acceptable it was not required or even understood to be required. Map makers or the artists that worked on maps or on town views did not perceive ships as an integral part of how to represent major ports let alone the seas. By 1500 while map makers showed few signs of an interest in putting the right ship in the right place they did show an interest in depicting novel vessels and in reproducing their technical details. With animals the numbers on maps fell between the thirteenth and fourteenth centuries but accuracy increased. By the fifteenth century map makers were even consistently putting the animals in the right places.[81] With ships the numbers rose dramatically in the course of the fifteenth century but the connection between location and the type of ship seemed still to elude artists. It was as if the point was not to put the ship in the correct context but to show a ship at sea, to demonstrate the ability to travel on the open ocean with what was proving to be ever greater freedom. Maps in the portolan tradition included much more ocean than did medieval *mappaemundi*. Instead of being incidental and a region to be ignored the larger oceans were becoming very much a part of the earth and its representation, as important perhaps as the land and so worthy of illustration. The seas were in the fifteenth century becoming a pathway to reach other parts of the globe, at least in the minds of some theoreticians.[82] More of the answer to questions about why ships made infrequent intrusion on maps and why cartographers felt compelled increasingly in the years around 1500 to fill the waters with ships is to be found in practices in Portugal early in the era of exploration.

4
The Classical Revival, Printing and Maps

In the Renaissance maps were works of art, the men who made them artists. They were interested in accuracy and interested in beauty. The latter might be part of the need to please a patron but the former was associated with the more general effort to understand all natural surroundings. For map makers there were accelerating trends, with roots in the Middle Ages, in the way artists represented the world. A new realism appeared in the fifteenth century and not just in Italy. Its earliest expressions came in fact in northern France and the Low Countries. The growing number of town views and bird's-eye views were one part of the new direction. The change coincided with a shift from maps being made overwhelmingly by and for theoreticians to maps made by practitioners.[1] That desire to represent nature with force and clarity was not unique to the Renaissance but speculation about the natural world took on a new and more vigorous character in the fifteenth century not least because of the closer examination of classical texts. At that time, when the transformation in maps began, geographical theory was an extremely lively field.

The growing theoretical interest was fed by and promoted the development of a new range of instruments along with the refinement of existing ones. In the thirteenth century most were made for teaching or observation rather than for practical application. The astrolabe was known as early as the fourth century BCE. Learned Europeans used it by the thirteenth century and voyagers used it by the mid fifteenth century. Sailors might not be able to make sightings with the astrolabe on board but they could and did stop to do that on land. Over time more and more astrolabe observations established positions of sites, the pace of accretion of data increasing at the end of the Middle Ages.[2] Developed in the twelfth and thirteenth century, quadrants found their way to shipboard certainly by 1460 and probably earlier so sailors could establish their positions. From 1529 Portuguese mariners used the related and more efficient Jacob's Staff to establish latitude. There was a general expansion in

the range of measuring devices that became available in the first half of the sixteenth century and from a number of articulate scholars who not only made the gadgets but wrote about them.[3] Reports from seamen with new data generated by the use of more and better instruments promoted greater contemplation about geography. Added to that was another source which had a more immediate impact for speculation about the shape of the world.

In the fifteenth century western Europeans discovered Ptolemy's *Geography*. They had his other work, an astronomical treatise describing an earth-centred universe called the *Almagest*, in a Latin translation by 1175 and in an Arabic translation before that. The *Geography*, or *Cosmographia* as Europeans called it until the mid sixteenth century, on the other hand was almost lost and only discovered by a Greek monk, Maximos Planudes (c. 1255–1305), in Constantinople in 1295. After that a number of copies was made and so became available in Greek. The Constantinople geographer Nikephoros Gergoras (1295–1359) was possibly the man who put Ptolemy's theory into practice and was behind the production of the first world maps based on the directions found in the *Geography*.[4]

In 1395 a group of prominent Florentines got together to learn Greek. Their informant was Manuel Chrysoloras, a refugee from the collapsing Byzantine Empire. He and the sometime papal secretary, Jacopo d'Angiolo, went to Constantinople around 1400 to find new Greek texts and they brought back with them a copy of the *Geography*, one which included maps. The Greek scholar and the people around him were involved in a large project to translate major Greek works into Latin so it is not surprising that Chrysoloras took on the *Geography*. Because of delays Jacopo d'Angiolo had to finish the task, that in 1406. Not only were the text and maps made available in Latin but also the work circulated immediately among some of the most prominent intellectuals in Florence and became a topic of discussion at meetings of a group of them at the Convent of the Angels between 1410 and 1440. It was a classical text with information about Rome and so to be revered and respected and exploited as was the practice with all works from Classical Antiquity among the men of that Florentine circle.[5]

The *Geography* was of special interest to people concerned with astronomy and, by extension, geography. The expression of the classical understanding of the world and its major land masses was something already widely known and absorbed in the Middle Ages. What impressed fifteenth century Florentines more was the long list of classical place names and the definition of location by coordinates with explicit descriptions of how to use such data to generate projections for describing the world graphically. The system of mathematical coordinates was a valuable addition in the long run to portolans, the system being implied if not fully incorporated in those sea charts as early as the 1440s and 1450s.[6] It would take more than a century before the

full utilization of latitude and longitude on maps. The historian Samuel Edgerton suggested that the *Geography* had an immediate impact on art and that the interest in and experiments with the use of perspective by, for example, Brunelleschi had their roots in the way Ptolemy explained how to represent the world. The appearance of the Latin translation did coincide with the use of grids to produce perspective in wall paintings but it is highly unlikely that there was a relationship between how Ptolemy saw the world and how painters understood their task.[7] No matter the effect on art the popularity of the *Geography* indicates the work had a profound effect on cartography in both theoretical and, in the long run, practical terms.

The Latin translation circulated in Florence and very soon beyond. Copyists and then printers produced a number of editions in the fifteenth century and soon with supplements, that is new maps to add to the original 26. The many manuscript versions were often large and generally sumptuously decorated.[8] The *Geography* was early a popular work for the new medium of printing, the first edition with maps appearing in 1477 at Bologna. Though it needed repairs and refining that one was quickly followed in the next year by a Roman edition. Six different printed editions appeared by 1490.[9] Of the some 222 maps printed before 1500 more than half were based on what Ptolemy wrote. Even a map at the beginning of a fifteenth century manuscript edition of Isidore of Seville was no longer a traditional T-O map but one which showed clear influence from Ptolemy.[10] Over time even more copies and versions of the *Geography* came out and with ever more additional material. The first modern maps which were not in the version brought from Constantinople, four of them, were included in the 1482 Florence edition. They added information not known in Ptolemy's time, information drawn from marine charts and from itineraries. The 1482 and 1486 Ulm editions proved popular because they combined the encyclopedic tradition of offering a visual avenue to Christian history as well as a luxuriously illustrated classical text. By the 1513 Strasbourg edition there were 20 modern maps, done by Martin Waldseemüller, which incorporated new information and even contradicted the originals. That edition may well mark the high point of the influence of Ptolemy on map making. There were more editions to come but they increasingly wandered from the classical tradition. The 1540 Venetian edition of Giacomo di Gastaldi separated the modern from the classical maps and after that the division into two parts was common practice. A 1561 edition by Girolamo Ruscelli had a total of 37 modern maps, 17 of those of lands outside Europe. After that peak editions of Ptolemy were few and atlases increasingly just had modern maps.[11]

The development of printing using moveable type and with it the development of skills with printing from wood blocks and copper engravings was a critical factor in the dissemination of the work of Ptolemy and also in the

ways in which his work was refined and changed. Metal engraving, first used to produce a map in the 1477 Bologna edition of the *Geography*, made it possible to use finer lines and so increase precision. What is more the plates could be changed to reflect changes in knowledge. Plates made it easier to insert new decoration. From the 1540s engraving rapidly became standard practice for producing maps in Italy. It was especially suited to city views where clarity was more important as was the ability to update.[12] Though engraving gave cartographers more scope, for much of the sixteenth century printers north of the Alps tended to prefer wood blocks to copper plates to produce their maps. The older and simpler form appealed to them despite the difficulties in making additions or changes. It proved well-suited to broadsides and multi-sheet maps and especially to anything which was to be seen at a distance. The choice of engraved plates or wood blocks depended very much on what necessary elements were available for production.[13]

Printing was effective for producing nautical charts and that led in the sixteenth century to the gradual disappearance of grand manuscript portolans on animal skins, though the process took some time. Printed charts and maps had the advantage of potential multiple reproduction with each example looking the same as the last. The uniformity, the absence of variation, had considerable and hard-to-measure intellectual and social implications but there were commercial implications as well. Printed maps were not necessarily cheaper. Many factors played a role in determining the final cost of printed maps relative to hand drawn ones. Colour for example added about 50% to the cost of a map or atlas.[14] Printing did not change the appearance of charts and maps in general. The signs remained the same as did the content. Printing did increase the total number of maps available, increased the information available and diffused it more widely and fed the growing interest in owning maps. Italian publishers transformed maps in the sixteenth century from specialized items used by the wealthy and powerful to common articles of trade, a part of everyday life.[15] That transformation also, over time, applied to sea charts.

From 1539 printers began to produce portolans, the practice starting in Venice with Giovanni Andrea di Vavassore, called Guadagnino, who published the first printed charts of the Mediterranean. He was followed and at a very slow pace by others who transferred the portolan manuscript tradition to engraved maps though his proved popular enough to warrant new editions in 1542 and 1558.[16] Venice was a logical place for the first printed sea charts not only because it was a major centre of printing, well ahead in the field of almost every other city in Europe in the first half of the sixteenth century, but also because Venetians were especially conscious of maps and mapping. Oddly just as printed maps grew in popularity so too there was a massive increase in the making of manuscript maps and for all sorts of purposes and in all sorts of

places.[17] The flurry of activity was short-lived and by the seventeenth century printed maps dominated European cartography. The early printed ones, unlike medieval manuscript maps, were in black and white. Colour even disappeared from some hand drawn maps in the sixteenth century, in imitation of printed maps. As early as 1511 or 1513 printers using wood blocks tried to add colour but it was a difficult process and meant inking twice though the effort does suggest how popular the traditional coloured map was. Portolan charts had a well-established system of colour codes for various objects so the problems of incorporating colour made the shift to printing them slower than with other maps.[18]

Printing changed maps and it changed books of sailing instructions as well. They became standardized and were reproduced in exact copies and for an ever wider public. The first printed descendent of the medieval portolan book appeared at Venice in 1490 and printed rutters followed elsewhere in Europe and increasingly so through the sixteenth century. The rapid growth in the output of printing presses in the first half of the sixteenth century and especially from the 1540s as the book trade became better developed put more maps and books including maps and books about maps and books about navigation in the hands of more people than ever before. It is all too easy to overstate the impact of printing, especially in the short run, since there were other and more forces at work dictating and directing changes in what was on maps.[19] Though printers in many parts of Europe increasingly produced maps the centres of publishing proved to be northern Italy and the southern Low Countries.[20] In the Middle Ages charts were made to order but with the advent of printing it was possible to make a number of copies. Press runs were still modest with makers hoping to sell the maps over time through retailers. The earliest printed maps tended to be large, meant as wall decoration, though collections of maps, like those done with editions of Ptolemy, enjoyed a considerable market. Map makers, once printing was in place and especially as it expanded in the sixteenth century suddenly had the option of becoming professionals, not necessarily tied to a patron or to contracts for the production of specific maps.[21] The new circumstances created new options for artists but at the same time introduced them to a different set of constraints.

An atlas has a dominance of graphic elements, usually maps, roughly uniform in format, design and presentation, and is standardized in the composition and arrangement of components. Ptolemy's *Geography*, though it had a series of maps, was not in the strict sense an atlas. The first true one was the *Theatrum orbis terrarum* produced around 1570 at Antwerp by Abraham Ortelius. Collections of maps bound together or connected one to the other were already common even in the late fifteenth century. A total of 69 such collections survive from the years before 1500. Portolan atlases typically had vellum sheets folded with adjacent half sheets mounted back to back, the

sheets joined together at a spine. Pietro Vesconte made collections of maps in the fourteenth century. Giacomo Giroldi in Venice around 1440 made a set of uniform portolan charts covering the usual Mediterranean and Black Sea region designed to fit in a book. He made subsequent sets of maps as did others in Italy such as Grazioso Benincasa and the anonymous Venetian artist of the Cornaro Atlas of about 1490.[22] 'Chart makers…supplied a special need in making atlases for presentation to royal or noble persons and officers of state… Less vulnerable than charts and working documents in general, special atlases tended sooner or later to find a home in private or public libraries, and were preserved for posterity.'[23] The late sixteenth century atlas was a book as a map rather than a book of maps. One source of that new form was collections of portolan charts. The other principal one was the versions of Ptolemy's *Geography*. The many additions made to his work from the first printed edition on made it increasingly like what would be the standardized atlas. In a sense Ortelius' 1570 atlas was a result of the evolution of editions of Ptolemy over the previous century and a half, combined with the portolan tradition.[24]

The *Geography* from its translation into Latin had a profound effect on European map making as various scholars tried to resolve Ptolemy's methods with what they already knew. In the 1420s and 1430s a group at Klosterneuburg outside Vienna tried to create maps based on Ptolemaic principles and to move beyond what they found in the classical text. Similarly Andreas Walsperger, a Benedictine monk at Constance in 1448 in a *mappamundi* with a grid tried to incorporate what he learned from Ptolemy. The Fra Mauro map showed signs of borrowing from Ptolemy though there were criticisms of the ancient geographer stated on the surface about the places not mentioned by him. Influence ran in the other direction as well. The new maps added to the increasing number of editions of the *Geography* had information based on modern regional maps and marine charts. The press run of the first printed edition from Bologna in 1477 was 1,000 and if the many other editions came out in similar numbers it is not surprising that the work was so influential.[25] Almost all editions of the *Geography* were free of decoration but in one edition, the 1477 Bologna one, there were ships on a very few of the maps. Vessels were put on various seas from the North to the Caspian to the Persian Gulf. One on the Baltic is an oddly shaped oared ship with a clumsily drawn triangular sail, a few oars in places where they would be ineffective, and a hull with overlapping planking. Another on the North Sea is a clumsily drawn depiction of what could be a *cog* with a sternpost rudder, single square sail, and a high forecastle but no aftercastle [Figure 4.1].[26] How vessels of seemingly northern European design got added is not obvious but they were there as decoration and certainly an afterthought, probably as part of experimenting with the new medium of printing. It is possible to make too much of the importance of Ptolemy's work to map making but it did feed and promote an

Figure 4.1 Coloured Map of Germania from the first printed edition of Ptolemy, with two ships in the North and Baltic Seas. Ptolemaevs, Cladvivs. *Cosmographia*. Bologna, 1477. Reprint Amsterdam: N. Israel, 1963. The John Carter Brown Library at Brown University.

interest in geography and helped to create the profitable interest in printed books on the subject. In addition it created a framework for incorporating new knowledge and information, especially important as new data flowed in from voyages across the Ocean Sea.

Europeans in the fifteenth century also revived another classical approach to geography: the depiction of the earth as a globe. Careful study of what Ptolemy said about projection lead a canon at Rheims, Jean Fusaris, to theorizing about and the making of a terrestrial globe in 1432.[27] There was a reminder of the Roman globe in the orb of coronation ceremonies. The difference was that such a globe now could specifically represent the earth. In 1492 some wealthy citizens of Nuremberg commissioned the making of what proved to be a path-breaking terrestrial globe. The choice for the task was Martin Behaim who possibly had made a voyage to the west African coast in 1484–5 and who was later to publish a book on Portuguese voyages along that coast. Because other terrestrial globes were not around to offer guidance he had to solve a number of difficult problems on his own. He had to decide how wide to make the open sea between Europe and Asia not knowing about America, how much of the African coast to offer in detail, how to transfer plane charts and printed maps to a globe, how much and what sort of

commercial information to include, and to what degree he would follow Ptolemy.[28] Behaim's work was based on an existing world map and on his own knowledge from living and trading in Lisbon. Not knowing quite how to describe the new object he called it an earth apple (*erdapfel*). The globe he made was 51 cms. in diameter and set a precedent for more and often grander and more comprehensive ones.[29] Printers early in the sixteenth century solved the problem of producing multiple copies of gores so that they could replicate globes and meet a rising demand.[30] Another result of Behaim's work was to generate the production of matched spheres, global and celestial. While depicting the skies on globes apparently predated 1492 the temptation was great, especially for wealthy patrons, to furnish their homes or public buildings with matched pairs of globes.

The need to produce globes and to accommodate the authority of Ptolemy meant that map making around 1500 took on new directions but ones which had to borrow heavily from and even rely on the portolan tradition. For Behaim as with portolan makers the system of coordinates imagined by Ptolemy created a grid which could be helpful if imposed on any map. The reference grid, well known in Antiquity, had not disappeared entirely in the Middle Ages. The world map al-Idrisi did for King Roger II of Sicily in 1154 had a grid. Land surveyors and architects knew how to use grids. Roger Bacon (c. 1220–92), the Oxford writer on science, suggested ways to understand the world in terms of a grid. Rhumb lines, though they did not generate a universal grid like that of Ptolemy, still did give a geometrical framework through which to interpret the physical space.[31] The presence of Ptolemy's *Geography* and the general rising interest in mathematics and measurement in the fifteenth century led to the generalized use of the grid system. The move was first evident in Florence but in Siena the future pope Pius II, in his commentary on Ptolemy written in the 1460s, stressed the importance of latitude and longitude as an abstract concept.[32] Showing the world in terms of a relationship to some abstract set of imaginary lines not incidentally gave it some unity as well as generated a consistency of conception and depiction to world maps and, ultimately, to all maps.

One more obvious and more telling case of the world described within a grid was the map, now lost, produced by the Florentine mathematician, astrologer, doctor, and humanist, Paolo dal Pozzo Toscanelli (1397–1482). Possibly influenced by some ideas about geography based on Strabo and formulated in what little remained of the Byzantine Empire in the early fifteenth century, he understood a globe where the sea was extensive, large, accessible, and describable in terms of a grid. His letter to the court at Lisbon, written in 1474 when he was in his late seventies and in response to queries from the Portuguese, argued for a possible sea route to Asia by sailing westward across the Atlantic. Copies of the letter and accompanying map, done

Toscanelli said in the form of navigation charts, reached Christopher Columbus and he carried them on his first voyage across the Atlantic in 1492. Efforts to reconstruct the lost map have not yielded any useful results. More important than Toscanelli's ideas about an all sea westward route to the Spice Islands in southeast Asia was his understanding that the Ocean Sea was continuous and so an avenue to be explored and possibly exploited.[33] For thinkers in the Middle Ages the world was round and it was a globe but for most of them the concern was not with the sea surrounding the land mass but with the land mass itself. Ptolemy's idea of a land-filled southern hemisphere contributed to the lack of interest in the oceans. Through the fifteenth century, in part thanks to a new understanding of the world in terms of a grid, map makers had to think more in terms not only of a globe, as expressed by Behaim in the 1490s, but also in terms of large bodies of water. That enhanced importance of the seas to thinking about geography and to map makers enhanced the importance of ships and gave them a greater role in the decoration of maps. While it might be an exaggeration to say that, 'The fifteenth century's recovery of Ptolemy's *Geography* mobilized a complex of forces constituting within the Western tradition a comprehensive, unifying, universalizing process released upon the globe by Renaissance Europe, and now significantly reinforced by an incipient geographical culture.'[34] it is certainly the case that cartographers enjoyed an entirely new context in which to work as the Middle Ages ended. Established forms and traditions of map making were already under pressure from the increasing interest in classical learning and in mathematics by the late fifteenth century. New geographical knowledge, created by Europeans exploring further and further afield, even more generated a need for new thinking, a new interest in geography and new forms of graphic representation of the entire world and of many parts of it.

5
New Routes and Portuguese Map Makers

European maps changed dramatically around 1500. Old distinctions faded and old categories applied less and less. The shape of change and its roots are most obvious in the work done in Portugal. The pattern set there was in the short but especially in the long run followed throughout Europe. Traditionally historians have discussed cartography in the Renaissance in national terms. Studies have dealt with maps in Spain, France, England, or Portugal. The map makers themselves have been identified with specific states. The study of cartographic history began in the mid nineteenth century in an era of growing nationalism. It is not surprising then that historians of maps treated their objects in the ways that historians of political and constitutional history treated their governments, trying to demonstrate the precedence, primacy, and superiority of their nations. The result, until the latter part of the twentieth century, was for individual scholars to concentrate on maps from just one country. It is now obvious that the old way was wrong and on a number of grounds. The European states of the nineteenth century did not exist in the fifteenth and the kingdoms that would emerge as national states had only the rudiments of government structures. The process of state building was a long one, only just beginning in the minds of political theorists and in political institutions of the sixteenth century. People who made the maps did not think in terms of nations. They did not include national boundaries or differentiate states by colour as has been the practice since the nineteenth century. Maps were simply not forms of national expression around 1500. Artists who made maps may or may not have been employed by governments or kings. They did work for patrons but their products were not just the results of what patrons told them to do. The maps made in the sixteenth century are the best testimony to the lack of overall plans imposed by a self-conscious state.[1]

In the fifteenth and sixteenth centuries discussion about geography, geographical theory, and ways to describe the world was pan European. The maps, produced in ever increasing numbers, were an expression of that interchange.

The goals, efforts, and accomplishments were not isolated or connected directly to the actions of states. Claims that '…cartography was early nationalized.' or that '…mapping quickly became the business of the state…'[2] while possibly applicable to the seventeenth or even late sixteenth century are at the very least an exaggeration for the Europe of the years around 1500. It is more correct to see cartography of the Renaissance not as the product of different states but rather of different schools of art or of decoration. The more critical forces for the makers of maps were their exchanges and relationships with travellers, scientists, and writers on geography and cosmography than with the officials of nascent and still emerging states. That said there remain some compelling reasons to deal with map making in terms of the political jurisdictions of the period. It was certainly the case that patrons mattered to what map makers did. It is also the case that most scholarship, following the pattern laid down in the early days of the study of the history of maps, is based on divisions along national lines. It is convenient, because of earlier work, to talk in terms of maps done in specific places but it is also convenient because schools of map making and more specifically of decoration were often associated with one place or one royal court or some noble or wealthy patron. As in so many other ways map making in Portugal around 1500 effectively illustrates the norms.

Portuguese map makers were the first to come under pressure to deal with a rising tide of new data and so were both unique and precursors of general developments throughout Europe. The success by 1340 of conquering all Muslim territories in their part of Iberia freed the Portuguese to head out into the open Atlantic, something fishermen had been doing for some time. Presumably at first as much by accident as by design they encountered islands in the Atlantic either unknown to Europeans or at least unknown since Roman times. In the 1330s the Portuguese had already seen and started to settle the Canary Islands. Madeira and the Azores followed in the second half of the fourteenth century. From the early fifteenth more voyages out in the open sea to the south joined those already made along the coast of Africa. In 1434 Gil Eanes doubled Cape Bojador, not a great distance south but a critical step in mastering the navigation of the coast. By the 1450s Portuguese explorers had reached the Cape Verde Islands, about the time settlement of the Azores moved ahead. Systematic exploration sponsored by the crown yielded first the doubling of the Cape of Good Hope by Batholomeu Dias in 1488 and the all-ocean voyage to India by Vasco da Gama in 1497–9. The chronicle of success in dealing with voyages of ever greater distance certainly impressed Renaissance Europeans. People outside of Portugal were aware of the explorers' efforts. Updated maps, as well as written records, spread information about where the travelers had gone.

Individuals from well beyond the borders of the kingdom were deeply involved in the Portuguese voyages. Critical for the ongoing exploration

efforts were expertise and finance from Italy. As the centre of commercial and navigational knowledge as well as the wealthiest part of Europe, Italy was the natural origin of the resources to enable royal patronage of the geographic expeditions. Members of the royal family and especially Kings John I (1385–1433), Duarte (1433–8), and most notably John II (1481–95) were central figures in the support of exploration. The tendency to lionize Prince Henry, the brother of King Duarte known as the Navigator ever since an 1888 biography published in London, and to credit him with establishing a school at the southern end of Portugal to promote sailing in uncharted waters has served to distort not only his role and that of the Portuguese crown but also to obscure the participation of Italians in the enterprise.[3] King Dinis (1279–1325) employed an admiral from Genoa. The first expedition to the Canary Islands in 1336 was led by a man from Genoa, Lanzarotto Malocello. A voyage down the African coast in 1341 was organized by a man from Genoa and one from Florence.[4] After the fall of Ceuta in Morocco to Portuguese forces in 1415 the process of exploration became more or less a project of the crown but that did not prevent or apparently lessen the participation of Italians in the enterprise.

The close ties between Italy and the Portuguese enterprise explains why Italian maps were the first to include new information about the Atlantic. The 1339 Dulcert map reflects the discovery of the Canaries. The 1370 Medici map reflects new knowledge of Madeira and a 1385 map shows sailors had reached the Azores. A 1424 chart by the Italian map maker Zuane Pizzigano, presumably derived from what Portuguese sailors saw, included a surprisingly accurate location for Madeira.[5] The Venetian galley captain who helped Fra Mauro, Andrea Bianco, in a 1448 map incorporated information about the African coast and the Cape Verde Islands, information which he presumably got from Portugal. Alvise da Cà da Mosto, the author of a description of mid fifteenth century Portuguese voyages of exploration, was a Venetian navigator known in Italy as Luigi. When he left the service of the king and went back to Venice in 1463 he took hydrographic information which then found its way on to the maps of Grazioso Benincasa. Even earlier the Fra Mauro map of 1459 suggests some knowledge imported from Portugal. Later the Behaim globe incorporated information from expeditions along the African coast. Place names for African sites on the Italian maps were usually Portuguese, a clear indication of the origins of the new intelligence.[6]

The slow development of map making in Portugal in the fifteenth century is striking. The fact that the king of Portugal commissioned the Fra Mauro map shows that the idea of having graphic representations of what sailors were finding was not alien to policy makers. There are indications of map making done in Portugal on commission from the king in 1443 with a potential for some work done even before that date, possibly as early as the arrival of Lanzarotto Malocello in the 1330s , though such claims are pure speculation.

There were skilled and knowledgeable men brought to Portugal throughout the fifteenth century from Genoa, Venice, and Majorca who carried with them the ability to make maps. The original source of expertise in map making for Portugal appears to have been the Balearics. While Italians supplied nautical, financial, and organizational skills it was Catalans and especially those from Majorca who brought their traditions of map making to Portugal. Extensive and varied decoration on sixteenth century Portuguese maps suggests Catalan roots for what was to become the dominant style.[7] How much effect Catalan practice had earlier is open to doubt since there are virtually no surviving products of fifteenth century Portuguese cartography.

No more than five maps or fragments of maps exist from fifteenth century Portugal and those are from the closing decades of the century. There is some question about whether or not some of the five were done in Portugal but there is no doubt about one map and one fragment. It is certain that there were Portuguese chart makers before 1500. The absence of surviving early Portuguese maps might not be '…the most amazing mystery in the history of Portuguese cartography.' but it is strange that all but a very few maps should have survived.[8] The updating required by new data may have made many maps quickly obsolete and so disposable. The 1755 Lisbon earthquake certainly destroyed many archives and libraries and an unknown number of early maps.[9] Whatever the cause it is difficult to tell what Portuguese cartography was like in the fifteenth century. The opposite was true for the sixteenth. One manifestation of the discoveries was sudden, remarkable, and unprecedented cartographic production in Portugal in the 1500s, 1510s, and 1520s. Artists produced a range of maps of the highest calibre, some being the most impressive and important maps of Europe.

Sailing in new and unknown waters promoted the development of navigation and navigational skills which shaped cartographic depiction. A Fleming, Michiel Coignet, published a book on the art of navigation in 1581 and in it he made a distinction between coastal navigation and ocean navigation. The former was common in the Middle Ages and there were pilots who knew how to sail within sight of land in their own regions. It was the latter that Portuguese sailors developed and perfected in the fifteenth century. Out in the open ocean there were no physical features, no coastlines, no markers for mariners. That gave the sea chart a different purpose from its predecessors, both maps of land and portolan charts. The charts covering an ever greater part of the globe had to offer some guides.[10] Scholars and sailors applied existing astronomical knowledge to problems of high seas navigation and with considerable success. They developed ways to use the height of the Pole Star to determine latitude. As they went down the African coast pilots found that it was difficult to take sightings of that beacon so they developed, under the impetus of royal patronage and with the help of scholars, ways to use the

height of the sun at midday to determine latitude. By 1478 a scholar detailed the necessary data for making such determinations in extensive tables for use throughout the three following years. Returning from the coast of Africa, because of prevailing winds and currents, captains had to sail out into the open ocean and were out of sight of land for up to two months before they turned east toward Iberia. If they could measure their latitude they had a much better chance of landing near their intended destination.[11] By the sixteenth century such tables for calculating latitude based on solar observation were a standard part of virtually all books on navigation and there appears to have been a way of using them called the Portuguese method,[12] another indication of the effects of voyages of discovery on the emerging conception of geography of the seas. By the late fifteenth century Portuguese sailors, with the aid of mathematicians, better measuring instruments, and possibly the use of new instruments which they found serving the needs of the local pilots they met in the Indian Ocean, had gone a long way to solving the problem of sailing out of sight of land for sustained periods.[13]

If not before by the 1470s new astronomical methods were having an effect on Portuguese charts. People interested in navigation and along with it cartography living in Portugal in the subsequent six decades were exposed to a broad range of new ideas and developments in navigation. Pedro Nunes' (1502–78) *Tratado da Sphera*, published in Lisbon in 1537, was both a culmination and a new departure in learning about sailing at sea. He not only summarized existing knowledge but introduced new methods and instruments. He also identified the problem that a straight line on a plane chart was not a straight course because of the curvature of the earth. Over short distances that did not matter and so was not of serious concern to sailors in the medieval Mediterranean when portolans were first made. For ocean sailors going to India it was, of course, critical.[14] The new type of navigation summarized by Nunes incorporated all the skills of Mediterranean sailors with those of mariners from the Atlantic and, combined with learning borrowed from the ancients, created the foundation for the path-breaking maps and charts of early sixteenth century Portugal.

The king often licensed or partly or even fully supported trips out into the Atlantic and down the African coast. The royal government in Lisbon came to realize the need for recording and transmitting knowledge gained to permit and promote subsequent voyages. As the volume of information increased authorities in Lisbon began efforts to standardize the new knowledge. Presumably the enterprise was small enough in the early fifteenth century that simple ad hoc arrangements were adequate for handing on hydrographic findings. That early informality became less feasible as trading to west Africa expanded and then ships began to make their way from Portugal to India. In Europe captains generally could find local pilots to get them from one region

to another. The first Portuguese captains in the Indian Ocean followed that practice, recruiting local Arab pilots to guide them from southeastern Africa to the southwest coast of India. It must have become obvious rather quickly that it would not always be possible to rely on the good fortune of finding helpful local pilots. The belligerence of the Portuguese, manifest already by the second decade of the sixteenth century, toward a number of political authorities around the Indian Ocean made the need for independent, that is Portuguese, sources of navigational skills obvious.

The royal government chose to establish an institution for gathering data about sailing from Europe to India and everywhere in between. The new office took responsibility for collecting information from returning sailors and passing it on in some convenient form to their successors. One of the most effective ways of transmitting that information was in maps. The *Armazém de Guiné e Indias* (Storehouse of Guinea and the Indies), set up in Lisbon possibly as early as the 1490s, had among its functions the promotion of geographical knowledge. The office maintained the *padroes* or master copies of the charts. In 1504 when King Manuel I (1469–1521) insisted that all portolans for the African coast had to be handed over to the keeper of a royal depot of charts, he in effect created something very much like a hydrographic office. Over time the role of the office expanded. The *cosmógrafo-mar,* the man responsible for signing off on the maps, by the mid sixteenth century also examined masters of nautical charts and nautical instruments and checked all the charts and globes made by them. He had to give classes to seafarers, to examine navigation officers, and keep a record of who they were. That formality, regimentation, and regulation was a product of a half century or more of a classic case of the expansion of bureaucracy. The goal for the office in general was to improve the written instructions for pilots and to improve the *padroes* so that charts would be as accurate as possible. By 1517 if not before Portuguese ships going to India took two nautical charts with them and the pilots had to turn the charts in to the *Almazém* on return, presumably with additions and corrections which could then be transferred to the *padroes*. The system was not foolproof. The knowledge gained by the first Portuguese to visit the China coast in 1517 and 1519, for example, took some time to turn up in world maps in Lisbon.[15] Such gaps were, thanks to the official status of the *Almazém,* the exception.

The Portuguese poet, essayist and historian, Jaime Cortesão, in 1924 claimed that the crown pursued a policy of silence, restricting information and so giving primacy to the commercial and political interests of the kingdom. Cortesão was trying to understand why so little written evidence of the fifteenth century voyages had survived.[16] The idea of a secrecy policy, although not unchallenged, became a commonplace among historians, was taught in schools in Portugal, and has been widely accepted by those seeking to associate map

making with the emergence of nation states in early modern Europe. The secrecy required by the kings is offered as the explanation for a lack of Portuguese maps in the fifteenth century, all the charts presumably having been destroyed for fear they would fall into the wrong hands.[17] The belief in such a system of strict control of knowledge remains widespread and is often standard fare for general works on the history of cartography.[18] It is associated with the rise of the state and/or the rise of capitalism, in some cases with the state as the agent of a rising bourgeois class using the control of information to gain control over the wealth of the newly discovered lands.[19] The practice is one that is understood to have spread across Europe, secrecy about geographic knowledge being a hallmark of sixteenth century monarchies.[20]

The claims for a policy of secrecy fail because of misunderstandings of the effectiveness of sixteenth century states and of the purpose of the office set up by the Portuguese king and by his counterparts elsewhere who took a similar interest in the management of geographical information. Many foreigners worked in Portugal in various aspects of the process of exploration. They and Portuguese sailors and map makers often found employment elsewhere after their service in the kingdom. All were free to and did travel and work in other jurisdictions and for different monarchs. The porousness of the market for skilled labour guaranteed the dissemination of information. That was true already in the early fifteenth century. If there was a policy of secrecy it was certainly easily undermined, and not even corruption was necessary to be sure that happened.[21] The men who worked for the king were free to publish their findings, the most prominent example being Pedro Nunes who was *cosmógrafo-mar* and whose book summarized Portuguese knowledge, detailed the difficulties of navigating the high seas and offered solutions. The *Armazém* in its various names and guises was, among other things, to be a centre for gathering and clarifying information. One feature of the office was collecting information for the sake of collecting, a practice of many wealthy Europeans in the Renaissance. The contemporary popularity of cabinets of curiosities was reflected in at least one of the functions of the hydrographic office: to gather information to entertain and satisfy the patron.[22]

The office had a more pressing function, however. The goal for the bureaucrats was to be sure that pilots and sailors went out with an accurate understanding of what they would face. It might be extreme to call the office a scientific institution but it was committed to gathering data and generating useable results. The government hired artists and cartographers on contract to produce maps, another potential leak, or rather flood, if in fact there ever was a policy of secrecy. Those map makers were not permanent state employees and were free to make similar maps for others. The king did insist, however, that maps be approved, that presumably to guarantee a high level of accuracy. Some of those map makers might well have tried to gain a monopoly or

quasi-monopoly of production but their interests were commercial rather than political and in any case it was not the state that was trying to make money from selling the maps.[23] Kings wanted to get information right so sailors would avoid trouble at sea. Experience with portolan charts suggested that once an error got onto a map it would stay and for a long time. The hydrographic office in Lisbon was set up, among other reasons, to make sure that misinformation did not get embedded into maps. That is why the king's cosmographer kept a master map and why he made new ones periodically to incorporate new data. The surviving Portuguese maps of the first half of the sixteenth century, the large number generated both in and outside the royal institution, certainly did express the ideas of the Portuguese politicians but they also expressed a desire to understand the mass of new information brought back to Lisbon.

The maps from Portuguese cartographers were popular and tended to be widely disseminated in the first half of the sixteenth century not only because they included the latest geographical information but also because they were of such high artistic quality. The quantity of surviving works is small for the first two decades of the sixteenth century but after about 1520 and especially after 1535 the number and the scale and scope of known maps increases considerably. They include giant maps which cover the entire world and atlases with a number of sheets which serve the same purpose to a greater or lesser degree, often done by prominent chart makers. The large world maps done to summarize knowledge from voyages to Asia and the Americas offered information and not only about land masses but also about methods of navigation. Portuguese map makers might well keep the compass roses and rhumb lines of Mediterranean portolans or they might just drop them as unnecessary. If navigation was based on global position described within an imaginary grid then the rhumb lines were redundant.[24] One thing that Portuguese cartographers slowly added was indications of latitude, the first measures appearing between 1480 and 1500. So it was more than half a century after sailors along the African coast recorded their position relative to Lisbon before maps showed latitude and then only tentatively. Scales were not universal even by the mid sixteenth century in part because there were problems with their insertion, more than one being used in some cases because of the difficulties created by the difference between true and magnetic north. Matters were confused for the Indian Ocean by inaccurate equivalences for the degree used by Arab and Portuguese pilots. By 1514 there were vocal advocates for putting latitude measures on maps, corrected for compass declination. By 1519 maps in some cases got scales of longitude even though sailors could not measure it with any sort of accuracy and would not be able to until well into the eighteenth century when clockmakers perfected chronometers which functioned effectively at sea. By 1500 cartographers had ever increasing quantities

of data on latitude from travelers' accounts, nautical books and charts used on board ship. Not all the data was equal in quality and it took some time for theoreticians to solve the problems of how latitude needed to be represented, problems which Portuguese map makers had to address immediately.[25]

As with late medieval portolans, either as separate sheets or in collections of related maps, the surviving world maps and atlases of early sixteenth century Portugal were almost always presentation copies. The extant ones sometimes boast luxurious illustration. The lands of the New World often have animals and people, and often exotic ones so the maps served as reports on recent findings. Though their knowledge might be inadequate or inaccurate and though map makers sometimes distorted images of flora and fauna, at least they got the locations for the animals right most of the time. Typically illustrators preferred larger beasts and exotic peoples to fill the empty spaces on the new continents they had to draw. What appeared on maps on land was a mix of myth, legend, imagination, and empirical observation. The pressure of new knowledge forced constant change in the illustration on land.[26] That was less true for the illustration on the sea.

Portuguese cartographers increasingly included ships on their maps. They depicted different types of vessels as they did with animals and plants. The ship illustrations are in some cases the only way anything is known in detail about the ships that carried Portuguese travellers into uncharted waters. It appears that, as with the sea coasts and flora and fauna, accuracy with ships was important to map makers. The artists who drew the vessels were often presumably different from the ones who did the other parts of the maps though there is no guarantee that was the case. Whether it was pressure from their sources, their own experience, or pressure from patrons, whoever did the job of putting the ships on the maps took pains to render the vessels accurately and to put the right ship in the right place.

'…Portuguese charts often produce a wonderful alliance of the cartographic with the iconographic'.[27], an attribute that was apparent even in the few fifteenth century products. They look very much like Catalan maps and include flags to identify ports with castles or city-sketches to show major sites. There are rhumb lines as well.[28] There are certainly no signs of ships on any of the fifteenth century maps. That changed soon after 1500. Two maps from the first few years of the sixteenth century have drawn attention because they show new lands in the Atlantic. The Cantino Map, produced in Lisbon in 1502, included the New World as a separate continent, the first world map to do that [Figure 5.1]. The impact of the map was muted because it did not circulate. Alberto Cantino bought it from an unknown Portuguese cartographer for Hercule d'Este, the Duke of Ferrara, so the Italian ruler would be able to see the recent advances in geographical knowledge. The map, now in the Biblioteca Estense in Modena, is the first to indicate some scale of latitude. It
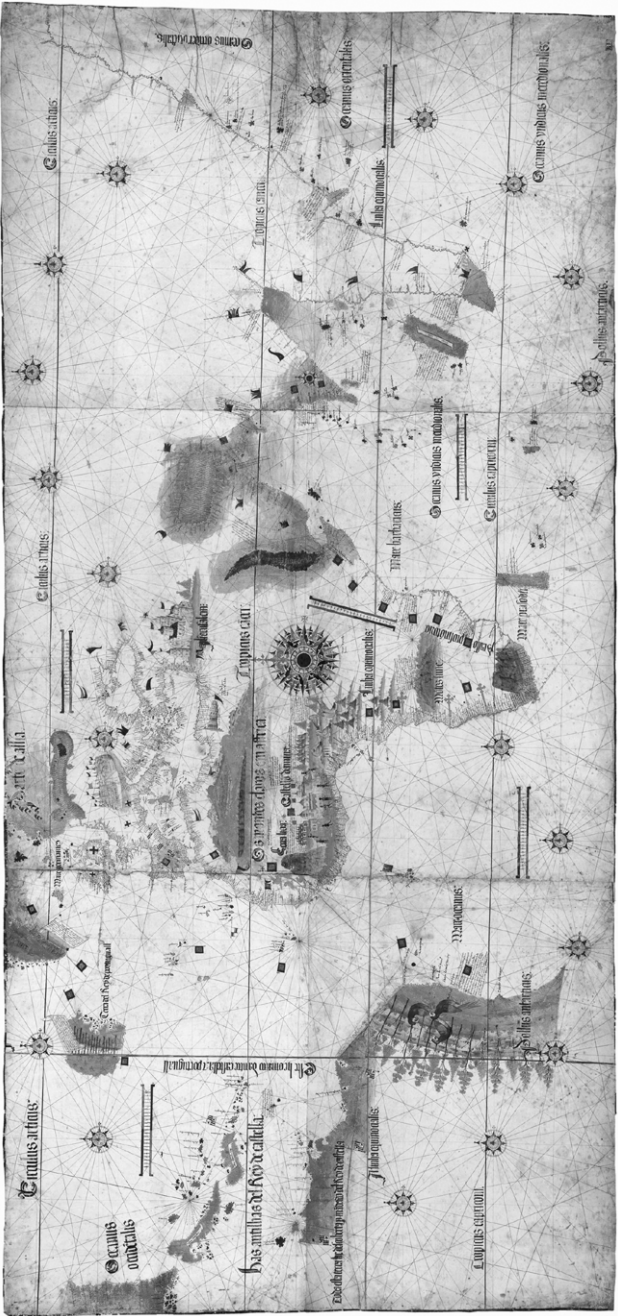
Figure 5.1 The Cantino Map, produced in Lisbon in 1502. Biblioteca Estense Universitaria, Modena, C. G. A. 2.

was not very helpful to the Duke when it came to the depiction of lands around the Indian Ocean since the map maker appears to have relied more on older Arab sources than on news from Portuguese sailors returning from India. The limited information revealed about the East does raise doubts about the contention that the Cantino map was a copy of the master map in the *Armazém de Guiné e Indias*. There are some sites which get special attention: Jerusalem, Venice and El Mina, the depot of the slave trade and centre of Portuguese commerce in west Africa. The large Caribbean islands, the Spanish Main and the coast of Brazil are all easily identifiable. The interior of Brazil even has indications of swamp lands, trees, and three birds. The map, then, had some decoration but it has no ships.[29] The world map by Nicolo de Caneiro Januensis done between 1502 and 1505 was based on a Portuguese prototype, possibly the same model as for the Cantino map since they are so similar. The cartographer was Genoese but it can not be said with certainty where he drew the map. It, like the Cantino map, has the rudiments of a latitude scale. It shows some of the new knowledge of the Indian Ocean. While it does have an elephant in Africa and so has decoration on land there are no ships at sea.[30]

'Portuguese overseas cartography of the sixteenth century is… remarkable for the great number of beautifully produced world atlases created by a relatively small group of cartographers….'[31] The Reinels, Homems and the Ribeiros, families of map makers, thrived in the first half of the sixteenth century and left some of the finest monuments of Portuguese cartography. They were by no means the only cartographers in the country but their work has proven the most durable and indicates the direction of the craft both inside and beyond Portugal. They were the leaders among a small group of highly skilled Portuguese map makers who established standardized patterns of illustration, including the depiction of ships.

Pedro Reinel may have been the maker of one of the earliest known charts to survive from Portugal, one probably from 1483.[32] His son, Jorge, lived a long and highly productive life rising to the office of royal cosmographer. From 1531 he was examining pilots, making nautical instruments, and approving charts for Indies voyages. The young man had some trouble with the law and so had to flee Lisbon, going to Seville and working there as a cartographer until his father came to fetch him in 1519 and bring him back to Portugal. While they were in Seville they appear to have served as advisers to their fellow Lusatian, known to his Spanish employers as Ferdinand Magellan, for his forthcoming voyage around the world. By 1524 the two map makers, father and son, were back in Lisbon and working for the king of Portugal. Pedro last appears in records in 1528, taking a pension, but Jorge would continue as a map maker into the 1560s. They were among the first cartographers to populate their products with extensive and accurate depictions of many types of ships.[33]

Figure 5.2　Jorge Reinel, planisphere, 1519. Detail including South Atlantic and Indian Oceans. Redrawing of the original, now lost, done by Otto Progel around 1843. The John Carter Brown Library at Brown University.

　Pedro produced two charts of 1500 and 1504, remarkable for their scope and for the depictions of coasts only recently visited for the first time by Portuguese sailors, but the charts had no ships on them.[34] Jorge on the other hand was prepared to complement the coast lines with ships in the water. An anonymous chart of the Indian Ocean from 1509 or 1510 is possibly Jorge's.[35] On it there are six ships spread out from the South Atlantic to the Indian Ocean and Arabian Sea [Plate III]. All of the vessels are variants on a *carrack*. Some have three masts but the largest have four, the second or bonaventure mizzen carrying a second lateen sail. The ships were dramatically sketched giving a sense of action and movement. They had low waists created by sharply turned up bows and sterns. There was a big mainsail and small topsail

on the mainmast. The dominance of one sail indicates ship designers had yet to appreciate the advantages of a divided sail plan, that is where the captain had a number of easily deployed smaller sails on each of the masts. More and smaller sails gave captains greater flexibility and also reduced the maximum number of men needed to handle the sails. In a sense the addition of a second lateen-rigged mizzenmast was a way to divide the sail plan and a sign of the long term evolution in rigging. The artist drew the different vessels as if they were all depictions of the same ship but with different views of that vessel at different stages of action or states of action,[36] a practice which turned up in later maps too.

The 1519 planisphere made by Jorge, possibly completed with the help of his father when they were both in Seville, has a total of 14 ships spread out across the world but there are clear differences among them [Figure 5.2]. The vessels in the Atlantic include a *galley*, two ships with lateen sails on each of two masts which might be *caravels*, and three which recall the four-masted *carracks* of the 1510 chart. In the Indian Ocean the design of some of the ships is a bit different. Each has a single square or almost square sail, the yards tilted showing another way to set the sails, a shallower waist because of straight rather than the usual curved gunwales, and a large aftercastle. Perhaps recalling the effort in the Catalan Atlas, there is a ship in the South China Sea with five masts possibly intended as a depiction of a Chinese junk. While the dominant vessels were European at least in this case the map maker tried to show something of another, competing, and perhaps superior and so respected shipbuilding tradition.[37] No map attributed to Pedro Reinel has a ship as decoration and not all those attributed to Jorge were populated with vessels. A chart of about 1540 which he signed has no sail anywhere.[38] Still Jorge did establish the value of showing ships.

The Homem family might even rival the Reinel's for their contribution to Portuguese cartography. Diogo, his son Lopo who was a student of Pedro Reinel, André who was another close relative and probably a cousin, and Lopo's son, Diogo, all produced remarkable maps. The last in the line of cartographers was involved in a Lisbon murder case in about 1544. Free on bail he escaped to England and though his father got the king to pardon him, there is no evidence that Diogo ever went back to Portugal. The oldest surviving chart by Diogo the younger comes from 1557 but it is likely that he was already earning his living as a map maker in London in 1547, producing large, valuable atlases on contract. By 1568 he had left England for Venice where he continued to produce charts and atlases at least until around 1571. His maps are sparsely decorated at sea and indeed often not decorated at all. Though he did put animals and people and tents and trees on land now and again, there are a few ships at sea and typically he did not take much care with the ones he included. That was obvious with a collection of maps he did for Queen Mary I

of England in 1558. The one of East Africa had indications of life on land. There are animals and a representation of the mythical Christian king Prester John, long thought a potential ally for crusaders. The map had, as an exception to his norm, indications of life at sea with three ships all under sail.[39] Diogo's career was largely a postscript to that of his much more famous and accomplished father. The same could be said of cousin André who rose to the post of cosmographer to King Charles IX of France but who produced only one known surviving work, a planisphere published in Antwerp in 1559.[40]

The justly better known Lopo Homem was responsible for charts for the king of Portugal from 1517. He was the author of a number of maps including a Mediterranean chart of around 1550, a North Atlantic chart of about the same time, and a planispere dated to 1554. He may have had roots in the aristocracy and so had an entree at court but his elevated origins did not stop him from repairing instruments and being involved in making maps. His later maps from mid century had no ships on them. The greatest monument to his work, though unsigned and so with some question about the cartographer, is the so-called Miller Atlas, the name indicating the last owner before it came into the hands of the Bibliothèque Nationale in Paris.[41] It was full of ships.

Lopo Homem made the Miller Atlas along with the Reinels, father and son [Plate IV]. All the ornamentation especially at sea suggests that it was the younger Reinel who was the moving force behind the illustration though the immigrant artist António de Holanda is generally credited with executing the decoration. King Manuel I of Portugal possibly commissioned the work as a gift for the young King Francis I of France (1494–1549). It was certainly always intended as a work of art to be preserved and never as a working atlas. It consists of 13 charts on 11 sheets, includes much of the world, and did mirror in its coverage Portuguese political interests around the globe. The map of Brazil, complete with native people on land cutting what is presumably Brazil wood, and the representation of the Indian Ocean shows how quickly the Portuguese had collected extensive precise geographical and biological information about the newly visited lands.[42] The coastlines in general are highly accurate. Among the many reasons for preferring the Dutch born Antonio de Holanda as the likely candidate for doing the illustrations was his familiarity with manuscript illumination and especially books of hours, an art form which heavily influenced decoration on maps. Also, he did a view of Lisbon between 1530 and 1534 with all kinds of different ships in front of the town so he was familiar with drawing a variety of vessel types. The maps are a riot of colour with a great variety of illustrations of people, animals, and buildings. The accurate renderings of flora and fauna, the detail of the costumes of people in Brazil, all suggest that the images were drawn from sketches which in turn were drawn from life.[43]

The variety of the total of 47 ocean going ships on maps in the Atlas is if anything greater than the variety of objects on land. There are flags flying
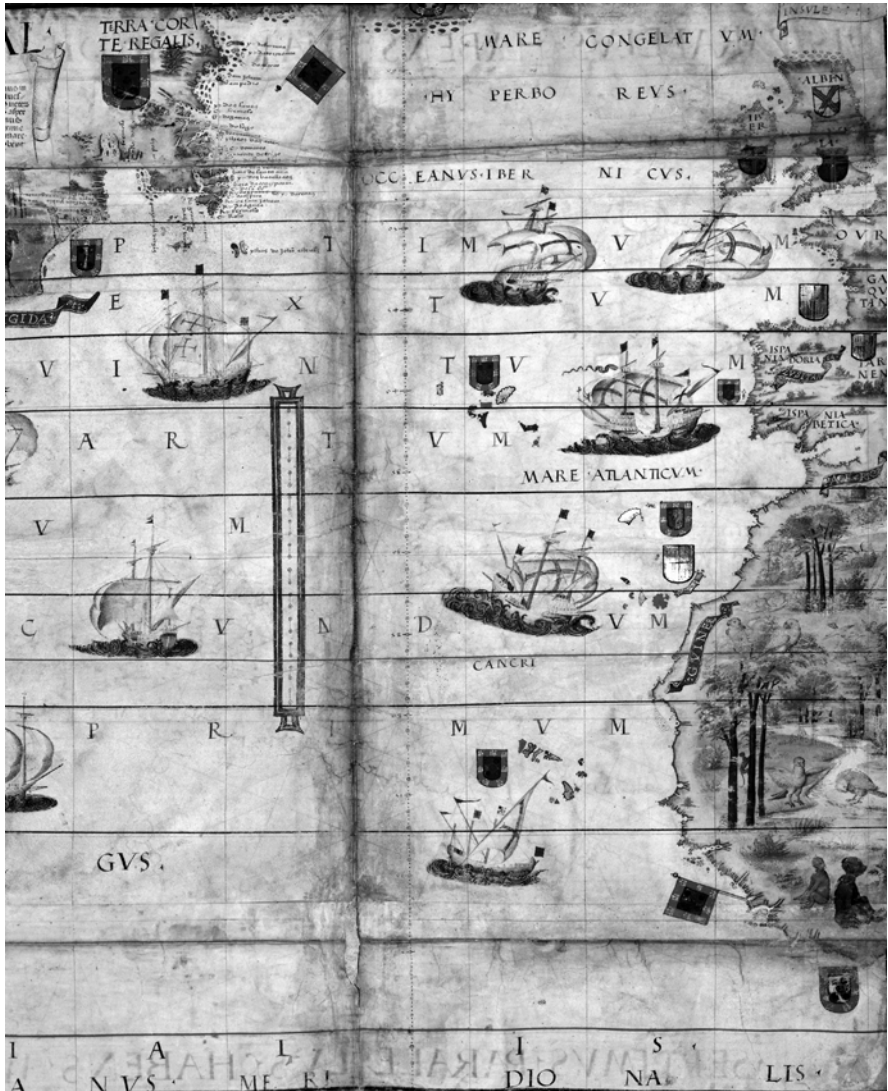
Figure 5.3 Lopo Homem and the Reinels, father and son, the Miller Atlas c. 1519. The eastern Atlantic with ships including a *caravel* off the west coast of Africa. Bibliothèque nationale de France, GE AA 640 RES, fol. 6.

on virtually all the ships, mirroring flags on land which indicate, among other things, possessions of Spain and Portugal.[44] Sails are often decorated with crosses, to indicate Christian vessels, or crescents to indicate Muslim ones. Ships appear on all sheets so they turn up all over the world but the Indian Ocean is especially full of vessels. The ships fall into six broad categories: the three-masted *carrack*, the two-masted early *carrack*, the small *caravel*, the large *caravel*, the *galley*, and exotic or non-European types.

The *carracks* are often shown from different angles as off the coast of Ireland. They have three masts including one lateen-rigged mizzen so they are similar to ships on Jorge Reinel's charts. Waists are deep and in some cases very deep, as with the *carracks* in the Indian Ocean, suggesting large cargo capacity. Some even have four masts with a lateen on the additional mast at the stern. There is usually an outlicker or yard projecting from the high raised stern to which the after lateen could be sheeted. There is usually a bowsprit angled sharply upward. The sails are typically set and billowing out. Both the main and foremasts have topsails, suggesting the move toward a more divided sail plan which was underway and slowly gaining some momentum. The type was apparently by 1519 becoming the standard vessel to illustrate maps. There were variants on the standard like the three-masted ships in the Atlantic with low aftercastles, rather low forecastles and straight gunwales. The shallow waist and sleek profile suggests a vessel of relatively less cargo capacity but greater speed so the artist indicated a distinction between vessels in trades to the New World compared to those going to India, a difference which would become pronounced through the sixteenth century.

The two-masted carrack with a single square sail on one mast and a lateen sail on the mizzen mast turns up in the South Atlantic. Though the aftercastle is high the gunwale is straight and the forecastle low suggesting it was an advance on the two-masted carrack design of the fourteenth and fifteenth century. The bow is rather pointed so the artist may have been thinking of a vessel more suited to inshore work and making landfalls where cargoes were not abundant and port facilities poor.

The first illustration anywhere of a *caravel* shows up off the coast of Africa, the vessel furthest south in the Atlantic [Figure 5.3]. The type had no upper-works, relatively high length-to-breadth ratios, and one to two lateen sails. It was highly effective in Portuguese exploration along the coast of Africa in the fifteenth century and *caravels* did make some voyages to and in the Indian Ocean. The *caravel* in the Miller Atlas has, atypically, three masts, each with a lateen sail only one of which is set. It seems more than a coincidence that the vessel should appear in the Atlantic off the African coast, that is in the region where it had proven most successful. The type may well have developed from earlier fishing vessels with Moorish roots and was possibly designed specifically for use in exploration, that in the first half of the fifteenth century.

It is impossible to say with certainty since there is no depiction of the type before 1500 and certainly nothing as comprehensive as the illustration in the Miller Atlas. That vessel has the typical low profile but with small enclosures at bow and stern. The third mast near the stern is considerably smaller, indicating that this was a ship in need of extra power to navigate.[45]

The large *caravel* had four masts with lateen sails on three of the masts and one or two square sails on the foremast. Thought to be a later development and especially suited to the sugar trade between Portugal and the Atlantic islands, the appearance of the type on maps suggests it was also popular for long distance voyages elsewhere and that it proved valuable in less well-known waters. Having three lateen sails would have kept crew size large, lateen sails being harder to handle than square ones and not divisible. The voyages Portuguese explorers and traders undertook often over some considerable distance and across the open ocean presumably could sustain the extra labour costs, as the appearance of the vessels on the maps indicates.

Four large *caravels* appear in the Miller Atlas and the same can be said of *galleys*. The one in the Indian Ocean has a single mast and sail and is in no way remarkable. The opposite is true of the exotic ships. Vessels with two masts, each with a lateen sail, are probably Muslim since the sails are decorated with crescents. Multi-masted ships with something like side rudders instead of the sternpost rudder common on all the other vessels appear in the Bay of Bengal and the China Sea. One even has seven masts and two versions have what could be battened lug sails. Those may be attempts to depict forms of Chinese junks. The images show once again that Europeans were interested in junks but also that they did not understand the design. Other exotic vessels have what could be three rudders and three sails, all lateen. There are two single-masted ships with what could be a square sail on each and scroll like stemposts and one even with a scrolled sternpost. The artists of the Miller Atlas offered a wide variety of information about vessels packed into a range of different illustrations that populate the waters of the entire world they depict. The body of illustrations is remarkable because it shows the different types of ships in use, the different uses of the different types and the breakthroughs and improvements in ship design of the previous century and more.

Diogo Ribeiro, another Portuguese cartographer, worked in Seville after a meeting took him there in 1519. The Spanish authorities hired him as a cosmographer and master maker of charts, astrolabes and other navigational instruments. He worked for the Spanish version of the *cosmógrafo-mar*. Since he and the Reinels were in Seville at the same time it is likely that they cooperated on the production of maps and globes. Active between about 1515 and 1533 two maps signed by Ribeiro survive and three other existing maps are probably by him.[46] His work most clearly shows the degree to which ships not only as decoration but also as an integral part of the transmission of

navigational information had become an accepted feature of European carto-
graphy by the third decade of the sixteenth century.

Not all the maps of Diogo Ribeiro had ships on them. An anonymous 1525
planisphere probably by him lacks any sign of a ship.[47] Another anonymous
chart now in Wolfenbüttel attributed to Ribeiro, however, has a number of
ships. One reason for the illustrations may be that the chart, dated typically
to c. 1532 but probably from after 1533 when Ribeiro died, could well be by
another map maker, the Spaniard Alonso de Chaves. The map includes most
of the world, the New World being especially prominent. There is one ship
near the West Indies and headed for the islands with another off South
America headed for the East Indies and a third vessel on the other side of the
Strait of Magellan going to the Moluccas. There are short captions explaining
where the ships are going.[48] The vessels are included to indicate routes and
destinations, to illustrate patterns of trade as well as navigation. That goal is
even more obvious on Ribeiro's 1529 planisphere, one of the most impressive
maps of sixteenth century European cartography [Plate V].

That map '…is a landmark in the development of knowledge of the world,
comprehending the whole circuit of the globe between the Polar circles, with
the East Indian archipelago appearing in both the west and the eastern
margins.'[49] It was to be among other things a summary of the discoveries up
to the date Ribeiro created it. The three surviving versions are also some of the
most beautiful of all manuscript maps. It could be that Ribeiro created the
map at the order of Charles V possibly for the emperor's own or for official
use. Copies of the 1527 as well as a 1529 version are at Weimar and a copy
of another 1529 version, falling between the other two is in the Vatican.
As was common with manuscript maps there are variations and significant
ones among the three. While the first has enjoyed a good deal of attention the
Vatican map is the one most often reproduced since it is better drawn and
illuminated.[50]

The 1527 chart has 20 ships, some with legends for the vessels such as
'I return to the Moluccas' and 'I come from the Moluccas', the latter for a
ship in the north Pacific. Three of the ships have no legend. The map also
has more human and animal figures than the earlier version. The map in the
Vatican had two ships in the circular table of declinations set in a compass
rose in the vast and uncluttered Pacific but they are left out in the 1529
Weimar chart which, on the other hand, has many more inscriptions and
legends. There were even changes in captions in the two 1529 versions with
one ship carrying the tag 'I come from the Moluccas' in the Vatican map but
it has the indication 'I am going to New Spain' in the Weimar version.[51] The
ships were drawn in great detail, even down to the fenders on the sides to
protect the hull planks when the ship was sitting at a dock. In the middle of
the Pacific in addition to that compass rose there is a new navigational device,

a horary quadrant, first developed at about that time and first illustrated on this map.[52] Ribeiro was interested in showing not only new ships and new routes but also new instruments. He was also interested in filling the suddenly vast open space that was the Pacific Ocean.

There is one large ship on the planisphere which appears repeatedly in the Indian and Atlantic Oceans. Many of the others, smaller vessels, seem almost to be complements to the large *carrack* shown at different angles as it seems to make its way from India to Portugal. It is the same three-masted ship with a
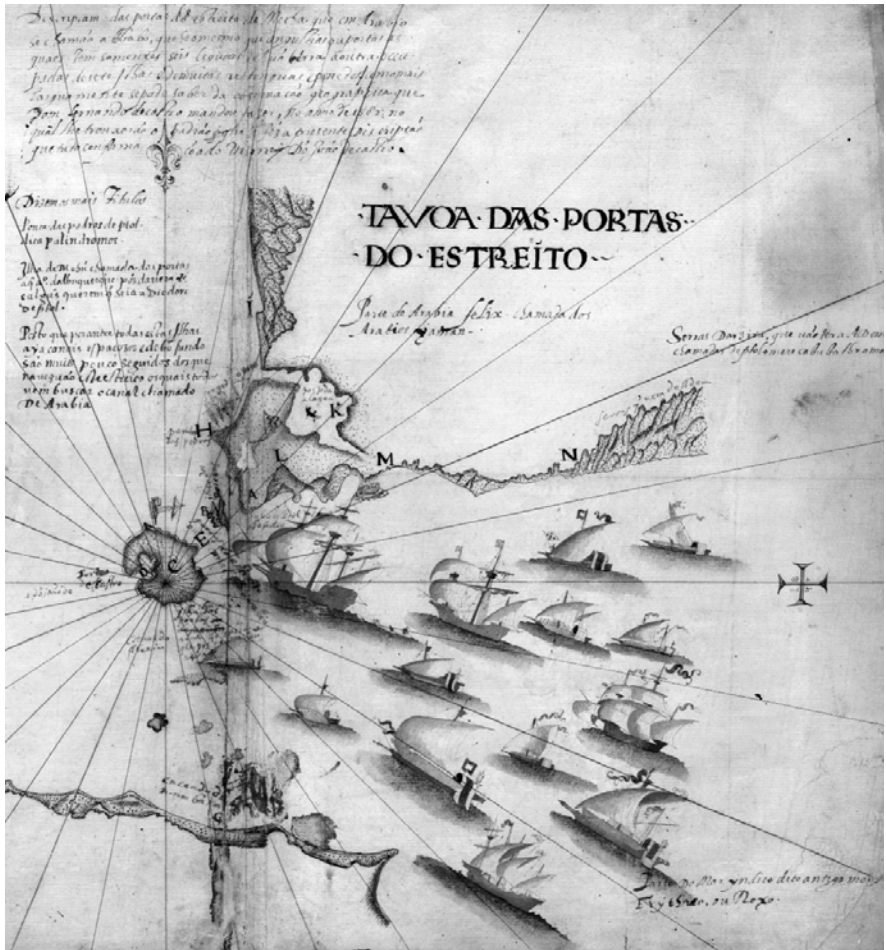
Figure 5.4 D. Joao de Castro, Portas de Esterito with 14 vessels of which eight are galleys from a rutter of the Indian Ocean. From his *Roteiro que fes dom Joao de Castro de Viajem que Fezeram os Portugueses Desda India atee Soez…* (Portugal, c. 1541). From the collection of the James Ford Bell Library, University of Minnesota, Bell 1541 f Ca.

lateen-rigged mizzenmast and a sail under the bowsprit that Ribeiro shows making its way across the Pacific on the Vatican version. The design is that of the standard deep sea cargo vessel Europeans used in long distance international exchange, with variations, through the sixteenth and well into the seventeenth century. In many cases the ship has all sails set, including small topsails on the main and foremasts. There are also one or two *bonnets*, that is extra pieces of canvas stitched onto the bottom of the large square sails. The smaller vessels indicate the same type of design with tapered upperworks at the stern and a very similar sail plan. The path of the large ship could well be that of the expedition of Magellan around the globe. Whether it is or not, the ship was included to show how sails should be used and what courses sailors should choose when sailing between Asia and Europe.

Variety as well as chronicling the Portuguese use of ships in Asia was the hallmark of the sketches made by Joao da Castro (1500–48). He went out to India in 1538 and was viceroy there for three years. A disciple of Pedro Nunes, he was concerned with a range of navigational questions including how to measure longitude. He wrote three rutters or books of sailing instructions as a result of his voyage out to Asia and the journeys he made there. Presumably he based the books heavily on information gleaned from local pilots. Da Castro made corrections in existing charts. In the rutters he included small sketch maps which in a number of cases included depictions of ships of various sorts. The drawings like the rutters concentrate on approaches to safe anchorages. The sketches may not have been made by Da Castro himself but rather by an artist brought along for the purpose [Figure 5.4].[53] For the Lisbon to Goa rutter all the ships depicted are virtually the same with high castles, straight gunwales, three masts with topsails on the fore and mainmasts and a lateen sail on the mizzen with a straight outlicker. There is also a sail slung under the bowsprit. It was a standard ship of illustration and presumably the increasingly standard ship of high seas navigation. The second rutter covering the coast from Goa to Diu has sketches which are harder to interpret but the standard ship appears again as do *galleys* but not the ordinary ones of the Mediterranean. Da Castro's *galleys* have three masts with the usual lateen sails on the main and mizzenmasts but a small square sail on a foremast suggesting the galleys were large as does the very large lateen sail on the mainmast. The *galleys* have oars and an unexpected scrolled stern with a pavilion aft as well. The third rutter dealt with the Red Sea and it too had *galleys* but they are more recognizable with two masts, both lateen-rigged. There are also cases of highly mixed fleets with various vessel types ranging from single-masted to two-masted *galleys* to ships without oars carrying the standard complement of two square sails on each of the fore and mainmasts and a lateen-sail on the mizzen to a big sailing ship with four masts, the fourth carrying a lateen-sail on the sternmost mizzen to a four-masted

large *caravel* with three lateen-rigged masts and a square mainsail and even a topsail on the foremast. The greatest variety of ships comes in a sketch of a naval battle with on one side what is presumably a Portuguese fleet made up of both sailing ships and galleys and on the other a Muslim fleet made up of a collection of rather uniform, low, light *galleys* each with a single mast.[54]

Da Castro had a lasting influence in part because Goa became a centre of map making, a process already under way when he went to Asia and one which he promoted.[55] Though he did not produce grand presentation charts as did the Reinels and Homems he did include in his sketches, just as they did in their collections and world maps, a variety of ships and did so with a drive toward accuracy. The pattern is to be found with other and less prominent Portuguese chart makers of the sixteenth century. António Pereira may well have been in Asia for a number of years from 1534 to the 1550s. His chart of c. 1545, probably one third of a planispere, has seven ships all in the Pacific except for one which is off the West Indies, lateen-rigged and single-masted. Three of the ships in the Pacific are the same vessel shown at different angles. They are the standard three-master.[56] Gaspar Correia also went to Asia from
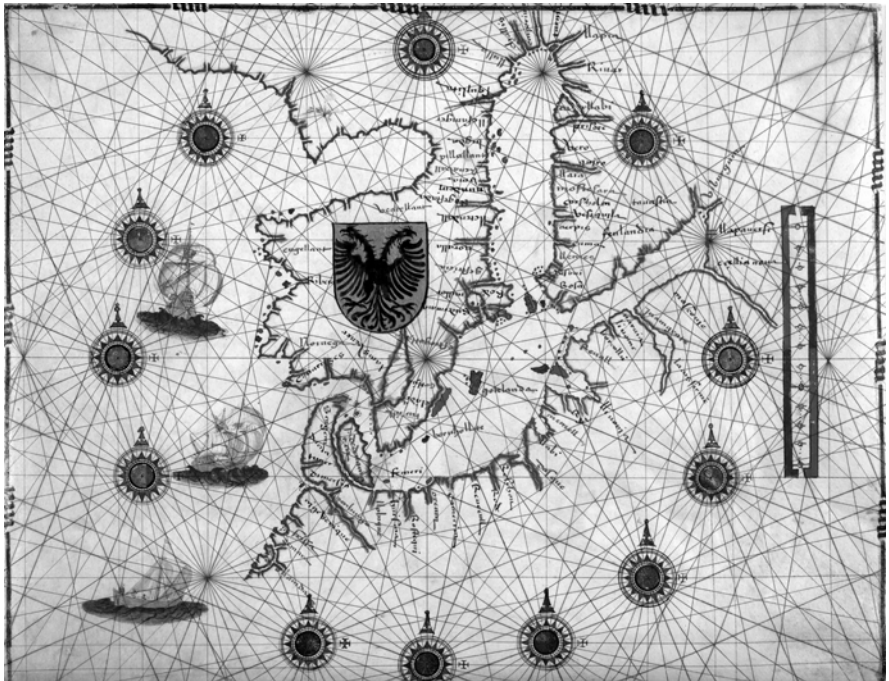
Figure 5.5   Joao Freire, Atlas, 1546. Three vessels including a small open one off the west coast of northern Europe. This item is reproduced by permission of *The Huntington Library, San Marino, California, USA*, HM 35 f. 1.

Lisbon in 1512 and remained there until he was murdered at Malacca in 1563. The instigator of the crime was the grandson of Vasco da Gama who thought Correia had not spoken well enough of the family in his four volume chronicle of the Portuguese in Asia. Among the illustrations of people and places was a depiction of a Portuguese attack on Aden in 1513 complete with small rowed boats carrying troops ashore, single-masted *galleys* with small pavilions at the sterns, four-masted big *caravels*, and the generic three-masted ship, his examples notable only for their deep waists. The same variety turns up in illustrations of the ports of Jedda, Cannanore, and Ceylon. Vessels of the same type seem to be gathered together in the harbours, possibly suggesting something about their draught and the depth of the anchorages. Notably the illustrator of the chronicle made an effort to show what local ships were like. Often those ships are segregated, perhaps suggesting something about their design and where they could go and perhaps suggesting something about contact between the local populations and the Europeans.[57]

More in the style and tradition of the Miller Atlas was the 1546 atlas by Joao Freire, a cartographer known only from the single work. The collection is made up of seven beautifully illuminated charts complete with extensive decoration including ships at sea [Figure 5.5]. Off west Africa there is a three-master seen from the stern, what could be a two-master, and a large *caravel*. Off Newfoundland there is a *caravel* and a standard three-master with a markedly deep waist. Off the Low Countries a small open vessel uniquely has a big yard or sprit forward of the single mast and fixed at the base of the mast. Spread around the Atlantic Ocean, the Mediterranean and Black Seas there are a number of standard three-masters and a couple of undistinguished *galleys* and a few *caravels* but with three masts, each carrying a single lateen-sail.[58]

Another chart, anonymous but possibly by a Portuguese cartographer, from around the same time has six ships in the Atlantic distinguished by the care with which they are depicted. There are all the usual types but with some novel additions. The best illustrated is the three-master off Brazil. It has a large and highly angled bowsprit and two square sails on each of main and fore-masts and a small lateen mizzen. There are again signs of an increasingly divided sail plan. There is a big four-masted *caravel*, each lateen sail being smaller than the one in front, with a spritsail in addition to the two square sails on the foremast. The vessel looks relatively long and has what could be a sizeable aftercastle. Between Ireland and Nova Scotia there is a *galley* with oars and a big lateen sail and what could be a foremast with a square sail. It is unlikely that a *galley* of that design would have ever tried to cross the North Atlantic and doubtful that one would have been able to survive such a voyage. The dismasted vessel off New England with only a sprit sail still functioning and possibly sinking may be there to suggest that not everything always went well for ships on the high seas.[59]

A number of sixteenth century atlases produced in Portugal or in Goa that covered all or part of the world did not have ships as decoration for the oceans.[60] Still the tendency was to include ships and even in terrestrial maps by the second half of the sixteenth century where ships show up off shore.[61] The Miller Atlas had the seas filled with ships. It included a great range of vessels and of many different types. There were some efforts to depict, even if in a clumsy and uninformed fashion, the ships of non-European design traditions. In virtually every case ships are shown in the places where they would have been used by Europeans and non-Europeans. Thanks to the interest in ships and in showing how and where they were used the cartographers created an excellent source of information about ships Portuguese sailors relied on for their voyages of exploration. Often the artists indicated how sailors managed the ships and used the various sails. Seafaring must have fascinated map makers, their audiences and their patrons, at least enough for the cartographers to include as many ships as often as they did. Seafaring must also to a significant degree have infiltrated thinking at least in some circles in Europe, raising questions about the nature of the sea and the political relationship between it and the Portuguese.

Circumstances changed for map makers in the fifteenth and early years of the sixteenth century. Classical learning, reinforced and expanded thanks to the Latin translation of Ptolemy's *Geography*, forced a reassessment of how to depict the world. There was no immediate reason to accommodate local and regional maps and charts to the methods laid out in that work but the second force at work placing pressure on cartographers made theorizing about ways to depict the world critical. Sailors, and especially those employed or licensed by the kings of Portugal, increased knowledge about formerly unknown islands and coasts. The need to depict regions such as the Mediterranean basin or western Europe as an integral part of the whole world then became irresistible. Also irresistible was the need to revise received knowledge since the new findings were at odds not only with what Ptolemy said but also the theories of the likes of Strabo and Pliny. The flood of editions of the *Geography* suddenly stopped in 1490 with no new edition until 1507, a sharp contrast to the seven editions between 1475 and 1490. The suspension was presumably because of the need to absorb new findings from voyages of exploration and to resolve that data with what Ptolemy said.[62] The first step was to add the new information, then combine it with existing knowledge and finally to adopt a new contemporary outline of the world, one very different from that of received authority. The ideas of Greek and Roman geographers provided a framework for the interpretation of new data. Thanks to schooling in classical scholarship men like Nunes and Da Castro could campaign for improved navigational methods and better maps designed less to be a show with elephants and flags and cities and more to be guides to finding location anywhere in

the world. Ptolemy might have supplied the mathematical structure for categorizing and interpreting novel data but it was the new data which forced creation of different maps and, in the process, different sorts of cartographers. The expanding body of geographical knowledge and the need to show it graphically gave map makers greater status and importance within circles of learning as well as among men of commerce.[63] The inclination, already obvious in medieval portolans, to render distances and directions from one place to another accurately, was now complemented by a growing desire to show coastlines accurately, to show aspects of life on land more precisely and to report accurately details about ships at sea. That tendency was most obvious, immediate and dramatic in Portuguese map making in the early years of the sixteenth century.

Finding new places, formerly unknown even to the great heroes of the classical world, generated an unprecedented interest not only in the lands beyond the Ocean Sea but also in geography and natural history. Skills of observation, cataloguing and of representation, and often graphic representation became more highly valued. The discussion of environmental and cultural phenomena became not just acceptable but required and what would come to be called ethnography became respected. The Portuguese were the first to face the new intellectual climate created by information brought back by ship from beyond European shores. Their experience was to be repeated by people throughout Europe over the following two centuries and more. Not surprisingly Portugal became a source of ideas and methods to deal with the new worlds and also not surprisingly a source of ideas and methods about navigation. Europeans borrowed from the Portuguese not just raw information and measurement instruments but also forms of expression.[64] That included ways of making and decorating maps. Portuguese maps and charts were more than show pieces, though they could and did perform that function of earlier portolan charts very well. The large maps and atlases were not for use in navigation. There were separate and different charts for that task on board ship. As maps and atlases became less like the representations of the seas for navigation their other functions, such as showing the shape of the world and showing the character of peoples and places in it, became more important.[65] Among the new tasks, in the eyes of Portuguese cartographers, was to show the ships that sailed the oceans and to show where they went. Ships of various types appeared in large numbers on many and especially on grand maps, well depicted as decoration and illustration, but also as symbols of what the sailors were doing.

Plate I Western Europe, North Africa and the Near East from the Catalan Atlas of 1375 by Abraham Cresques. Bibliothèque nationale de France, Espagnol 30, Planche III.

Plate II Portolan of the Mediterranean and eastern Atlantic by Mecia de Viladestes, 1413. Bibliothèque nationale de France, GE AA 566 RES.
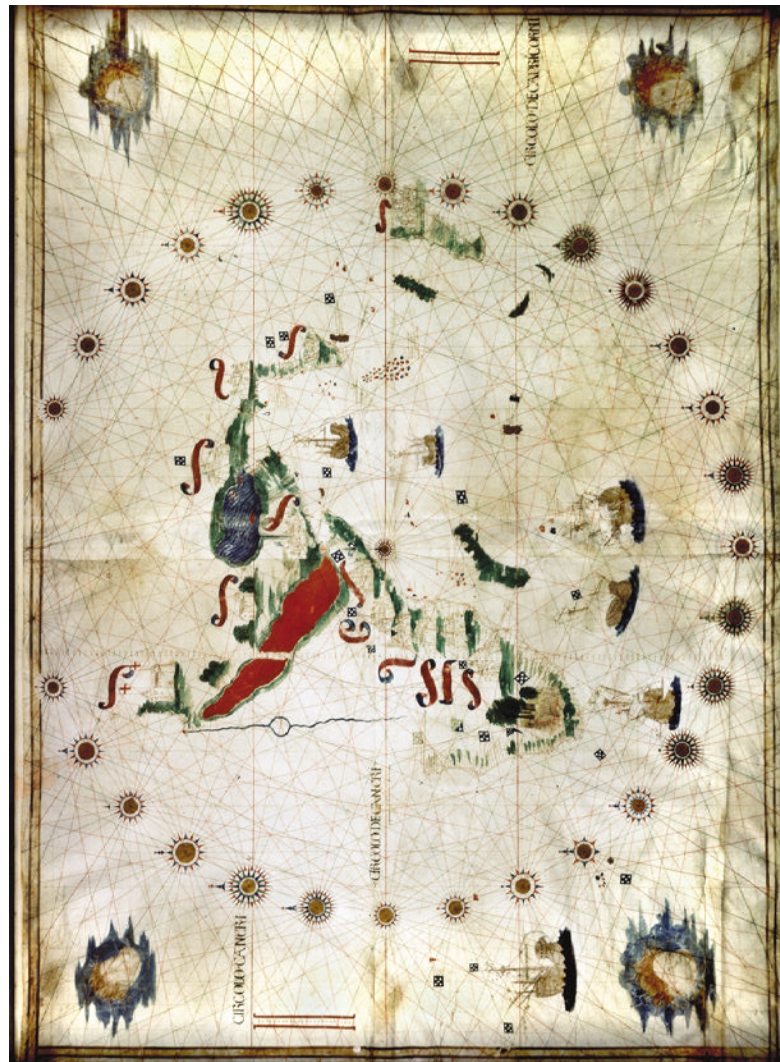
Plate III Jorge Reinel, 1510, South Indian Ocean with six ships off the coasts of Africa. Herzog August Bibliothek, Wolfenbüttel: Cod, Guelf, 98 Aug. 2.

Plate IV The Indian Ocean with ships of varied types. From the Miller Atlas c. 1519 by Lopo Homem and the Reinels, father and son. Bibliothèque nationale de France, GE AA 640 RES, fol. 3.

Plate V Diogo Ribeiro, planisphere of 1529. An 1889 copy of the original in the Vatican Library. Courtesy of the Library of Congress, G3200 1529 .R5 1889 MLC.

Plate VI Piri Reis World Map, 1513. From the collection of the James Ford Bell Library, University of Minnesota, facsimile (Kurumu Yayinlarindan: No 1); Istanbul: Devlet Basimevi, 1935; Bell 1935mPi.

Plate VII The Vallard Atlas, Southern Africa and the southwest Indian Ocean, Dieppe, 1547. This item is reproduced by permission of *The Huntington Library, San Marino, California, USA*, HM29 f. 5.

Plate VIII Map to describe lands that were part of a legal dispute between Rotterdam and Delft, 1512, origin unknown. Nationaal Archief, The Hague, Aanwinsten collectie kaarten en tekeningen (nummer toegang 4. AANW), inventory number 686.

6
Iberian Influence in Southern Europe

Cartographers everywhere had to deal with new information, at odds with received knowledge. They also worked within the theoretical context dictated by currents of Renaissance humanism and a fascination with Ptolemy's *Geography*. Portuguese mapping practices spread rapidly in the first half of the sixteenth century. Many features of charts made in Portugal were familiar to map makers in France, the Ottoman Empire, Greece, Italy, and especially Spain because Portuguese cartographers shared with all of them precedents established earlier in Mediterranean cities and towns. The models for the Reinels and Homems and their Lisbon contemporaries were Catalan. Portuguese patterns were not at odds with what others did but rather a variation on the norm which had roots in thirteenth century Italy. Coming as it did embodying the struggle to reconcile the novel with the traditional and carrying the authority of new discoveries Portuguese cartographic forms and methods carried great weight throughout Europe.

Portuguese map makers who moved to Spain brought their methods with them. There had long been close ties between Spain and Portugal in science, astronomy, and navigation. Political union was anticipated since it appeared a logical long term result, at least to the crown of Castile, of the defeat of the Muslim rulers of the peninsula. The transfer of technical knowledge embodied in the hands and minds of migrant practitioners was the standard method for the diffusion of technology in late medieval and early modern Europe. Map making was no exception when it came to the development of Spanish cartography.[1] In addition the flow and then, from the last years of the fifteenth century, a massive injection of new geographical data brought back by explorers pressed Spanish map makers to contemplate what those findings meant to geography and to the graphic representation of geography. People in both Iberian kingdoms had to move beyond medieval mapping practices and classical theory at about the same time and for many of the same reasons.

Sailors in the pay of or licensed by the Spanish monarchs operated in the Atlantic Islands in the fourteenth and fifteenth centuries. Fishers and traders

and settlers visited the Canaries and established permanent colonies there by the fifteenth century. Christopher Columbus on his first voyage stopped in the Canaries to refit his ships and change rig on the *caravel Niña* from lateen to square on one mast for the long ocean crossing which he anticipated. Because of the prevailing wind patterns starting from Gomera gave him a chance to make the Atlantic crossing.[2] He also showed that lateen-rigged ships were not the choice for such voyages. Columbus' success in finding land, the subsequent realization that what he found was not China and the uncertainty about exactly what it was generated a number of voyages of exploration almost immediately. Columbus himself led three more after the 1492 venture but he was by no means alone. Each expedition added to Europeans' knowledge of what they came to realize was a New World to them. The information about those lands on the other side of the Atlantic, though it diffused quickly to all of western and central Europe, arrived in Spain first. With political and economic commitments to those newly discovered places the authorities in Spain had even more interest in the description of them on maps. Sailors sent out were to bring back their findings represented in charts, maps and sketches. Often those first efforts proved to be highly accurate and of higher quality than later work. Since there was much to show the maps were often large and generally done in the style of Mediterranean portolans. They included the already standard depiction of southern and western Europe as well as North Africa though in smaller scale. The animal skins they wrote on were still about the same size but the cartographers now had to include more on those skins: the Atlantic, islands of the Caribbean, and an increasing portion of the American mainland. The products remained plane charts with no projection, treating the surface of the earth as flat as was the case with portolans. Navigators did not make maps since they had other methods to find their way. The maps produced were more or less useless for navigation over any distance. Their function was descriptive.[3]

   The map from around 1500 and possibly from 1504 attributed to Juan de la Cosa (1462?–1510) is the oldest surviving one to show Columbus' discoveries [Figure 6.1]. The problem of novel but incomplete information was handled by leaving out or obscuring what was not known. For that reason among others the authenticity of the map has been questioned.[4] At the left of the map in the eastern Caribbean where de la Cosa might have drawn the Yucatan peninsula he instead put, on the neck of the vellum, a depiction of Saint Christopher. The reference may be to the carrying of Christianity to the New World but more likely is that it was a direct reference to Christopher Columbus and was there to promote the legend of the great explorer. It was common by that time to put a religious image in the neck of the vellum so a saint was not out of place. The map maker joined Columbus on one voyage and made at least one other trip to the New World. That may help to explain the quality of his depiction of the West Indies. The renderings of islands there

Figure 6.1 Juan de la Cosa, Map of the Atlantic with islands in the Caribbean, 1500, Museo Naval, Madrid.

are more accurate than those of Ireland or Scotland on the map.[5] There are dots on the map which may have served as a distance scale, something new but which would over time become common. De la Cosa included the results of John Cabot's voyages in the service of the king of England of 1497 and 1498. More prominently he included the findings of Portuguese sailors in India, mentioning a number of ports there. He added some lands which were fanciful. Some of the islands are coloured such as Java which is green, and there are birds in the trees and swamps in the Brazilian interior. The presence of items inland may indicate his fear of leaving the land mass blank and a similar fear may have affected his treatment of the oceans.[6]

Juan de la Cosa was not above showing ships on his map. There is a total of 12. Two of them are single-masted single sail high-charged ships which would have been more or less at home in northern Europe or along the Basque coast where the type appeared on town seals in the Middle Ages. There is one *full-rigged ship* complete with a high aftercastle. The rest of the ships have the tell-tale low profile of *caravels*, often with a sharply curved stempost. There is a mixture of two- and three-masted versions and among the three-masters one suggests a square sail on the foremast and lateens on the other two masts. Some of the three-masted *caravels* carry only lateen sails. One of those is off west Africa and the other two are off the north coast of Brazil.[7] The general shapes of the hulls on those ships are similar to the ones of the *full-rigged ships* that turn up crossing the Atlantic on slightly later Portuguese maps. De la Cosa was an experienced sailor so would not have made a mistake in depicting the rig. It is possible that, just as Columbus changed the rig on a *caravel* to make the Atlantic crossing, captains changed the rig, dropping the square sails on full-rigged ships once they got into the Caribbean. That would have made the ships more maneuverable. There is no mention of such action though other Spanish maps show the same type of three-masted lateen-rigged ships.

One early sixteenth century Spanish map maker then was willing to use ships as decoration for the seas. He chose in all cases to show Spanish ships, not native craft. Those were slow to show up on Spanish maps of the New World, a pattern that was different from Portugal where representations, perhaps bad and inaccurate, of Arab and Chinese ships appeared from the second decade of the sixteenth century. Juan de la Cosa must have known about native vessels of the Caribbean but they were apparently not important to him. Map makers could not keep up with the geographical knowledge that Spanish sailors brought back from the Caribbean, the Gulf of Mexico, and the western Atlantic in the forty years immediately after Columbus' first voyage. '…while slow to reflect discovery, maps were quick to encourage it…'.[8] The increasing pace of exploration which the maps fomented made them, like Juan de la Cosa's, obsolete even more quickly.

Castile was very similar to Portugal in the way the government organized map making. Faced with the need to support and govern new trading posts and settlements on the other side of the Atlantic Ocean and faced with the

inability of Columbus and his family to address the myriad related problems effectively, the crown of Castile established an office in Seville to handle all shipping between Spain and the New World outposts. The *Casa de Contratación* rapidly became critical to the authorities since trans Atlantic trade increasingly meant the import of gold and, even more important over the long run, silver. The overwhelming majority of the products first of creek beds and then of mines in Spanish America went through the single institution in Seville. Responsibility for trade also meant responsibility for navigation. So, like the *Armazém de Guiné e Indias* in Lisbon, the *Casa de Contratación* had the job of maintaining a store of up-to-date cartographic knowledge. In 1508 a royal charter established a department of the *Casa* for that purpose and named Amerigo Vespucci as the chief pilot. The hydrographic office was responsible, among other things, for keeping and constantly correcting the *padrón real,* a master world map just like the one maintained in Lisbon. Spanish captains carried copies of the map with them and were instructed to make additions and return updated charts so the new knowledge could be incorporated into the master map in Seville. The *padrón real* served as the model of whatever charts navigators took with them on board ship but also as a model for presentation maps to impress and inform the powerful and important. In practice, however, the system was considerably more chaotic than the projected orderly production and supply of sea charts.[9]

   The cosmographical office also got responsibility for training pilots and for providing not only charts but also navigational instruments to sailors making Atlantic crossings. If information for the master map was going to be collected accurately and in a useful way then the sailors who went on voyages had to be trained in how to gather that information. By the 1520s in addition to the *piloto mayor* in charge of the office there were also cosmographers who worked on both maps and instruments. By the 1530s one of them appears to have had a monopoly over the making of maps and, by implication, the income that came with it. Among the directors in the early years of the hydrographic bureau were some of the most distinguished map makers in Europe including not only Amerigo Vespucci but also Juan Diaz de Solis, Sebastian Cabot, Diogo Ribeiro and, down to the mid sixteenth century, men such as Nuño García de Torreno, Alonso de Chaves, and Diego Gutiérrez.[10] The very talented Portuguese immigrant cartographer Diogo Ribeiro became *cosmógrafo mayor* in 1523. Although he had been making maps and instruments for voyages like that of Magellan for some time it was in his role at the hydrographic bureau that in 1527 he got the job of making a new *padrón real* and presentation copies of that map in 1529 for the pope and perhaps the emperor, the result being those outstanding monuments of Iberian cartography [Plate V]. Ribeiro, using new data brought back by sailors, corrected earlier errors such as the drawing of the Mediterranean. He used latitude measures to get rid of a consistent error in medieval portolans which had given the Straits of Gibraltar and Alexandria the same distance from the equator. Though

he and other Spanish map makers corrected the orientation of the Mediterranean which was wrong on the 'standard portolan', cartographers in workshops in southern Europe ignored the improvement and continued to produce charts like those of the fourteenth century. Ribeiro had as his predecessors the Reinels, Pedro and Jorge, Portuguese born cartographers who had worked in Seville making maps for the Spanish crown. Ribeiro had as his successors men of perhaps not equal but substantial talent who produced maps and globes of high quality.[11]

Responsible for supplying pilots with reliable charts the cosmographers at the *Casa* made them in considerable numbers and made their livings from sales to those sailors. The association with the hydrographic bureau and the type of novel information the men had, thanks to their connection with exploration and the patronage of the crown, meant they also made world maps. The Castilian monarch from 1516 to 1555 was the Emperor Charles V. He had cartographers supply him with gifts which he handed on to prominent figures. The works tended to be grand, designed to enhance Charles' prestige, and so not incidentally more likely to survive.[12] These elaborate products were increasingly likely to have illustrations, including depictions of ships.

The 1526 Juan Vespucci map, done by Amerigo's nephew and successor as *piloto mayor*, uses an imperial eagle in mid North America to indicate which lands were those of Charles V.[13] At 85 × 262 cms. it was a large map and presumably closely related to the *padrón real*. The seas have eight ships, all but one being more or less the same three-masted vessel with a deep waist, high curved forecastle, and some of the sails set. The ships are the typical deep sea vessels of early sixteenth century long distance voyages, the only exceptional thing being their size indicated by the hull profile with castles towering over the main deck, the presence of main topsails, and bonnets. The ship is similar to the two depictions on the world map also done by a map maker from the *Casa*, Nuño García de Torreno, in 1525. The one exception to the pattern of showing virtually the same ship repeatedly on the Juan Vespucci map is a vessel off Java which is perhaps intended to be a junk. One Spanish cartographer at least by the third decade of the sixteenth century had an interest in exotic Asian craft like that of contemporary Portuguese map makers.[14] A 1522 map of the Moluccas also by Nuño García de Torreno has three ships in the south Indian Ocean, all on the same tack so it is difficult to make out their rig though the mainsails and lateen mizzen suggest the standard high seas cargo ship. South of Java a fourth ship has four slightly canted rectangular sails, apparently another effort to show a junk. The 1533 map of America and the Philippines commonly attributed to Diego Ribero, but possibly by another cosmographer from the *Casa*, Alonso de Chaves,[15] like the others indicates that by the 1530s ships were a normal part of decoration for larger Spanish maps and especially those based on or related to the *padrón real*.

Sebastian Cabot left the service of King Henry VIII of England and by 1537 had joined chart makers working for the Spanish crown at the *Casa de Contratación*.

In his role as *piloto mayor* he produced a world map in 1541. After approval from Charles V it was printed in the Low Countries in 1544. The map was probably a version of or derivative of the *padrón real* and is not of the quality expected from a man with his experience and knowledge. It did show the Amazon and the Gulf of California so includes some of the latest geographical knowledge. Ornamentation and text as well as a portrait of the Turkish sultan fill the large expanse of the Pacific Ocean and the land masses are populated by people and animals. A total of eight ships appear on the map with none elaborately depicted. All of them are the same or almost the same three-master, shown from the side, the stern, the stern quarter, and the bow. Like the map itself the portraits of ships are not distinguished. Cabot not long after publishing the map, in 1547, returned to England and the service of the crown, training pilots and making maps. He was responsible for a woodcut wall map of the world which included a Northwest Passage. It survived until lost in the fire which destroyed the Whitehall Palace in 1698. Presumably his time in England served not only to disseminate information about Spanish discoveries but also to pass on Iberian cartographic methods.[16]

Not all the works from the principal cartographer at the *Casa de Contratación* in Seville came with ships. Alonso de Santa Cruz, who very much had the ear of Emperor Charles V and educated the monarch on cartographic matters, in 1542 did both a world map and a book of islands. Consistent with island books dating back to Buondelmonti's of the second decade of the fifteenth century there were no ships in the 1542 Spanish iteration of the form. Santa Cruz made a second, impressive presentation copy for Philip II in 1559. It included information on the solar system, on climates, and some 113 maps of islands. He included many of the islands of the Caribbean along with information about the peoples of the New World but there were no ships. Santa Cruz' 1542 world map did have twelve ships on it, though, including a *galley* in the mid Pacific headed toward Guam. It is unlikely that *galleys*, even great *galleys* like those that traveled between Italy and northwest Europe in the fifteenth century, ever sailed in the Pacific and especially not across the high seas far from sources of freshwater for their massive crews.[17]

Sancho Gutiérrez' world map dated to 1551 and maps in works on navigation like Martín Cortés' published in 1551 and Pedro de Medina's very popular one of 1545 had ships at sea as part of their decoration. Gutiérrez, who probably had family members active in the *Casa*, included a number of ships especially in the Pacific. He took little care in drawing them. The depictions are small, the rigs consistent one with the other. There is little if anything to distinguish them, the ships being virtually all of exactly the same standard type. The bows are drawn up and more exaggerated than the sterns and there are topsails on both the fore- and mainmasts. On the other hand the maps in the book on navigation have fewer and rather distinctive vessels, the ones found in waters closer to Europe being smaller, not as detailed, and
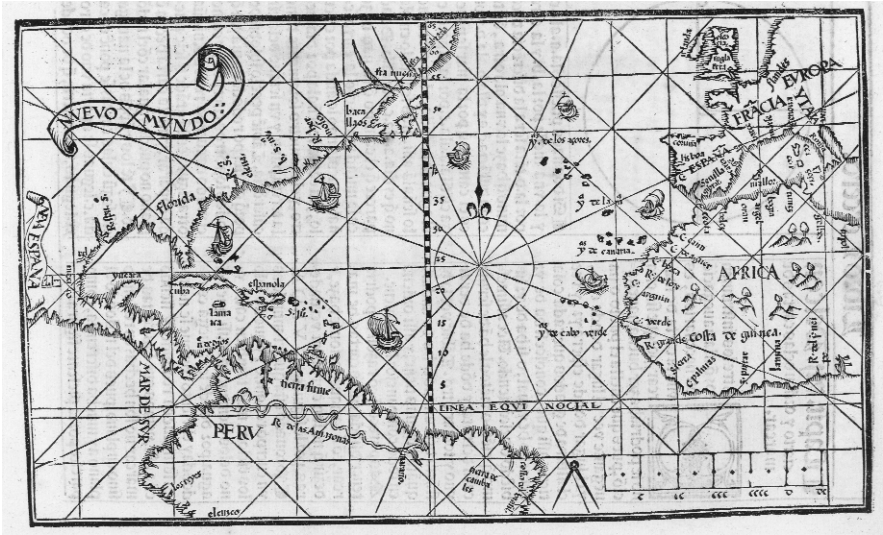
Figure 6.2   Pedro de Medina, Map of the Atlantic from his *Arte de Nauegar…*, 1545. The John Carter Brown Library at Brown University.

with highly curved hulls making them look like *hulks*. The vessels off the American coast are single-masted with a single square sail and with both fore- and aftercastles and what seems to be a small structure on the aftercastle.[18] The vessels are somewhat old-fashioned and do not reflect the kinds of ships other maps show. Pedro de Medina had been to the New World and talked to sailors coming back from long distance voyages. His map of the Atlantic included different views of the same ship as if it were following a fixed and known route [Figure 6.2]. The single-masted types that appear on his maps probably were not the usual choice for captains making such ocean voyages, however. In other maps in his book there are sketchy representations of other types of ships including *galleys* and sailing ships armed with guns. The work was highly influential, translated into a number of languages and the source of knowledge about new methods of navigation for sailors across Europe.[19] The map illustration came with the information in the book. While there was no necessary consistency in how Spanish cartographers decorated their maps still by the middle of the sixteenth century the map makers associated with the hydrographic bureau of the *Casa de Contratación,* and even those who were not, felt obliged to include ships on their charts.

Interest in mapping and representation of the globe was heightened in Spain and in Portugal because of territorial disputes. By the 1494 Treaty of Tordesillas the Iberian monarchs divided the world, the demarcation line running from pole to pole 370 leagues west of the Cape Verde Islands. The Treaty superceded the bull granted by Pope Alexander VI the year before which had set the line just 100 leagues west of the islands. The kings preferred to have the decision in their

hands rather than in those of the pope who claimed control over the new lands since they were islands and his predecessors since the eleventh century had been pressing claims to jurisdiction over islands. Papal approval for exclusive rights of exploration had a well-established history. An extensive series of papal declarations in the fifteenth century touched on expansion, generally seeing voyages southward as part of an effort to outflank Muslims in the Middle East. A 1436 bull gave Portugal the task of bringing Christianity to the Canaries. By the bull *Romanus Pontifex* of 1455 Nicholas V gave Prince Henry of Portugal the exclusive right to explore the African coast to the southern limit with neither party at the time having any certain knowledge of what that limit was.[20] Parcelling out areas of exploration and potential colonization and commerce was not new to the Iberian kingdoms. Spanish fishers and settlers in the Canaries were not satisfied with the pope's 1455 dictate and conflict over rights in the Atlantic Islands and along the African coast led to the 1479 Treaty of Alcáçovas-Toledo. The agreement divided the Atlantic into spheres reserved for the subjects and agents of the rulers of Portugal and Castile. There were other and more serious matters dealt with in that peace, including succession to the Castilian crown, but by assigning the Canaries to Castile and the African coast to Portugal the rulers established the precedent that they could decide between themselves what ships could operate where in the world. The South Atlantic, and by extension the world's oceans, might not be known but it was possible for kings to lay claim to them.[21]

The 1479 agreement drew little interest and the Treaty of Tordesillas, being of much the same type, at first also faced no challenge from other Europeans. As the potential for exchange in both the Far East and the New World became more clear other monarchs began to question the legality of the claims of the Iberian rulers. The Valois kings of France, locked in a sustained war against Charles V and the House of Habsburg, were the first to defy the papal grants and Iberian treaty once they realized the financial support their enemy was gaining from the New World. Starting with French interlopers in the New World and Southeast Asia in the 1520s northern Europeans made periodic forays into the seas claimed by the kings of Spain and Portugal. The Protestant Reformation, the accession of Elizabeth I to the English throne in 1558, and the Dutch Revolt against Habsburg overlordship starting in 1568, gave others even more reasons, strategic, political, military and religious, to challenge the Treaty of Tordesillas. Before it became a dead letter in the seventeenth century the Treaty did have a profound effect on cartography, one which indirectly promoted decorating maps with ships.

The division agreed in 1494 was based on a measure of longitude, but Europeans had no accurate way before the eighteenth century to measure east-west distances at sea. Even as late as the end of the sixteenth century measures of trans Atlantic distances were inaccurate, possibly on purpose but more likely just because the technical capacity to measure accurately did not exist. The inability to measure longitude was even more important in the Pacific. In theory the

demarcation line ran around the world and so through the Spice Islands, the Moluccas of modern eastern Indonesia. Since access to nutmeg and mace among other exotic goods was one of the principal reasons for the voyages of Columbus and of Vasco da Gama the kingdom that ended up with those islands was a critical matter. The need to establish exactly which parts of the newly discovered or explored lands belonged to whom under the provisions of the Treaty of Tordisillas led to an almost obsessive interest in record keeping, to the sponsoring of voyages like that of Magellan to establish oceanic distances, and the drawing of maps which showed graphically which parts of the world belonged within the sphere of which kingdom. The problem led to the exchange of geographical information among Spanish and Portuguese cartographers as both struggled with trying to get the right answer.[22]

World maps and maps of the Atlantic called for an indication of where the line of demarcation fell. The concern for establishing the exact position appears to have promoted interest in the use of a grid system both in understanding the world and in the practical matter of drawing maps. It was not necessary to include ships on the maps but certainly there was more reason to do so given the scope of the maps and the desire to demonstrate what parts of the world sailors from Spain had reached. Increasingly the maps covering large areas had ships on them. The 1502 Cantino map done in Portugal for the Duke of Ferrara clearly showed the line of demarcation. Juan Vespucci's 1526 world map had a line through the Atlantic as did a number of Spanish maps of the

Figure 6.3   Robert Thorne, map of 1527 done in Seville for the English ambassador. The John Carter Brown Library at Brown University.
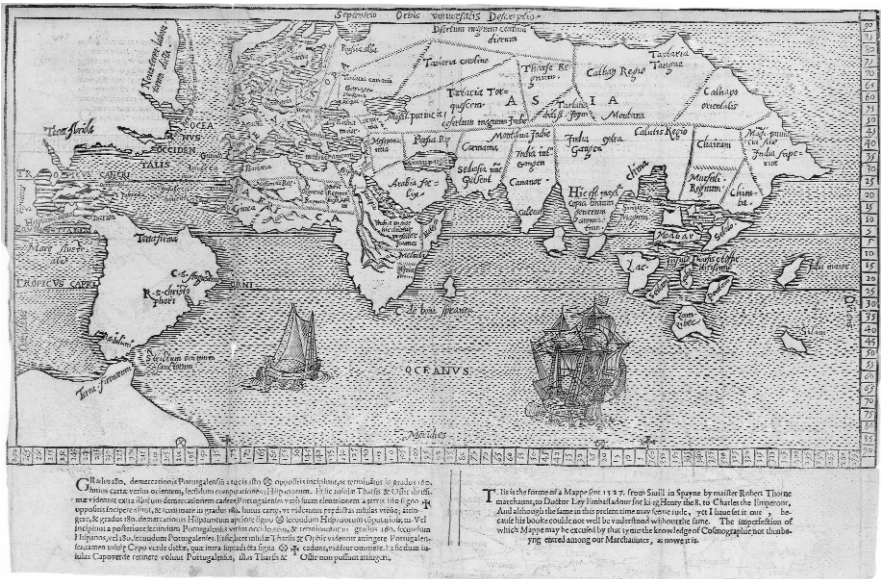
early sixteenth century when the exact division was in doubt. Vespucci's addition of that imperial eagle in the New World was to leave no confusion about which part belonged to Castile.[23] In 1522, the Castilian Nuño Garcia de Torreno drew several maps of Magellan's expedition based on information he got from Sebastian del Cano who had taken over command of the voyage when the commander was killed. The purpose of Garcia's map was to show that the Spice Islands fell inside the Castilian sphere. A 1527 map made in Seville by a merchant, Robert Thorne, for the English ambassador to the court of Charles V, is decorated with three ships [Figure 6.3]. One is the rather standard three-master but with the straighter gunwales popular for ships crossing the Atlantic. Another has one mast with a spritsail and an additional sail hanging down from the forestay. It was meant to be a small open boat that one man could handle and not the kind of craft for open ocean sailing. The vessel in the Indian Ocean is a large *full-rigged ship* with all sails set and a deep waist, very similar to the ships on a number of other maps. The ambassador and his master, Henry VIII, were probably more interested in the demarcation line that ran down through the Atlantic than in the depiction of ships.[24]

Even Pedro de Medina in that popular 1545 navigation book of his, *Arte de Nauegar*, included the Tordesillas line on his map of the Atlantic. By that late date cartographers' including the mark of division was rare. The matter of measuring where the line fell in the Far East had been resolved, not by the application of geographical or scientific theory or by the compilation of new information but by political compromise. In 1527 by the Treaty of Saragossa Charles V abandoned his claim to the Moluccas in exchange for cash on the understanding that if he returned the money he could revive his claim. The pressing need to finance a new war against France took precedence over any scientific considerations. The discussions leading up to the 1527 treaty guaranteed more careful reexamination of what was known and of how to draw the *padrón real*. After the political resolution of the dispute debate still carried on among cosmographers and pilots in Seville about how best to represent the world and to do so being consistent with the known division, with the known physical location of lands and with the needs of navigators to find their ways. The debate which continued to mid century served to give map makers greater importance and authority than ever before. The dispute served as well to make geography even more a subject worthy of interest and respect.[25]

The exchange of personnel, continuing exchange of information and the similar problems the two kingdoms faced insured cartographic responses in Spain like those in Portugal.[26] All parties were concerned about the development of effective instruments for navigation and charts were one part of the equipment cosmographers produced for pilots in Spain and Portugal. While Spanish map makers shared many practices with their Portuguese counterparts they were perhaps somewhat slower in adding illustrations to their maps and especially in adding ships. Over time, however, any difference disappeared and Iberian maps

by 1550 often had ships on them no matter where they were made. Other kingdoms in Europe politically different from Portugal and Spain did not react in the same way to the discoveries but surprising is how similar maps produced throughout Europe proved to be as the sixteenth century wore on. They were more and more alike in the ways novel data was graphically represented. The influence of the early starters, the experience of Portugal and Spain, led others to read and translate Iberian books in order to follow their methods of navigation and instrument making, and to produce similar maps. It was not only the ways of making maps that people in the rest of Europe followed. It was also the character of decoration. So in Italy, the eastern Mediterranean, France and the rest of northern Europe map makers included ships and in numbers, designs, and characteristics like those that appeared on maps from Iberia.

Italian cartographers were quick to incorporate Portuguese discoveries on their maps and they were just the same with information about the Atlantic Islands and the New World. The first printed world map showing Columbus' discoveries, Francesco Roselli's 1506 copper plate engraving of Giovanni Matteo Contarini's original, was published in Venice or Florence. It was in the portolan tradition though with clear influences of Ptolemy. Its principal addition was the islands of Cuba and Hispaniola. The oval projection made it easier to follow the courses of explorers.[27] By the mid sixteenth century when the atlas maker Battista Agnese included a black line on a map showing the spice route opened by Magellan the inclusion of geographical information from Iberia was standard practice in Italy [Figure 6.4].[28] Some medieval Italian maps did have ships on them. A small fishing boat was an acceptable addition to a fifteenth century map and river boats could appear in a landscape and on a T-O map as part of the illustration in a fifteenth century copy of a work of Petrarch[29] but after 1500 ships became more common. At about the same time as Rosselli was producing his world map Francanzano da Montalboddo put two vessels on the first printed map of Africa [Figure 6.5]. The 1508 work from Milan had ships which are strange in many ways including a very small v-shaped sail on the single short mast, in one case stepped much further forward than would be prudent. The shape of the hull is vaguely consistent with ships of the time but the ratio of length to breadth seems rather higher than was typical. The drawings of the ships show a lack of precision and possibly also a lack of knowledge.[30]

The printing of charts, started in 1539, came in the wake of and as part of a flood of works on technical topics as varied as anatomy, ballistics and hydraulics among many others that flowed from Italian presses starting in the second decade of the century. The publishing boom came after improvements in engraving and printing made it possible to produce identical copies of a quality equal to the sketches of the finest artists. Those early printed charts were certainly intended for use on board ship and they had no ships as decoration. Aided by the rapid growth in printing throughout Europe and the growing market for printed material, maps became objects of interest to businessmen who saw them
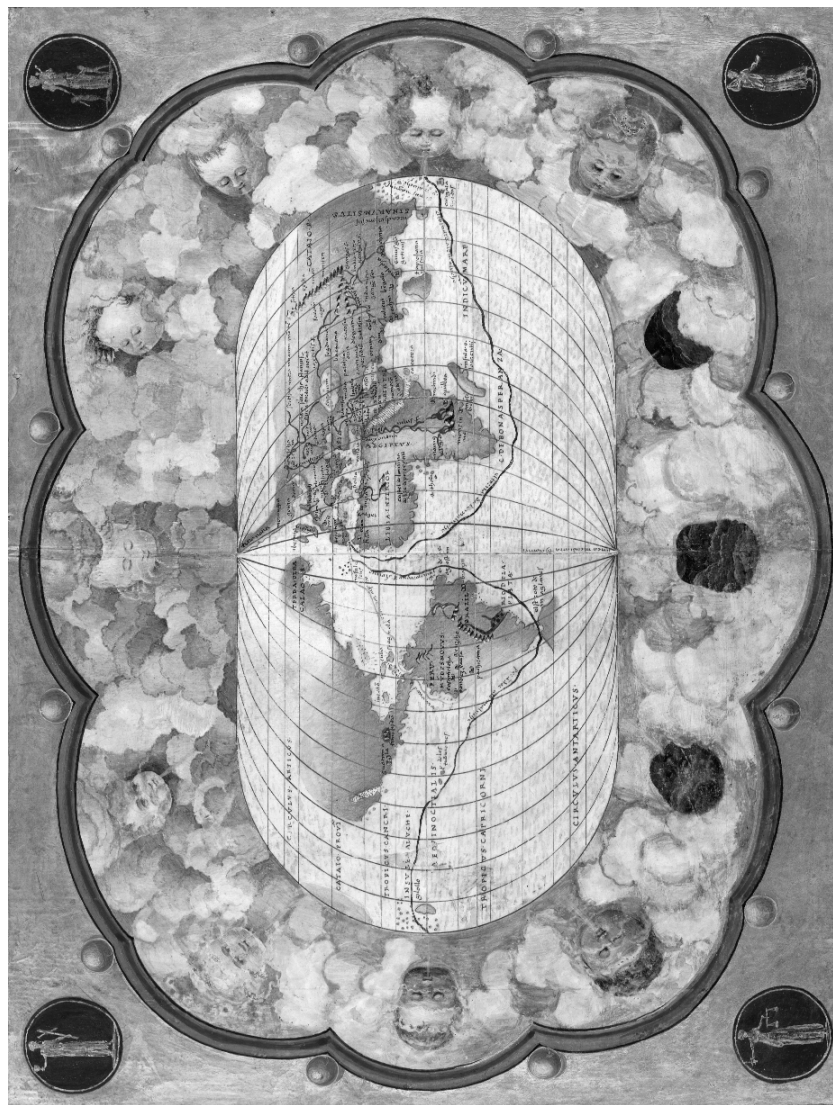
Figure 6.4 Battista Agnese, World Map showing route of Magellan, 1543–5. The map was once owned by Emperor Charles V. The John Carter Brown Library at Brown University.
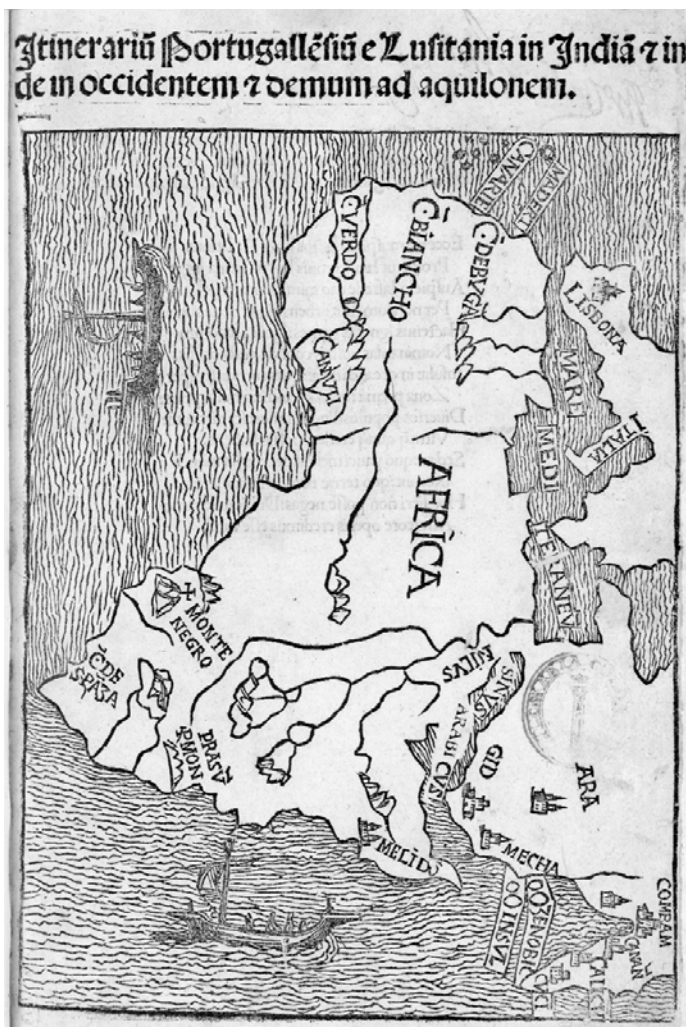
Figure 6.5 Francanzano da Montalboddo, the first printed map of Africa, Milan, 1508. The John Carter Brown Library at Brown University.

as potential sources of profit either as free standing large sheets, possibly for wall decoration, or as illustrations in books. In printed form maps returned to that latter function which had been their sole one in the early Middle Ages. The large number of printed editions of Ptolemy's *Geography* beginning with the Bologna edition of 1477 was only one indication of the growing interest in and market for maps. The inclusion of more and more new maps showing the latest findings of Portuguese and Spanish explorers in virtually each subsequent edition of Ptolemy also indicated the nature of the market with maps being a vehicle for chronicling the widening horizons of Europe. Very big maps were popular

through the seventeenth century because people put them on their walls, as a number of Dutch paintings of interiors show. For buyers those big maps were for both decoration and diversion as well as chronicles of new knowledge.[31]

In 1548 the Venetian printer Giacomo Gastaldi produced yet another edition of the *Geography* and included 34 new maps of his own. It was a part of his active business in producing maps of many types and places. Gastaldi served as cosmographer to the Venetian Republic and made maps for the state as well as for the growing open market, making in the process some maps of very high quality in all aspects.[32] His output included a 1546 world map with 10 ships, prominently shown. Six appear to be single-masted and somewhat out of place on the high seas though the intention may have been to show fishing craft. Three of the ships are three-masted, not drawn very carefully. The remaining ship, in the Indian Ocean, might just be an attempt at depicting a junk but it is difficult to tell, as with the other vessels, because the ship is very small. The Gastaldi world map carried little decoration but derivatives from it were much more lavish. About 1550 Mateo Pagano produced a woodcut map which included, along with forests and mountains on land and sea serpents in the water, 17 ships in all. Some are single-masted *galleys*, some single-masted and some two-masted sailing ships. All the vessels are small, shown at different angles, and none carries three masts. The ships were not typical of deep sea sailing vessels which strongly suggests they were added later, not intended as integral decoration, and almost an afterthought inserted to distinguish the map from Gastaldi's. On the other hand when the engraver Paolo Forlani published the Gastaldi world map in 1560 and again in 1565, though he tended to follow closely his models, he included large ships of different types [Figure 6.6]. It was almost as if the oceans had become the
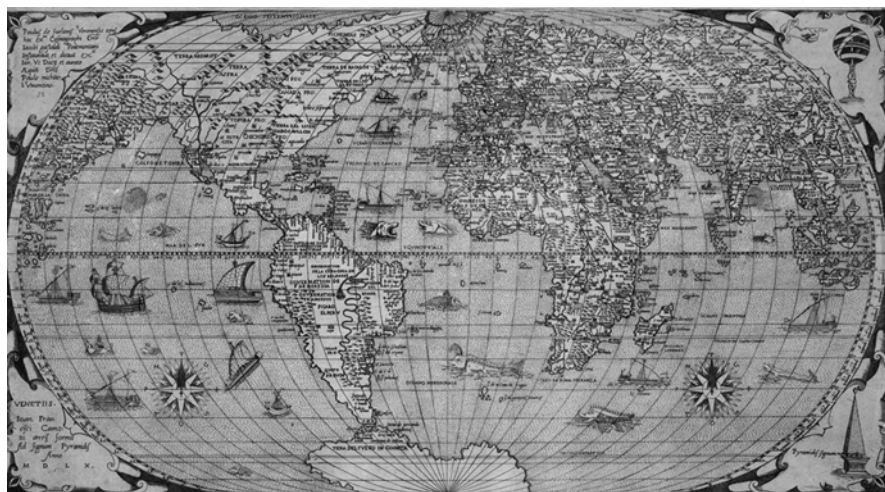
Figure 6.6   Giacomo Gastaldi, world map in the 1560 version by Paolo Forlani, Venice. © British Library Board. All Rights Reserved. MAPS C. 7. e. 1 (2) (state 1).

background and even the frame for showing the carefully rendered ships.[33] Gastaldi's maps were popular as sources for copies beyond Italy as well. While he was prolific and set a standard for map making he did not set a standard for decoration. It is difficult to generalize across the entire range of his output but it appears that he did make concessions to the growing practice of decoration over time. A 1556 book illustration by him had a number of ships, though all the same three-master seen at different angles, around an island. A 1561 map of the eastern Mediterranean by him had many ships, though the accompanying map of the Far East had none.[34] So even for a cartographer of the status of Gastaldi by the mid sixteenth century the tendency was to populate maps with ships.

Gastaldi also did illustrations for Giovanni Battista Ramusio's three volume compilation of travel accounts. The first edition which appeared in 1550 was immediately popular and called for a number of subsequent editions and imitation, most notably by the English geographer Richard Hakluyt who published his *Principal Navigations…* in 1589. Ramusio drew on a growing body of memoirs generated by men coming back from voyages to various previously unknown parts of the world. He translated those reports into elegant Italian and dedicated his work to monarchs, hoping they would be inspired to follow the practices of Portuguese kings in supporting voyages of exploration. Ramusio's goals were scientific and scholarly, updating geographical information for the benefit, among others, of map makers.[35] Antonio Pigafetta, a surviving member of the Magellan expedition, in an established tradition produced an account of his voyage soon after his return in 1522. It proved popular enough to get the attention of publishers and inclusion of his story in the Ramusio compendium was the logical result almost 30 years later. Pigafetta's original manuscript book included illustrations. There were 23 altogether, 21 of which were of islands. The lack of novelty indicates he had few skills as a map maker. Fifteenth century island books were his model. As with those the outline of the island was critical and little if anything is shown inland or on the sea. The single exception to the absence of illustration is a vessel off what Pigafetta called the Islands of Thieves, the Marianas. It seems to have been an effort to show a sea going canoe of the South Pacific with a large outrigger. The two men who sit at either end of the ship hold oars or rudders and the mast in the middle of the ship is much too small for a vessel of the type as is the v-shaped sail hanging down from the yard.[36] Pigafetta was not the first European who tried to show the design of an exotic ship but did not understand or did not have enough information about it.

Ramusio, even before his collection of travel accounts, had published a map of the New World, that in 1534. Printed from a wood block and intended to illustrate a history of the West Indies, it included a ship in the Atlantic with a caption stating where it was headed, exactly as on the 1527 map of Diogo Riberio who at the time was working at the *Casa de Contratación*. The claim in the cartouche was that the map was based on two charts held in Seville and certainly the type of ship shown and the caption are consistent with the claim. The illustrator also put

a *galley* off the Bahamas.[37] The expectation would have then been for maps in Ramusio's *Navigazioni et Viaggi* to include ships. What is more Ramusio used Gastaldi as his engraver. Even so the expectation was not fulfilled. In the first 1550 edition the map of Mexico City had small boats in the lake around Tenochtitlán but they were all simple row boats. The map of Africa in the first volume was completely devoid of ships but the world map which served as a frontispiece for volume three had three ships, one off the Brazilian coast and two in the Pacific. Each has three masts with the mizzen carrying a square sail just like those on the main and fore masts and canted at the same angle. It is an unlikely rig and the depictions, though simple, are by no means small or shoddily done. Still it does appear that no great care was taken in showing contemporary high seas vessels.[38] The 1556 edition had an island surrounded by ships, drawn by Gastaldi. The 1563 edition had new maps and they had ships. The redrawn map of Africa includes five ships, one of them sinking off South Africa and the other four sailing the South Atlantic. It is the same ship that appeared in the earlier edition with three apparently square sails, each on one of the three masts. Over time more reports were added to the collection and with new information came new illustrations like those for the third volume published in 1606 which had depictions of fishers off the coast of Newfoundland to go with accounts of French exploration in the St. Lawrence Valley.[39] In the 1556 version Gastaldi did introduce ships around Sumatra and in a 1565 version there were ships off Brazil so with the editions of Ramusio as in other phases of Italian map making mid century marked a time when ships, though not universal, were rapidly becoming common illustration for maps.

The temporary mid sixteenth century preference of wealthy buyers in Italy for manuscript maps over newer more precise printed ones, the opposite of the case in northern Europe, meant there was work for a number of portolan makers who often followed Portuguese models. If anything there may have been an increase in the production of decorated manuscript portolans in the wake of the introduction of printing.[40] Battista Agnese was not alone in making charts in the old style, though he was unique in his sizeable output of some 50 portolans and possibly as many as 70 counting all the products of his busy workshop.[41] Often those were devoid of ships.[42] Connections with exploration did not necessarily generate ships on maps. Girolamo Verrazano, brother of the Italian navigator who sailed in the service of the king of France, made a chart in 1540 to show some new finds and to indicate where exploration should proceed. He did not decorate that work or, apparently, his other charts with ships.[43] On the other hand, the Neopolitan portolan maker Vesconte Maggiolo added ships to both a world map as well as to a map of the Atlantic in a 1511 atlas. The vessels are large and have high, even exaggerated castles with rigs that are hard to make out because of the angle at which the vessels are shown. One ship probably has full-rig, another possibly a mast with square sails on it and a second mast with lateen rig, and one has three masts but all rigged with lateen sails. The second ship is the older form

of *carrack* though apparently still known in the early sixteenth century. The last, a large *caravel*, is a type that shows up on contemporary Portuguese maps. Vesconte's son, Giacomo di Maggiolo, was adding ships to maps in the 1560s. The vessels are large, three-masted, with high castles and consistent with the work of other contemporary artists in northern Europe such as Pieter Breughel.[44] In the second half of the sixteenth century Joan Martines from Messina became cosmographer to the king of Spain. He too produced maps consistent with earlier portolans but did not feel required to illustrate them with ships, at least in an atlas from around 1550 or in a set of four charts which likely came from his hand or on a 1587 set of maps.[45] The Venetian cartographer and engraver Giovanni Francesco Camocio on the other hand had no trouble adding *galleys* or even a fleet of *galleys* to a collection of island maps from the early 1570s so even island books by that date were succumbing to the pressure to include ships at sea on maps.[46]

Not all map makers in Italy were Italian by birth. The high quality of work done by cartographers there combined with the number of printers involved in producing maps made it a logical destination for enterprising map makers from elsewhere in Europe. The level of learning in the peninsula was also an attraction but perhaps more important by the mid sixteenth century was the spread of Protestantism in the North which drove some Catholic clergy to take refuge in Rome. The map trade in the city was largely in the hands of foreign immigrants, some of them creating dynasties that lasted a half century. Antonie Pérac Lafréry came from France and settled in Rome in 1544 where he produced copper engravings for printed maps. Apparently none was decorated with ships.[47] On the other hand George Lily, an English Catholic exile at the Papal Court, in 1546 produced a copper engraving for a map of the British Isles with four ships on it. Each ship has three masts with a topsail on the mainmast but not on the foremast and a lateen mizzen. Each was shown at a different angle and each had a deep waist and high stern suggesting vessels already of somewhat older design than the date of the map.[48] Perhaps Lily's distance from his homeland and from the ships that visited her ports inclined him to show known and well-established ship types.

The most important and certainly most impressive map by an emigré was the *Carta Marina* of Olaus Magnus [Figure 6.7]. He had been a church official in Sweden and was out of the country when the king and his allies imposed Lutheranism. Olaus Magnus never returned to his homeland and from 1537 he settled in Rome, remaining there until his death in 1557. The map, published in Venice in 1539, consists of nine sheets and, not satisfied with simply producing the map, he also brought out two explanatory booklets, in Italian and German, with elaborate keys to connect them to the Latin on the map. If that was not enough Olaus Magnus in 1555 published a book in 788 chapters further explaining the varied biological, ethnographic, mythological, and political content of the map. His work got new life when that French immigrant Lafréry, called
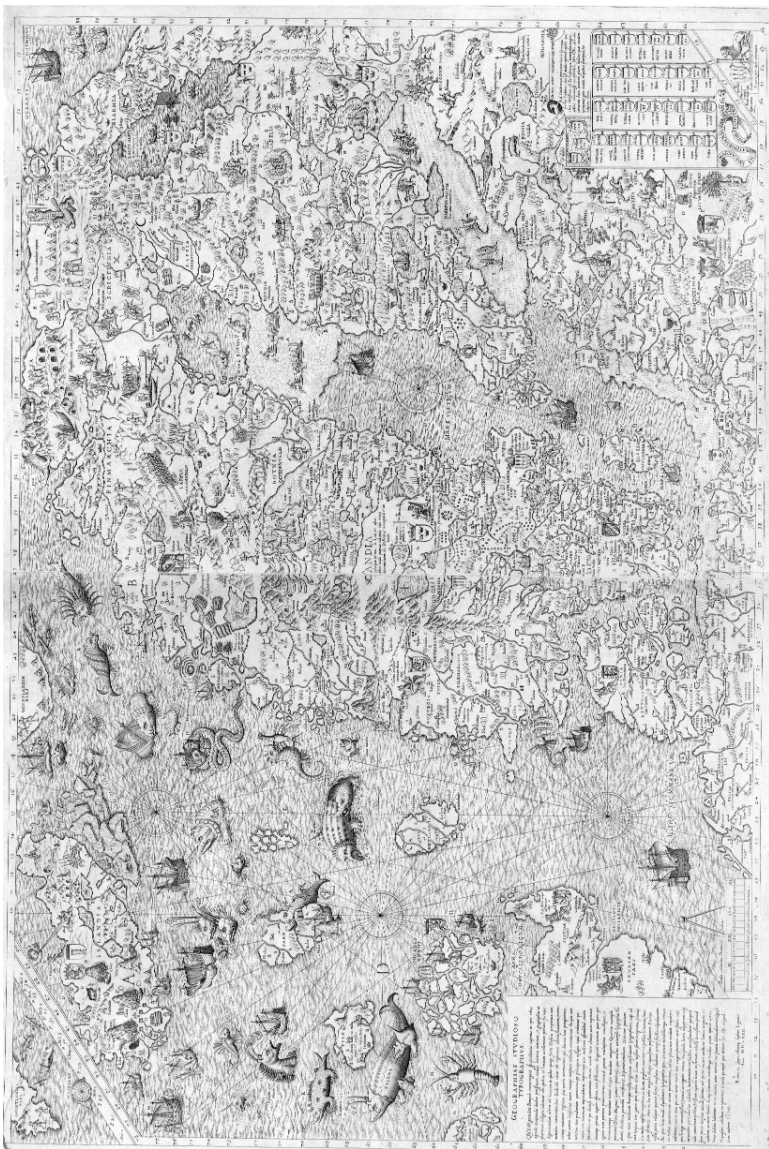
Figure 6.7 Olaus Magnus, portion of the *Carta Marina*, published at Venice in 1539. The John Carter Brown Library at Brown University.

Antonio Lefreeri in his new homeland, produced a copper engraving of the map in Rome in 1572. Based in part on already existing maps of the North, the *Carta Marina* was a compendium of information which recalled the densely populated *mappaemundi* of the high Middle Ages. It advanced on earlier depictions of the shape of the Baltic Sea but it was remarkable principally for all the decoration Olaus Magnus was able to pack onto the map.[49] He wanted to show the maritime culture of the North and that included many ships of different sizes and design, some sailing along, some involved in fishing or whaling, and some under threat from the various sea creatures which populate the map. The range in vessels is everything from heavily built large three-masted sailing ships with high castles to small rowing craft. As an emissary for the pope Olaus Magnus visited a number of ports in northern Europe and apparently incorporated into his maps some of the commercial information he gleaned on those trips. The ships often have their port of origin written underneath them and he even commented on the profitability of trade from certain Hanse ports to Iceland. He also showed a Hamburg ship sinking a Scots one with gunfire. The ships themselves are not depicted carefully but the principal design features are easily recognized and in the case of the Swedish ship and the one from Gdansk he, or rather the Italian artists who probably worked from his sketches, made a special effort to depict the vessel accurately. The Swedish ship is a three-masted *carrack* with overlapping hull planking, a form of construction disappearing in the North in Olaus' day. Lefreeri in the later edition changed the planking so that it abutted rather than overlapped giving the hull the by-then-common form. Olaus' ships in some cases had topmasts and topsails so he was aware of the expansion of canvas on ships as he was aware of the use of guns, though he did place the guns rather high in the vessels which sailors at the time already knew was dangerous.[50] The *Carta Marina* is remarkable and unique for a number of reasons. It showed extensive signs of reliance on existing Italian practice and certainly required the combination of sophisticated cartographic, artistic, and printing skills that existed in Italy. A motive for its creation may have been spreading an anti-Lutheran religious and political message but the result was, among other things, the exploitation of trends in map decoration which were spreading to Italy from Iberia. Ships were an essential part of that decoration.

Whether in portolan charts, printed maps, or world maps Italian cartographers of the first half of the sixteenth century tended to be more conservative than their Iberian counterparts. Maps produced in Italy might have been technically superior as were reproduction techniques but Italian map makers seemed reluctant to break with the past and accept completely the trend toward putting ships on the seas of the world. Maps produced in Iberia and the presence of immigrant cartographers from elsewhere in Europe contributed to the erosion of more conservative Italian practices. By the 1550s and 1560s that reluctance had all but disappeared and ships were the norm for filling not only the large expanses of open ocean but also the borders of all kinds of lands depicted on their maps and charts.

The long history of involvement of Italian merchants and city-states in the eastern Mediterranean guaranteed connections with cartographers, the exchange of information and growing consistency in mapping. The presence of an extensive Venetian empire stretching along the Adriatic coast and through a number of islands almost to the Levantine coast through the first half of the sixteenth century meant that many of the maps of the region were by Venetians and also that maps made by men living in the eastern Mediterranean and even on the other side of the political and religious divide in the Ottoman Empire were influenced by Italian and, directly or indirectly through Italy, by Iberian practice.

Greek cartographers could draw on a long Byzantine map making tradition and that included men in either the Venetian or Ottoman Empire. Though sailing directions may well have been in use recalling the *periploi* of the ancient world it is not certain that such books or for that matter any books were supplemented with maps for illustration in the first half of the sixteenth century. At least some of the copies of Ptolemy's *Geography* had maps but they were of course nothing like portolan charts. Only one Greek chart from before 1500 survives and the number of known sixteenth century Greek map makers is small. Men such as Ioannis Xenodochos, Gaspar Viegas, and Salvator Oliva made maps of Greek waters in the first half of the sixteenth century but those charts were all devoid of ships. The language of the maps and those of other cartographers was often Italian.[51] In the case of Nikolaos Sophianos's *Totius Graeciae Descriptio*, a large wall map designed to show greater Greece up to the adoption of Christianity, the work was highly consistent with Italian practices. The map maker, though born on Corfu, spent almost all of his life in Italy. His map, produced in Rome in 1540–2 but known from subsequent 1545 Basle and 1552 Rome editions, had six ships depicted sailing the Mediterranean. The goals may have been antiquarian but the vessels were contemporary with the exception of the largest which is a failed attempt to depict a classical vessel. The four three-masted sailing ships are small as is the single *galley* so there is not much detail.[52]

Giorgio Sideri (c. 1510–81), whose Greek name was Zorzi Sideros and who on and off lived and worked on Crete, included ships on his maps as well. He produced some 11 surviving portolans through the mid sixteenth century, often for prominent Venetian political figures. He typically relied on earlier work taking Catalan models to a very limited degree for depicting the hinterland on islands and Italian models for much of what he showed at sea. His 1541 Mediterranean portolan has 20 ships, 10 of them described as a Portuguese fleet in the Red Sea. The design of the ships in that fleet is hard to make out against the red background but the remaining ships are clearly rendered. They include a *full-rigged ship* with a massive mainsail, other three-masted ships with more divided sail plans and deep waists, as well as two-masted lateen rigged *galleys*. One of those is under oars. There is also a three-masted ship with a low profile and all the sails are lateen. Sideri's large *caravel* shows up in the eastern Mediterranean so it was a type in use even far from Portugal or the Portuguese empire. His 1550 map of

the Atlantic is populated with 10 sailing ships or rather 10 views of the same ship. It is apparently full-rigged with a relatively high aftercastle though the rig and hull form are difficult to make out because of the angle at which the ship is shown. The ships are not elaborately or extensively depicted and the impression is that they are there to take up space and little more. Sideri's later maps, that is after about 1550, took on greater colour and decoration. His 1563 map of Crete has three sailing ships, all *full-rigged* and all much the same, and ten *galleys*. They too are consistent with only two of them having slightly different decoration and flags.[53] Whether or not there was a Greek school of cartography by the mid sixteenth century maps from Crete, as far as ship decoration was concerned, were looking like those made elsewhere in southern Europe.

Turkish charts began to appear after 1400. They tended to look like Italian ones with only sparse ornamentation. Turkish map makers at the end of the Middle Ages relied on western European models either known directly or indirectly through Arab predecessors, in North Africa for example, who shared the map making traditions of people on other shores of the Mediterranean.[54] Little is known about the other careers map makers had. At least it can be said that the men who made charts in Venice came from varied backgrounds, sailor being the most common occupation but in the Ottoman Empire the typical career for a cartographer was government official.[55] The most famous Turkish map maker of the sixteenth century was an admiral, Piri Reis. He was the nephew of a pirate turned admiral. Piri Reis sailed and fought extensively for the Sultan, that is before, in his 80s, he was beheaded after a failed campaign. His *Kitab-ibahriyye* (*Book of the Sea*), which appeared in two versions, a short one of 1521 and a longer of 1526, was in the tradition of island books though more in the mode of the late fifteenth century version by Sonetti. It did, especially in the expanded version, draw on a wide variety of knowledge from different parts of the Mediterranean. Accompanying the text of sailing instructions were some 216 portolan charts.[56] His greater fame comes from the 1513 map of the Atlantic, part of a lost and larger world map, which shows results of Columbus' first three voyages, indicating how quickly new geographical information spread throughout the Mediterranean [Plate VII]. Piri Reis later said that he relied on *mappaemundi*, an Arab map of India, four Portuguese charts, and information from Columbus in the preparation of the map. On land the map has animals and people. At sea the coasts are lined with ten ships rather carefully and accurately drawn and shown at different angles. Half the ships are two-masted lateen-rigged ships with a low profile, possibly intended to be *caravels,* and called *karavele*. There are *full-rigged ships*, probably *carracks* and called *barça* and *köke*. They have only one square sail on each of the fore and main masts and a lateen mizzen. The square sails have bonnets to supplement them in good weather. The depictions of ships are included in such a way as to suggest they were thought of as an integral part of the map. As with the *Book of the Sea* the map indicates a broad range of sources from throughout southern Europe for names, stories, coastlines,

and illustration. In both works the admiral showed a variety of vessels, often using Turkish names to identify them, the names in many cases showing roots in Romance languages. Piri Reis took information from elsewhere and brought it together in a form accessible to people in the Ottoman Empire, looking to foreign ideas, practices, and models. In putting ships on maps he matched the contemporary work done in Portugal and if anything, in the care taken to show the ships, exceeded it.[57]

Turkish cartography did not end with Piri Reis. Matråkçi Naşuh did charts describing naval action for the Sultan in the 1530s and 1540s. His *Tārih-I Feth-I Şiklōş ve Estergon ve Istūnibelgrād* (*History of the Conquest of Şiklōş, Estergon and İştunibelgrad*) shows plans of Mediterranean ports under Ottoman attack, complete with sketches of *galleys* in action. There are vessels in harbours as well, often sailing ships but the *galleys*, typically elegantly drawn, dominate his illustration just as they dominated the fleet in the campaign in the western Mediterranean. The tradition continued and by the late 1550s map makers in Istanbul produced sea atlases including comprehensive world maps. Battle scenes with ships continued as well, in the 1570s and beyond.[58] The tendency in the eastern Mediterranean was to incorporate new geographical information but even before the news of Spanish and Portuguese finds arrived the import of Italian and even more Iberian practices had already made the charts of Greek or Arab or Turkish map makers much like the others done in the region. As with Italy part of the shift toward common practices was the inclusion of ships on maps and inclusion of them not incidentally but as an important constituent of the map.

In France the experience of Portuguese cartographers was only one of the major strains which fed map making in the early sixteenth century. King Francis I imported Italian map makers. A successor, Charles IX (1550–74), imported Portuguese cartographers including a member of the Homem family.[59] France already had well established indigenous map making and printing before those immigrants arrived. Le Huen printed a French edition of Bernhard Breydenbach's *Peregrinatio in Terram Sanctum* in 1489 at Lyons, transferring the 1486 wood blocks to copper engravings and showing the map of the Holy Land complete with the *great galley* that carried the pilgrims there. The *Mer des hystoires* printed in Paris in 1488 and again in Lyons in 1506, modelled on that 1475 *Rudimentum novitiorum* published at Lübeck, was illustrated with even more and better drawn vessels than the original. They ranged from small open craft to large, single-masted cargo ships which were probably *cogs*. Lyons was also not incidentally the site for publication of the first French edition of Ptolemy's *Geography*, that in 1535.[60]

In addition to the tradition of printed maps there was also a growing independent scientific interest in France in astronomy and with that navigation and cartography. Oronce Finé was a rather unique individual and perhaps should best be seen as an isolated phenomenon. He was the first man to hold the chair of mathematics at what would be the Collège de France. An expert on language as well as mathematics, engineering, cosmography and astronomical instruments,

he tried his hand at map making too. His first map, done in 1517 for a new edition of Breydenbach's trip to the Holy Land and designed to inspire French participation in a Crusade changed the ship arriving on the eastern Mediterranean shore from a *galley* to two fast moving square-rigged ships dashing toward the shore, one carrying a fleur-de-lis. The point was presumably that the vessels were carrying troops to take the fight to Jerusalem. His 1532 map of France, based on Ptolemy's methods, was to be a model for future ones. His 1534–6 woodcut world map, derived from his earlier 1531 effort and in a bi-cordiform projection, included some recent discoveries and it did not ignore ships. There are nine, three in the Pacific and six in the Atlantic, but they are small and hard to make out. It is difficult to identify the types which suggests that Finé was not seriously concerned with the vessels but felt obliged to include them. The same is true of the extremely rare other cases when he added ships to topographical maps.[61] The islands and lands were more important to him.

Finé was not alone in France in exploring novel cartographic methods. Heironymous Gourmont, for example, published a map of Iceland in Paris in 1548 based on Olaus Magnus' *Carta Marina* complete with boats around the island. While not all sea charts or world maps had ships on them vessels could and did turn up on local maps in France by mid century. A 1543 map generated to describe engineering work on the River Vilaine near Rennes included a number of ships, some in port with their sails down but others along the river powered by wind. The ships are not carefully drawn but they do indicate how pervasive illustrating ships had become.[62] Even T-O maps got ships on them. As early as the mid fifteenth century a world map in a life of a saintly abbot got six contemporary ships, possibly *hulks*, on the ocean that surrounded the circular world.[63] A widely-copied book by Barthélemy l'Anglais, illustrated in 1479–80 for a certain seigneur Jean du Mas, counselor to the king of France, similarly had a simple T-O map but prominent in the sea and the river dividing Asia from Europe and Africa were ships, three single-masted but one a three-master with some of the newest design features of contemporary vessels.[64] The T-O maps might disappear in the following century but the ships certainly did not.

Explorers from the kingdom brought back geographical information about newly discovered lands and French cartographers felt obliged to show French discoveries made in Asia but even more those made in the New World. The voyages of Verazzano and of Dieppe sailors to Brazil in the 1520s and of Jacques Cartier in the 1530s and 1540s provided a variety of data worthy of representation. The expeditions to what would be New France were planned with the participation of King Francis I who, in the case of Cartier's third voyage in 1541, asked the advice of a Portuguese pilot, Joao Lagarto. The pilot was impressed with the king's knowledge and comprehension of navigational problems. When he showed the king two charts Francis responded by bringing out two of his own, presumably produced through royal patronage.[65] Sea charts were an integral part of planning French voyages of exploration as was the import of Portuguese knowledge. The

combination created a centre for map production in Normandy. Ports there were active in the Atlantic fishery before John Cabot's 1497 and 1498 voyages to Newfoundland and men from places like Dieppe rapidly took advantage of the potential Cabot found in the waters off the east coast of North America. Involvement in other and more adventurous voyages quickly followed. Men from Norman ports led and financed French exploration. Their experience with navigation and their geographical discoveries were the basis for the making of sophisticated maps which were also impressive works of art. 'In their elaboration, these charts blurred the distinction between map and artistic manuscript, between empirical knowledge and imagination. While preserving the nautical apparatus of compass roses, rhumb lines, and latitudes, the land interiors are now filled with a fantastic array of birds, beasts and flowers which serve as a background for visions of primitive peoples, noble or savage, in America, Africa or Asia.'[66] The seas got somewhat similar treatment.

In the 1530s Portuguese cartographers living in Normandy or local map makers in conjunction with Portuguese cartographers were already producing portolans and in some cases decorating them with ships. The Dieppe school emerged in the 1540s and was to thrive until around 1580, producing more than 200 surviving charts in total. One reason for the success of Dieppe map makers was the influence of Portuguese forms of illustration. Norman cartographers were somewhat different in that they did not so much make maps for the crown but rather produced them on contract and often for local maritime entrepreneurs whose interests might well have been more practical. The inclusion of so much about people, animals, and plants on the lands suggests buyers wanted the maps to serve as aids in planning new expeditions.[67]

Jean Rotz was born at Dieppe John Ross, the son of a Scottish father and French mother. His *Boke of Idrography* is the earliest surviving major work of the Dieppe school [Figure 6.8]. He produced it as a presentation atlas for Henry VIII in 1542 hoping that it would get him a job at the English royal court. He even added some legends in English along with an extremely laudatory dedication to the Tudor monarch, presumably to curry favour with the king. The plan succeeded and Rotz worked in England until Henry's death in 1547. After that he went back to Dieppe where he became involved in shipbuilding and trade and does not seem to have made any more maps. The world map for his *Boke* may well have been based on a lost 1541 world map by another and justifiably famous Norman cartographer, Nicolas Desliens.[68] Rotz relied on Portuguese models since he gave a number of place names in Portuguese. The 12 charts of the *Boke* were all of the same size and of uniform scale. They are rich in pictures showing ports, cities, wildlife, and native people. The abundance of detail especially of the Far East and Brazil suggest that Rotz had sailed on French voyages of exploration.[69] Not all the charts show ships. Only two of the regional maps have them. The large sailing ship off the coast of Portugal has three masts with a topsail on the mainmast, a
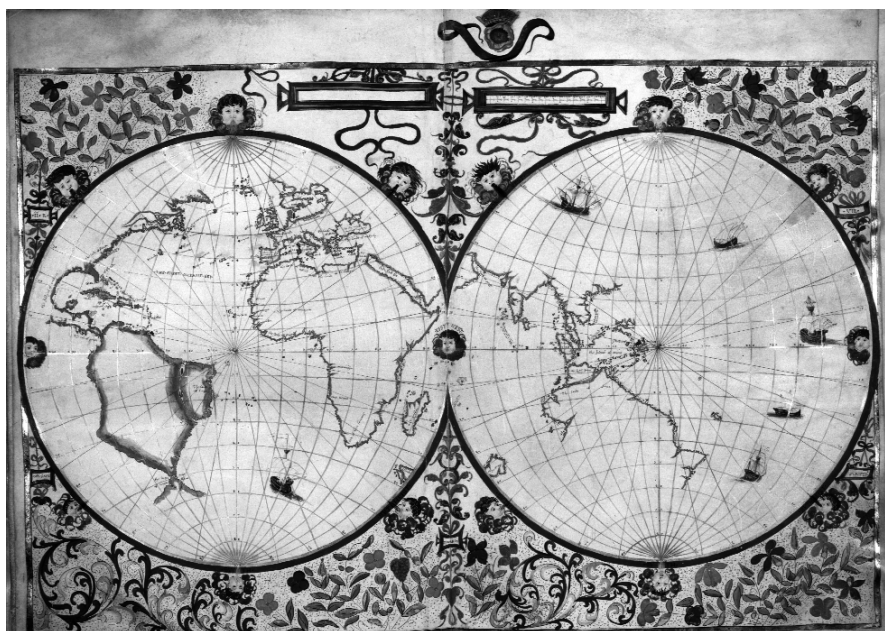
Figure 6.8   Jean Rotz, world map from the *Boke of Idrography*, 1542. © British Library Board. All Rights Reserved. BL Royal MS. 20E. ix.

long bowsprit and a high aftercastle though the waist is, surprisingly, not pronounced. In the South Atlantic two very similar ships appear but with deeper waists, topsails furled and bonnets fixed. The world map is in two hemispheres with one ship in the South Atlantic and five in the Pacific. The first is hard to make out since the sails billow out and cover much of the vessel. Of the ships in the Pacific one is a three-master with all lateen sails and a second is a two-master also lateen-rigged. In both cases all sails are set. The profile of the vessels is like that of *caravels* on Portuguese maps. The remaining three ships are three-masted and seen from different angles. One has virtually no forecastle so it may be a *galleon*, a new type only very recently developed. One of the other two is more heavily built with a deeper waist and so reminiscent of a *carrack*.[70]

Two other atlases that emerged from the Dieppe school, one now in The Hague and the other called the Vallard Atlas, are similar enough to Rotz' to suggest common sources of information and exchange of information among the three cartographers who produced the works. The Hague atlas, done about 1545, has 14 decorated charts. The Vallard Atlas of 1547 is a truly remarkable work of extremely high quality with illustrations, including those of ships, comparable to the finest Portuguese atlas. Included are images of negotiations between Europeans and native people in what would be New France and ethnographic information along with extensive geographical information from Sumatra and Java la Grande in Southeast Asia. Whether the Java shown

indicates some knowledge of Australia or is just the island that now carries that name is unclear.[71] The maps of the Vallard Atlas included illustration of a number of ships at sea like a four-masted vessel in mid Atlantic with a small square sail on the foremast and three lateen-rigged masts aft. The waist is truncated because the raised works at the stern run so far forward in the ship. While the curve of the hull may be a bit exaggerated the protective protrusions along the side suggest attention to detail and an interest in accuracy. The standard three-master puts in an appearance, for example in the Arabian Sea, but other types show up as well such as the five two-masted *galleys* that join the *full-rigged ship* in the Adriatic Sea. The foremasts on the *galleys* may carry square sails but the mainsails are unquestionably lateen. The decoration at sea came close to matching the quality of illustration on land not so much for the variety but in the effort to offer accurate representations of a range of vessels. The Indian Ocean got a *full-rigged ship* with the typical very deep waist and a four-masted *caravel* and in addition off the Cape of Good Hope a monarch riding a sea creature but instead of the king of Portugal the Dieppe cartographer has inserted the king of France [Plate VII].

A number of other cartographers were active in and around Dieppe in the mid sixteenth century. Nicolas Desliens, Jacques de Vau de Claye, and Jean Cossin all were producing maps but not all included ships on their maps. Many did, however, and often. Jean Jolivet, for example, in 1545 produced a copper engraving of a map decorated with many ships, presumably French, of different types sailing in a number of directions.[72] So did two other notable Norman cartographers who were contemporaries of Jean Rotz, Pierre Desceliers and Guillaume Le Testu.

Desceliers completed world maps in 1546 and 1550. The earlier chart had three ships, all remarkable for their deep waists. One ship, in the Pacific, is larger than the other two and carries four masts. Topsails are indicated on the fore and mainmasts and lateen sails are on the two mizzens. As with many other sixteenth century ships a massive spritsail is shown under a large bowsprit which rises at a better than 45% angle from the bow. The two ships in the Atlantic have the more standard three masts with square sails in use on fore and mainmasts. All three have extensive vertical fenders as well as sizeable wales running the length of the ship along the sides.[73] The atlas Desceliers did around 1546 carried similar ships on a number of the 12 maps. The place names used indicate reliance on a Portuguese prototype. The 1550 chart is complete with two ships in the Pacific locked in battle, four in the Indian Ocean, another in the Philippines, and five ships in the Atlantic [Figure 6.9]. The three in the North Atlantic and indeed everything in the northern hemisphere is inverted. It was a different half of the world. Most are the standard *full-rigged ship* with sails on the foremasts smaller than those on the main. One ship has four masts with lateen sails on the two mizzens. In general the ships have heavy hull protection like those on the 1546 map. One

122
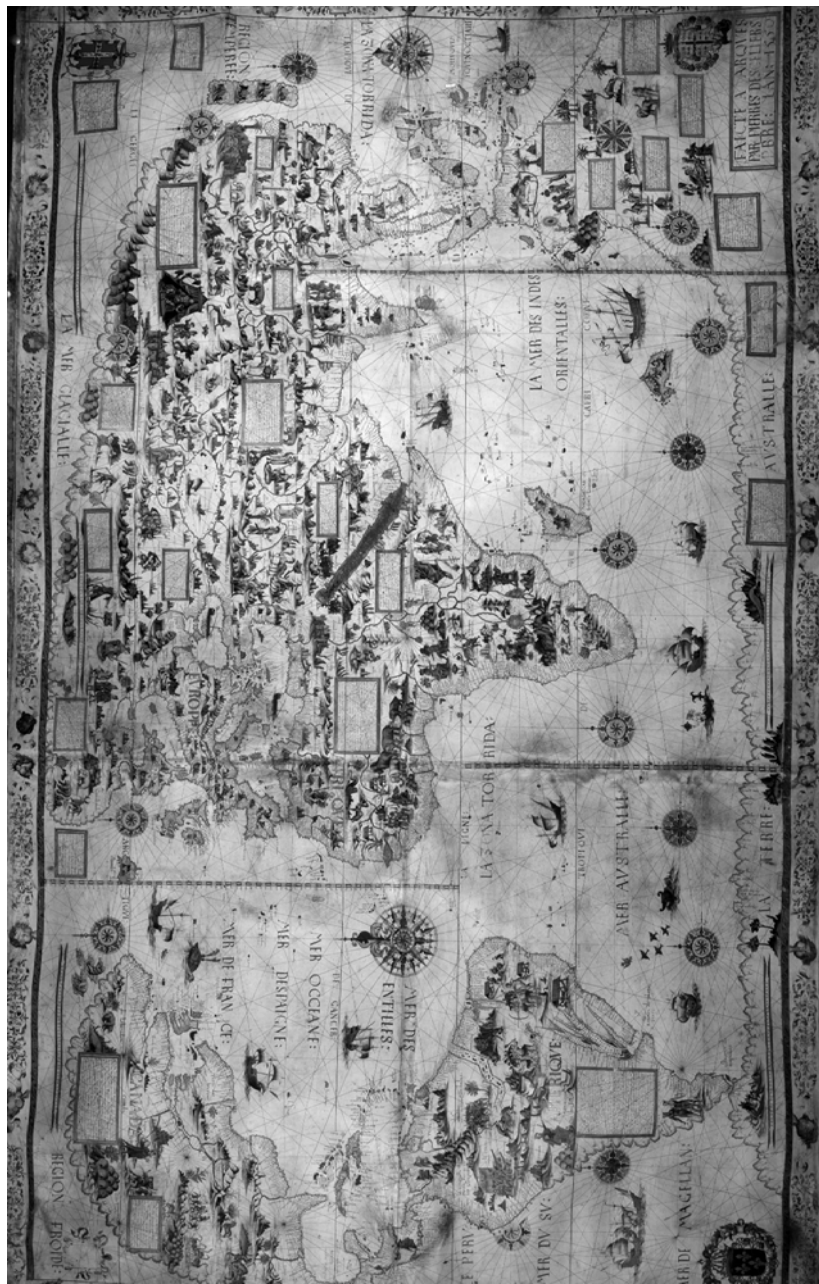
Figure 6.9 Pierre Desceliers, World Map of 1550 with different orientations for northern and southern hemispheres. © British Library Board. All Rights Reserved. BL Add Ms. 24065.

ship does have a deeper waist than the others so there was some effort, if limited, to differentiate among the ships. Desceliers included on his map 25 inserts with text to supplement and expand the information on the surface and making it the object of consultation and repeated examination.[74] The ships were there to expand and extend the impact.

Guillaume Le Testu was a Dieppe pilot who was to die under the command of Sir Francis Drake in the New World in 1572. Le Testu was not above including ethnographic and biological information, like fellow members of the Dieppe school, which was based on observation, not on theory or received knowledge from the classical past. Presumably when Le Testu and the other Dieppe map makers put ships on their maps the depictions were based on observation as well. His atlas had ships in the North Atlantic all of much the same type with three masts, two sails on each of fore and mainmasts, and, oddly, no spritsails. The bows are sharply swept up and there are deep waists between midship and the forecastle. Le Testu did make a world map for his 1556 *Cosmographie universelle* published at Le Havre but on that there were no ships. Le Testu included a number of ships on each of a series of separate 1556 charts of the Atlantic coast of the Americas. The vessels are typically full-rigged with topsails on the main and fore masts. He did include a four-masted *caravel* with lateen sails on the main and mizzenmasts and a small square sail on the foremast near the bow, that south of Cuba. The *full-rigged ships* have very high aftercastles and deep waists but fall within the range of the standard ship of map illustration of the mid sixteenth century. Le Testu did add a small, double-ended fishing boat, in the East Indies in possibly another attempt to describe a vessel used by indigenous people, and so a reflection of the ethnographic interests of members of the Dieppe school and for that matter other map makers of the day. Le Testu did not feel obliged to include ships every time but when it came to making another world map in 1566 he included a number of vessels, well and clearly rendered.[75]

The works of the Dieppe masters '…show a remarkable fusion of traditions… [T]he portolan chart style derived from the Portuguese…[was] combined with elements of medieval French illuminated manuscripts, shown in the wonderfully decorative flowery borders. Having emerged from the collaboration with the Portuguese the cartographers of Dieppe prospered for only about twenty years, until their port was caught up in the French civil wars, after about 1560.'[76] Some work did continue after that date. A collection of charts from the 1580s, which may be the last work of the Dieppe school, is like many predecessors such as the Le Testu 1556 atlas in a number of ways including the extent and character of illustration of ships. The map maker put 17 vessels on the charts, far short of the 72 in Le Testu's 1556 atlas, but they do look very similar to his all the way down to the hints of gunports.[77]

The connections between the Dieppe school and Portuguese cartography were strong. Connections between French cartography and map making in other

parts of northern Europe are in general harder to determine. The destruction of most records to do with the map makers in an English bombardment of Dieppe in 1694 makes the tracing of any links even more difficult. The work of the Dieppe school formed something of a bridge between Iberian practice and map making in northern Europe. The map collections generated by Rotz and the cartographer of the Vallard Atlas among others came closer to the modern conception of an atlas than most previous collections and so were a basis for the full elaboration of the idea of an atlas in Ortelius' work, his atlas being produced just in the years when the Dieppe school was collapsing.[78]

The development of the Dieppe school indicated the way cartography developed in the first half of the sixteenth century. The presence of Portuguese, French, and Scottish-French map makers in the same place producing maps on order, in conjunction with official and unofficial purchasers, to chronicle voyages of exploration, to establish a sound basis for further similar journeys and to record a variety of information about many aspects of daily life and about technology, all in an appealing and artistic manner summarized the character of cartography by around 1550. The inclusion of a variety of people who brought a range of skills together for the creation of maps was not unique to Dieppe. In Spain, Italy and the eastern Mediterranean individuals brought their knowledge in their own minds and bodies and so created what was rapidly becoming a set of European norms for how maps should be made and how they should be decorated. It would, of course, be wrong to claim that there were no barriers to the diffusion of cartographic practices just as it would be wrong to ignore the regional differences which did exist and did persist. In certain parts of Europe among certain groups some approaches to illustration hung on more strongly than in others. Whether it was through conservatism, ignorance of alternatives, or a conscious rejection of developments elsewhere is difficult to say. Portuguese practice at least when it came to showing ships on maps was more and more common through the first half of the sixteenth century. It was true throughout areas of Romance speech but that was also the case as quickly if not more so in Germanic-speaking parts of Europe. Mapping traditions beyond the Rhine and English Channel were certainly different from those in lands around the Mediterranean. That had to do with levels of geographical knowledge and the technology used to produce maps in the North compared to southern Europe. Another reason the illustrations were not the same on maps made in England, the Low Countries and in Germany was that the ships northern cartographers knew in 1500 boasted designs much at odds with those of Mediterranean craft and at odds with many vessel types in use on the Atlantic. The ships were not the same in the two parts of Europe and so the ships put on the maps, at least for a while, were not the same.

7
Northern Europe and Southern Practices

Map making north of the Alps and east of the Rhine followed a somewhat different path from that which prevailed in the Mediterranean. Just as there were distinct ways to build ships in the North and the South in the Middle Ages so too were there distinct approaches to navigation and different instruments for sailors to find their way. After thirteenth century design improvements made it possible for ships to sail out of the Mediterranean through the Straits of Gibraltar, overcoming contrary winds and currents, contacts between the two parts of Europe increased sharply and so did the exchange of maritime technology.[1] The differences in ship construction and in wayfinding did not disappear immediately. The types of ships, the types of trips, and the methods of navigation meant northern sailors needed different kinds of nautical information from that which their counterparts had to have in the Mediterranean. With cross-fertilization practices began to appear more like each other. The pace of convergence increased in the fifteenth but much more so in the sixteenth century. Map making was not immune. The charts and world maps produced in England, the Low Countries, Germany, and Poland by 1550 showed many of the features of those that came from workshops and printing houses in Iberia and Italy. In the North as in the South cartographers were not tied to one kingdom or one patron but could move if opportunities arose. Still language may have served as a barrier to the mobility of map makers, that is between areas of Romance and of Germanic speech. It is certainly true that patronage, and especially royal patronage, made a difference to where cartographers worked and to the quality of what they did. More important than language or the actions of kings and nobles were scientific advances and influences from the high quality work done in Portugal and by the followers of Portuguese cartographic practices.

There were no portolan charts made in northern Europe in the fourteenth and fifteenth centuries. There were small, bound lists of sailing instructions so northerners did create something like the portolan books of the Mediterranean. The

information presumably had been transferred by word of mouth and then writ-
ten down beginning in the fourteenth century so that by some time in the first
third of the fifteenth a composite *Seebuch* existed with instructions for pilots on
how to navigate the Atlantic and North Sea coasts of western Europe to northern
Norway and to sail the Baltic to Tallinn. People produced the sources for the
compilation at different times and in different parts of northern Europe so there
were inevitably variations in style and form. The instructions might not be very
detailed and they could contain errors, passed on as copyists reproduced the text.
Das Seebuch includes distances, tidal times, courses, depths, descriptions of the
bottom, and directional data on harbours and roads, all clearly addressed to
sailors with details relevant to them.[2] The production of such a work may have
been inspired by the increasing number of ships from the South that were
finding their way to northern European waters and by the southern sailors who
wanted to have guidance in a familiar form. *Das Seebuch* was to be highly
influential with later books of sailing instructions and maps drawing on the
descriptions in it. That was only logical since there was no earlier work like it.
From the late fifteenth century compiled sailors' notes created the raw material
for increasing numbers of rutters. The handy, small pocket books had magnetic
compass courses between ports and capes, distances between them, the direction
and times of tides at important points, and soundings.[3]

While there might be portolan books, and borrowing from *Das Seebuch* by
Mediterranean portolan authors there were no charts in the North. The claim
that the absence of such maps was a sign of a conscious and well-executed policy
of secrecy on the part of the league of port towns known as the Hanse has no
concrete basis. The assumption that a loose and constantly changing collection
of independent jurisdictions with no standing bureaucracy and no permanent
body of officials could create such a policy, let alone enforce one, reflects a lack
of knowledge about medieval institutions. The assumption that northern navi-
gators needed charts reflects a lack of knowledge about how men sailed in the
estuaries and along the coasts of the Baltic and North Seas. There were maps in
northern Europe by around 1400 but there were no charts of the sea. Italians
who might well have produced portolan charts did not venture north of Bruges
and London so they did not have the raw data to create the kinds of maps
they had long been making of the Mediterranean.[4] Northern Europeans did not
need charts because they did not navigate the way southern Europeans did. As a
number of authors from the mid fifteenth century Venetian cartographer Fra
Mauro to the late sixteenth century Flemish pilot book author Michiel Coignet
said in the North sailors navigated with the lead to take depth soundings and did
not use the chart and the compass.[5]

It was not that no one knew about the compass in northern Europe. As early as
the ninth century Scandinavian voyagers to Iceland possibly used the device as
an aid to navigation. Sailors from the Low Countries were aware of the device in
the thirteenth century. When they used the compass it could serve as a timepiece

as well as a direction finder, and the extra function helped in judging tides.[6] Though they knew about compasses northern mariners did not use them to plot courses because the character of the sea bed was much more relevant and gave them a more accurate indication of position. Usually the ships were in relatively shallow waters where sailors could easily make depth soundings and so stay out of trouble by measuring the water under their ships. It was only in the late sixteenth century under the influence of southern European practice that pilots in the North came to use astronomical navigation as it was developed in Italy and in Portugal. That is not to say that German or Dutch or English captains did not sail out of sight of land. From the Viking Age sailors did make trips across seas and even into the open Atlantic and for those the compass could be a handy aid as was knowledge of the stars. Most voyages, though, involved relatively short distances. The repetition of trajectories made matters simpler for pilots and so the complex equipment of Portuguese navigation was redundant.[7] No one in the North ever put together a master chart based on compass bearings as had been done in the Mediterranean. When portolan charts did appear in the North in the sixteenth century it was the result of copying practices in the South. By that time charts were not just collections of data on distances and directions from port to port but were a mixture of such practical data collected from experience and a learned tradition which included more than just the work of Ptolemy. Northern maps in the first half of the sixteenth century did not evolve slowly but rather leapt in a short period of time from virtually nothing to being the most sophisticated products of European cartography. By the closing years of the sixteenth century maps made in the Low Countries and to a lesser extent in Germany and in England were as good or better in aiding voyagers than ones from the South, and for that matter, from anywhere in the world. The transformation came about by imitation of imported practices, by innovation based on learning and on the rapid inclusion of new information, combined perhaps with an understanding on the part of the cartographers and their patrons of the functions of maps in the new circumstances which prevailed in Europe.

The kingdom of England relied on imported maritime technology in shipbuilding. King Henry VIII brought in Italians to craft *galleys*. His father, Henry VII, imported the Italian sailor, John Cabot, to explore the North Atlantic. When it came to cartography it was only logical then to bring in foreign talent. The Dieppe map maker Jean Rotz hired by Henry VIII was especially valuable since he was familiar with Portuguese practice. So too was Sebastian Cabot, hired away from the *Casa de Contratación* and brought back to England in 1547. Even more Diogo Homem brought Portuguese mapping techniques to England, that in 1545 when he arrived evading that Lisbon murder charge. He remained in England through to the late 1550s, as did Sebastian Cabot, making maps and passing on knowledge. They were joined by other Portuguese cartographers so there were ample opportunities for English maps to look like those from Iberia.[8] A 1569 world map by Diogo Homen showed many of the interests of the rest of his

map making family including using ships for decoration.[9] Englishmen overseas also developed mapping skills, George Lily in Rome being the most obvious example. The result in the short run was better maps and in the long run more maps and of high quality.

In England in 1500 maps were little used and poorly understood but by 1600 they were a common part of life. One reason for the change was royal patronage. King Henry VIII started his reign showing little interest in cartography but after a decade, thanks to the influence of certain advisers, he began to explore their value for military and political ends. By the time of his death in 1547 the inventory of his possessions took some six pages to list all the maps – including painted wall hangings in the Palace of Westminster – globes, and navigational instruments he had gathered.[10] In 1514 when faced with war with France a map of the coast of Kent was made but that was a minor effort compared to the set of maps Henry had produced when in 1538–9 he feared a French invasion. Flush with funds the king wanted to improve coastal defences and so rather quickly, with the help of specially commissioned maps, decided where to build or improve fortifications. Since those maps were of harbours and bays, the places the French might attack, they were often decorated and sometimes elaborately with ships. The view of Calais has 30 to 40 ships, a collection of both three-masters and four-masters but within those categories the artist, Richard Lee, repeated the same ship.[11] The view of Dover had ships in the harbour and the same ship shown at sea in four different views. With Hull there were 11 ships in the harbour and one at sea but with a more rounded stern and rounded bows than was true of ships on other maps of the day. An image of the 1514 French attack on Brighton, probably done about the same time, included large three-masted *full-rigged ships* with mainmasts stepped relatively far astern and deep waists and also *galleys* that could easily have shown up in the Mediterranean. They are long and carry lateen sails. The best illustrations of ships, both technically and artistically, on the family of maps from around 1540 are those of Portland along the Dorset coast and Mounts Bay along the Cornwall coast [Figure 7.1]. The former includes two single-masted ships and two three-masted vessels. The latter has, along with a number of other ships, one very large vessel in the lower left corner under full sail with a following breeze so the billowing sails take up a significant share of the image. The maps were neither topographical nor were they sea charts. The map makers, pressed into service quickly and possibly with little experience, improvised. Their work did, however, indicate increasing proficiency at producing maps of quality and with decoration.[12] In almost every case they added ships, sometimes abundantly. Their inspiration may have come from the choice of their customer, King Henry VIII, or they may have added ships to obscure any shortcomings and lack of experience. Their inspiration could also have come from their exposure to maps from southern Europe where the inclusion of ships was becoming normal.
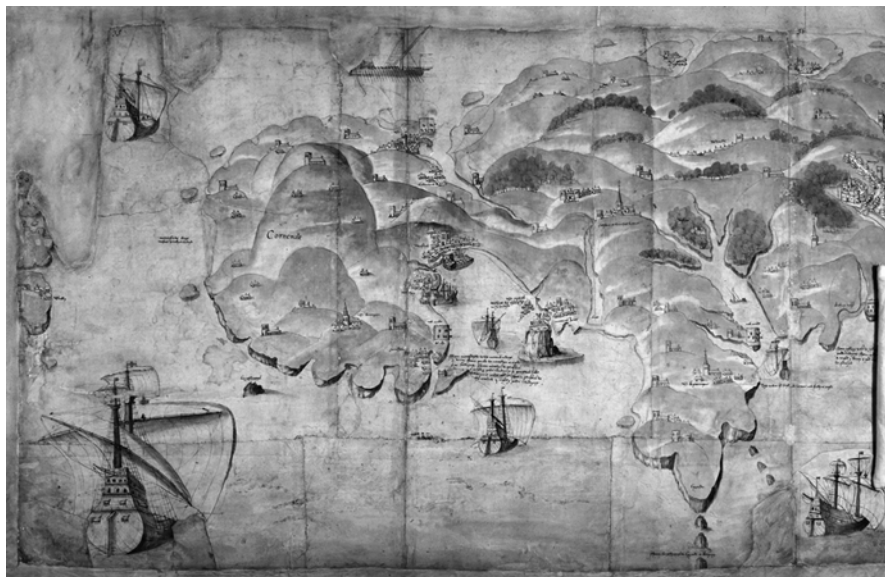
Figure 7.1 Mounts Bay off the coast of Cornwall, from a series of coastal views done for King Henry VIII, around 1540. © British Library Board. All Rights Reserved. BL Cotton MS Augustus I.1. f. 35.

King Henry VIII and England were not alone in showing an increasing interest in topographical maps in the early years of the sixteenth century. It was a phenomenon which could be found among rulers throughout Europe. What had been itineraries or bird's-eye views now took on the attributes of the most sophisticated world maps complete with scale and also with decoration.[13] The maps had military or naval uses, like the coastal views done for king Henry, or they could serve in court cases or could just be for edification or even pleasure. They were used early and more frequently on the Continent in legal proceedings. The great frequency of boundary disputes at high levels or the nature of the legal system which relied more on professionals rather than local people to adjudicate such matters could explain the greater use of maps there than in England. The more and better topographical maps did not become standardized. They remained varied in style and approach, and in illustration.[14]

After mid century Henry's successors and their advisers continued the patronage of map making. A council, acting in the name of King Edward VI, hired Sebastian Cabot and Diogo Homem who made that impressive collection of maps for Edward's successor, Queen Mary I, in 1558. In the reign of Mary's half-sister, Elizabeth I, England continued to acquire nautical materials and knowledge from Portugal, in part to feed the growing interest in the New World.[15] John Dee, an admirer of Portuguese navigational work, became adviser to the

crown on cosmography and as such was influential in promoting exploration as well as training pilots, that from mid century. In 1573 Christopher Saxton started the job of producing a series of county maps, the most comprehensive such collection to that point and his inclusion of the royal arms on each map pointed to the sovereignty of the queen over her lands. One large room in the royal palace at Whitehall had globes and maps of varied types decorating the walls including world maps in full view of the courtiers who spent time there.[16] In the second half of the sixteenth century England might lag behind the Low Countries and even Germany in work on nautical science and in chart making but in views of towns and local maps there were great similarities in work produced throughout northern Europe. When it came to illustrating ports men on both sides of the North Sea showed many of the same features including docks and windmills but also ships and of different types.[17]

Cartography in Germany preceded that in England in ways of representing the seas. It was not so much map makers working on the coast as those in the interior of the Holy Roman Empire who more quickly matched Mediterranean practices. The presence of interested patrons and of a growing as well as technically sophisticated printing trade contributed to the pace of change. So too, as in Italy, did an interest in the discoveries made by Iberian sailors after 1492. The fascination with the New World and with direct contact by sea with the Spice Islands generated a need to translate that novel information into recognizable forms accessible to a wider public. Because Germany was far from Lisbon and Seville, far from the sources of the new geographical data, the collection, consideration, and presentation of the findings of Iberian sailors was always to a significant degree an academic exercise. It was a matter for contemplation and discussion worthy of university professors. Geography became a topic for a number of books and a university subject.[18] The instructors in turn often became involved in cartography either as advisers to patrons or as map makers themselves. That made the enterprise somewhat different from what went on in Italy. In Germany map making was, as in Portugal and Spain, connected to instrument making. The same university professors who wrote about maps and mapping also described and made and even sold nautical instruments. The German astronomer Peter Bienewitz who was known as Petrus Apianus was a professor of mathematics at Ingolstradt and had a press where he produced maps made by others. Apian also took part in the explosion in publication of works on scientific instruments in the first half of the sixteenth century, joining the company of men like Nunes, Finé and some other map makers in Germany. There was a new and growing interest in practical works on mathematics and cosmology and scholars met growing demand with popular works. Apian's maps, like the 1530 and 1551 ones of the world, did not include ships even though they included information about the New World. His career indicated the mix of the theoretical side of cartography, drawing more and more on learning in mathematics and astronomy, and the practical or technical, drawing on the experience of navigators

and of printers.[19] With no direct access to the captains and pilots who sailed to new lands Apian and his fellow professors relied by default on what they could glean from theory and what they could get second hand from contemporary Iberian sources, including through maps.

Apian's career also indicated the importance of having publishers interested in bringing out up-to-date maps and doing so quickly. There was an established printing tradition in Germany by 1500 which had already produced maps with ships on them. The reports of pilgrims to the Holy Land in the work of Breydenbach and the *Rudimentum novitiorum* were illustrated with maps. Printers followed those works in the first half of the sixteenth century with maps added to illustrate Bibles and in some cases those maps of the eastern Mediterranean and the Red Sea got ships as decoration. Lucas Cranach the Elder did a map for a Bible published in 1525 in Zurich.[20] It boasted four sailing ships and five rowed vessels, three of the later being shown in the Dead Sea, an extremely unlikely venue. Three of the sailing ships are tubby with a single mast and single square sail reminiscent of the *cogs* of northern waters. All of them have large prominent aftercastles. The fourth sailing ship may be a *galleass*, a descendent of the *great galley*, with three masts carrying what may be square sails but also equipped with oars.[21] Printers, however, did not limit their use of ships for map decoration to editions of the Bible and travel accounts. The interest in the New World led to the production of world maps, as Apian's career showed. World maps were the logical vehicle to show the recent voyages and what the explorers had found and so more prone to be illustrated with ships.

Globes were even better than world maps for reporting the work of explorers because they offered a way to show all 360° of the spherical earth before chart makers had found a way to do that. In 1497 John Cabot used a globe to show where he had been.[22] Martin Behaim, who had spent a considerable time as a merchant in Portugal and time sailing with Portuguese mariners, not surprisingly incorporated on his 1492 globe a change in cartography that was to become common in Portugal. Scattered across the seas, among 111 miniatures including dogs, fish, seals, mermen and mermaids, and the extensive text, are 11 ships. How much effect the shape of the globe had on the shape of the ships is not possible to say.[23] The four ships in the Atlantic are all headed west. They all are single-masted with a single square sail but in each case the sail is trimmed in such a way to make something more like a right triangle with the hypotenuse across the single yard. Another vessel, off the southern tip of Africa, is two-masted. The illustration is suggestive of Portuguese ships trading in the South Atlantic and so different from the standard trading ships of northern Europe. The rest of the ships, and especially those off Ireland and even the one off Java, have high castles both fore and aft and look much like large *cogs*.[24] That was the type presumably that made the voyages between Lisbon and northern Europe in the fifteenth century, though the globe maker felt free to place it in almost any sea around the world.

Behaim's most prominent successors among globe makers in Germany were typically university professors. Johann Schöner whose appointment was at the University of Nuremberg produced five globes from 1515 to 1533. In each case there was a descriptive text to go with the globe.[25] His 1523 *opus* even turned up, slightly altered including the addition of a the line of demarcation from the Treaty of Tordesillas, on the 1533 Hans Holbein the Younger painting of the ambassadors done in England not long after the globe had been made. Holbein's patrons presumably wanted to be shown surrounded by the latest in astronomical and navigational gear and the painter obliged.[26] Schöner's 1523 globe has a line tracing the voyage of the Magellan expedition and it, like his other globes, was decorated with ships. Schöner's first globe of 1515 has three ships, the 1520 globe nine, and the 1523 globe five. Most of the vessels have a very deep waist, a stern-post rudder, and a single mast with a single square sail. A smaller version with low castles shows a slight curve to the hull and another a highly curved hull with the forecastle higher than aftercastle. Whether the ships were intended as *cogs* or variants on the northern European *cog* such as the *hulk* is difficult to say. In a very few cases Schöner also added open boats with men rowing. He may have intended the three ships on the 1520 globe, one large and two smaller ones off a gigantic Cuba, as Columbus' ships. In all cases the sketches of the ships are very simple and offer little detail.[27] Each globe had sea monsters as well as ships. None of the drawings showed a high degree of precision. The medium did not help. There was little space even with his largest globe, 87 cms. in diameter, and even less space for decoration the greater the distance from the equator, either north or south.[28]

Schöner had predecessors and contemporaries who made similar globes. The Lenox globe, named after its owner, is from around 1510. Along with a rather fuzzy New World there are single-masted ships each with only a single square sail. The somewhat shallow waist indicates a smooth curve to the hull.[29] Any one of them would look at home on a Schöner globe. A globe from Nancy of about 1535 has two ships one of which is apparently single-masted and very broad so it was like the ships on Schöner's globes. The other is three-masted but all the sails are square and there are hardly any if any castles suggesting a different design.[30] Georg Hartmann in Nuremberg around 1535 produced a set of 12 gores and included a line tracing the course of the Magellan expedition with a ship that follows the line, the vessel reappearing at least three times. It has two masts and possibly three. The other vessels on the gores include rowed boats, one with a sail, and three single-masted square-rigged ships.[31] Caspar Vopel (1511–61) taught mathematics at the University of Cologne. Before his large world map of 1545 he made some globes, the earliest in 1536. While only a few gores have survived it is clear that ships were acceptable decoration for him. Of the five vessels on the surviving portion of the globe all are two-masted with the mainmast carrying a square sail and the mizzen possibly carrying a lateen which would recall early *carracks* of the fourteenth century. In the southern hemisphere the ships are upside down, something done by more than one sixteenth century globe

maker.[32] By the mid sixteenth century globes were common and the tendency for the variety of makers, in Germany at least, was to decorate their works with a number of ships spread around the world.

The projection used by Schöner and Vopel was based on the work of a remarkable German map maker, Martin Waldseemüller. He explained the mathematics which made it possible to print the gores for globes, using wood blocks. With multiple exact copies coming off a printing press using those blocks it was no longer necessary for the cartographer to make the globe. Anyone with some technical skill could without supervision put the gores on an orb of the right size. Waldseemüller's first try at printing gores in 1507 came at about the same time as the Florentine printer Francesco Roselli (1445–1510) was doing the same thing in Italy. Other German globe makers relied heavily on Waldseemüller's methods but they did go beyond his globe and added ships, something he did not do.[33] In 1507 as well as the globe Waldseemüller made a world map, possibly printed in the Vosges village of St. Dié, Lorraine, but probably drawn and perhaps also printed in Strasbourg. It was Duke René II of Lorraine who made St Dié a centre for high quality wood block printing and research in geography. There he brought together three scholars interested in the new discoveries: Mathias Ringmann, Gualtier Lud, and Waldseemüller. They cooperated in the production of various works including the globe and world map of 1507, a great map of Europe of 1511, a new edition of Ptolemy's *Geography* of 1513 printed in Strasbourg complete with 20 modern maps, and a new world map of 1516.[34]

The 1507 map, possibly based on the 1505 or 1506 map of the Genoese cartographer Nicolo di Caveri, had a press run of something on the order of 1000 and so was more widely circulated than any previous world map [Figure 7.2]. That gave it a broad impact in northern Europe with many map makers imitating or following it. To get a map of the impressive size that Waldseemüller wanted it had to be done in 12 separate sheets. It reflected new possibilities in printing with maps ranging up to 150 × 300 cms. so they could serve as wall decoration in place of more expensive tapestries or oil paintings. The lower cost to consumers made it feasible for printers to speculate by investing in larger press runs in justifiable hopes of reaching a wide market.[35] Another 1507 Waldseemüller product was the *Cosmographiæ introductio*, inspired by Amerigo Vespucci's *Four Voyages…*, which also came from St Dié. The world map was presumably designed to accompany the book or the other way around. Its contemporary popularity came from the information about the New World and its historical curiosity comes from it attaching the name America to that part of the earth. The map of Europe got an accompanying booklet in 1511, written by Ringmann.[36]

The 1513 edition of Ptolemy included a new world map which made it the first printed map to show the continents on the other side of the Atlantic. The new edition with a separate set of *tabulae modernae* marked a break with the classical tradition and with reliance on antique precedent. The consciously

Figure 7.2   Martin Waldseemüller, World Map of 1507. Courtesy of the Library of Congress, G3200 CT000725C.

modern maps were not just of Asia, Africa and the Atlantic but also various parts of Europe and they were based to some degree on portolans and so on compiled observations. The new geographical information set Europeans apart from and made them in a way superior to their classical precursors, something that had been increasingly obvious for some 50 years. Waldseemüller's version was a strong indication of the changing perception. Though conscious of moving beyond Ptolemy that did not diminish respect for the ancient cartographer. The 1507 map included in the border two small bust portraits, in circles decorating the borders, of men holding scientific instruments. The two chosen for the honour were Amerigo Vespucci and Ptolemy. There was decoration on the map and there was a ship, off the coast of South America. It is two-masted with a single square sail on the mainmast. The sail on the mizzen is not set though presumably it is intended to be a lateen. The aftercastle hangs out over the stern and there seems to be no rudder. There is hardly any waist and the forecastle rises just forward of the mainmast. An inscription below says that the ship is Portuguese but it is doubtful that any Iberian captain would have commanded such a ship ever and almost certainly not in the mid Atlantic in the early years of the sixteenth century.[37] The map might well have included the latest cartographic information but the single depiction of a ship did not indicate the same up-to-date understanding of shipbuilding technology. The revised version of the map which followed somewhat more than a decade later was not much of an improvement when it came to depicting ships.

In 1516 Waldseemüller published at Strasbourg what he called a *Carta Marina Navigatoria Portugallen Navigationes Atque Tocius Cogniti Orbis Terre Marisque…* [Figure 7.3]. While the 1507 map fit into the Ptolemaic mould the new one was

Figure 7.3   Martin Waldseemüller, world map from his *Carta Marina Navigatoria Portugallen Navigationes Atque Tocius Cogniti Orbis Terre Marisque...*, 1516. Courtesy of the Library of Congress, Kislak Collection.

more obviously based on information from contemporary sailors and especially Portuguese ones. He even listed the travel sources he used in a statement in the lower left. The shape of land masses and the names used suggest he relied heavily on the Canerio chart, something he did not have in 1507. He must also have had a new source of information about northeastern Europe since he moved away from the Ptolemaic depiction of the region. Though more like a portolan the value of the 1516 *Carta* for navigation was almost nil. It was in 12 sheets and measured 136 × 248 cms., designed to cover a wall. Waldseemüller was working on a revised version of the *Carta Marina* when he died and Laurent Fries took on the task of producing the successor which proved somewhat reduced in scale. It came out around 1525 and was reissued in 1527 and 1530 but despite the reprinting apparently did not enjoy very wide circulation. Neither it nor the 1516 version proved as influential as the 1507 world map which was a model for Schöner, for a reissue under his own name by Peter Apian, and for maps by other distinguished cartographers. The *Carta Marina* had many small vignettes, animals, and depictions of a number of local rulers including the Great Khan of Tartary or China. Off the Cape of Good Hope there is another royal figure identified as King Manuel of Portugal shown riding a large fish or dolphin. Though the map has rather extensive decoration it has no ships. The figure of the Portuguese monarch on the open sea may, however, have served a purpose similar to that of putting a ship there.[38]

Waldseemüller's successor in producing major monuments of German cartography was Sebastian Münster. He published his *Geographica Vniversalis* in Basle in 1540, already a centre for printing and that included the printing of maps.[39] Just two years before Caius Julius Solinus had brought out a world map, printed in the same city. That woodcut is poor in terms of cartographic detail but there were two ships both under attack, one by Neptune who is climbing on board and the other by a sea monster. The ships are single-masted and have small flat forecastles. The curved hulls suggest they were intended to be *hulks*. Such ships, even as warships, would not have sailed the Indian Ocean. Münster's maps, though he borrowed from Solinus, were superior in almost every category. His *Geographica Vniversalis* was another edition of Ptolemy but with 17 new maps including one with a depiction of Magellan's ship in mid Pacific. Münster inserted symbols, such as Portuguese and Spanish flags. He also added names, many of them later entrenched in common language because the work proved so popular. It went through 40 editions in the following 100 years.[40] Already on a 1532 map Münster had included a ship with a single square sail and possibly a sail under the bowsprit. It had a moderately high aftercastle but was not precisely drawn.[41] In the third edition of the *Geographica Vniversalis* of 1545 there are ships on some eight maps. Often there are sizeable aftercastles or rather box like arrangements sitting above the sternpost. Bows are generally sharply brought up and the rig – almost always a single mast with a single square sail – and running gear are

badly or incompletely drawn. The vessel in the Pacific has a curved bow and so looks like a *hulk* but it is unlikely that any sixteenth century *hulk* carried shields along the side as they appear in the illustration [Figure 7.4]. One ship off Tunisia, shown going down, has a thick composite mast, necessary to handle the very large yard and big square sail. Münster even included two ships on Lake Constance, one a single-masted square-rigged ship with a somewhat confusing steering arrangement and the other, smaller, with the same rig but a side rudder rather than the standard sternpost rudder of sea going ships.[42] The ships in general are archaic, perhaps the types that would have been sailing northern European waters a century before. In that they are like the ships on Waldsee-müller's maps and on globes of the period.[43] The map in Münster's hands was becoming part of a collection with some order, exploiting different forms including text and decoration to go with the essential details of coastlines and paths of rivers. His works was a major step toward the first true atlases of the last third of the century,[44] and though his works were a step toward the inclusion of ships on maps they were not a step toward accurate depiction of ships.

Another German cartographer in a 1535 map had two ships in the mid Atlantic. Another in a 1543 woodcut map of Prussia included four ships in the Baltic.[45] Chronicles more and more were accompanied by city views, one of the

Figure 7.4   Sebastian Münster, map of the western hemisphere, from his *Cosmographia: B[e]schreibu[n]g aller Lender…*. Basel: Henrichum Petri, 1544. From the collection of the James Ford Bell Library, University of Minnesota, Bell 1544 f Mu.

best examples being Münster's *Cosmographie* which was popular enough to warrant 36 editions from its first appearance in 1544 to 1628.[46] Chronicles often got maps too. In the case of the 1545 chronicle of the Swiss Confederation the publisher took 12 of the illustrative maps by Johannes Stumpf and created what he called a Swiss Atlas which he brought out in 1552. The work was popular enough to be reprinted almost annually until the end of the century. The maps of Europe and of Gallia have ships on them, three-masted sailing ships and in one case an oared *galleass*. More impressive though are the eight maps of the different parts of Switzerland which include depictions of boats on the many lakes [Figure 7.5]. There are two types: a rowed open boat and a single-masted open vessel with a single square sail. Not all of them are carefully drawn and not all the lakes have ships but even for maps from Switzerland and even for inland

Figure 7.5   Johannes Stumpf, *Die Landkarten des Johann Stumpf 1538–1547*, Aargau, Plate VII of the maps of Switzerland. Herzog August Bibliothek, Wolfenbüttel: Xb 2° 70, Karte VII.

bodies of water decorating maps with vessels was by the mid sixteenth century not only acceptable but apparently normal.[47]

The tradition of including ships on maps illustrative of the Bible continued and grew. The great majority were based on the Exodus map by Cranach which was a standard complement to Lutheran Bibles. The ships on them like the other attributes of the illustrations and the text of course carried special meaning. The Calvinist Bible, published in French at Geneva in 1559 also had a map, one which also proved influential. There are two ships off the coast of the Holy Land, the larger with a single mast though possibly two, a sternpost rudder, a high aftercastle and a curved hull suggesting origins in the design of the *hulk*. The smaller second ship is a single master with less of a curve to the hull. In all other ways they show features of long established and even old fashioned European ship designs. A year later the English Bible, also published at Geneva, got three ships on its map and they appear to have been more up-to-date. Each has three masts, probably with a lateen-rigged mizzen in all cases, and topsails on the fore and main masts. One of them even lacks the curved hull form of *hulks* and *carracks* and instead has the straight gunwale of Portuguese ships used in the Atlantic. Many of the ships depicted in the varied maps were small and not precise so often it is difficult to say exactly what the artist meant. Over time their numbers grew as did the area of the world covered by the maps in Bibles. The move toward more contemporary ships became clearer as the century wore on so that by the 1590s ships on Biblical maps looked like newly developed highly efficient Dutch cargo ships.[48] That was in part because the printing of Bibles and the production of maps became increasingly centred in the Low Countries.

The provinces along the North Sea in the lands bordering the many mouths of the Rhine was in the sixteenth century a fertile area for the development of cartography. Close connections with both Portugal and Spain through regular trade made access to geographical information relatively easy. Antwerp became not only the entrepot in northern Europe for the distribution of exotic goods brought by Iberian ships from the Far East and the New World but also a thriving centre of commercial printing. Political ties between Spain and the Low Countries were up to 1555 embodied in their common monarch, Emperor Charles V. As the ruler of a collection of different European lands and an empire which continued to grow, he took an interest in the graphic representation of what constituted his lands not only to demonstrate his authority but also to help in the administration of the diverse collection.[49] There was also, as in Germany, a growing academic interest in astronomy, navigation and maps. Evolution in cartography was slow in the fifteenth and early sixteenth century but that gave way to ever more rapid advances from the 1530s on and among those advances was including illustrations of ships on maps.

Vessels, and generally smaller inland craft, turned up on local maps in the Low Countries even in the early fifteenth century. On a mural showing the disastrous

but overdramatized St. Elizabeth Flood of 1421 is a rare early depiction of the simple fore-and-aft rig which would dominate small inland craft for centuries.[50] More common were maps made for use in litigation. The oldest surviving map from the Low Countries comes from a court case of 1358 and by the late fifteenth century sketching maps to help in making legal or administrative decisions had become normal.[51] A 1468 dispute about tolls before the highest court in the Low Countries led to the production of a map 520 × 57 cms. describing the approaches to the port of Antwerp.[52] The rivers are filled with ships including three-masted ocean going ships which resemble each other, two-masted ships, and one-masted vessels with square sails. Some are fishing boats but many are trading vessels. One of them might even be the surveillance vessel of the toll collectors, trying to gather what was due to them. The map was to help in defining the jurisdiction of the ruler and so had continuing value which led to a copy being made in 1504 for use in subsequent disputes.[53] A less grand map was produced possibly for a dispute between the towns of Rotterdam and Delft around 1512 and it too had vessels, a fishing boat and a couple small inland craft as well as three river boats under sail [Plate VIII]. One of those sails even appears to be triangular.[54] Maps for court cases usually covered only a small area and may have never been introduced into evidence, only serving as aides-mémoires to those presenting cases. There was no necessity to include ships on the waterways around disputed lands or projected polders but they often did appear. The logic was to include inland vessels, small open boats with a fore-and-aft rig of spritsail and forestaysail and sternpost rudder. Certainly such craft do turn up on maps and frequently. But early sixteenth century maps for court suits could also have, stuck in inland waterways where they probably did not belong, three-masted *full-rigged ships* complete with topsails on the main and fore masts, the kinds of ships that sailed the high seas.[55]

Not all maps made for boundary disputes got ships on them. The same was true of the increasing number of topographical maps generated for administrative purposes. From 1524 the government of Charles V required authorities responsible for polders to keep surveyors as regular employees, people who logically would make maps.[56] On a more grand scale in 1559 Jacob Roeleofs was named cosmographer royal by the new monarch, Philip II, and given the job of making plans of all the towns in the Low Countries for use in their defence. Known as Jacob van Deventer, he already had a reputation as a map maker having worked as a surveyor for the province of Holland and produced a number of provincial maps. Over the following 17 years and with great difficulty he produced some 250 plans. The many surviving town views show no signs of any ships but on the other hand van Deventer's earlier provincial maps made between 1536 and 1546 demonstrated the variety of the latest sorts of vessels sailing in Low Countries waters. His 1546 map of Zeeland included many islands shown with names for towns and villages, depictions of churches and, at sea, at least 23 vessels. A few were three- and even four-masted sailing ships but in the

rivers and along the inland waterways he put single-masted boats and even smaller vessels close in to shore.[57] Other copies and versions of the same map done around mid century came with fewer ships, sometimes armed and in some cases even with two masts and two square sails. In one version Neptune appeared riding a sea monster.[58] Michele Tramezini published versions of some of Jacob van Deventer's maps of different provinces of the Low Countries at Venice in 1537 and 1556. They were even more popular and circulated more widely than the originals. Those maps too were abundantly decorated with ships. Gelderland and Brabant being inland got few ships while Friesland and Holland got 20 and at least 33 respectively. The map of Zeeland had at least 20 [Figure 7.6]. There was again a variety of types ranging from four-masters to open fishing boats, some with high castles and some with none. A few ships are repeated with varying views but many are different from any others on the maps.[59]

Pieter van de Beke made a map of Flanders before Jacob van Deventer tried his hand at it. The 1538 woodcut map was apparently part of a propaganda campaign of the Flemish aristocracy against their Habsburg overlords. There are at least a dozen ships off the coast done to different scales ranging from a small rowing boat to *galleys* to four-masted sea going cargo ships. That early provincial map just like contemporary and later maps of waterways, other regional and even local maps got ships, and not just big ships but also smaller vessels which were typical of the coasts and inland rivers and lakes. The presence of printers able and willing to produce maps, derived in some cases from foreign examples and litigation over boundaries and over the management of waterways certainly aided the growth of cartography in the Low Countries.[60] So did political disputes and the related government interest in maps and the theory behind them.

Gemma Frisius (1508–55) was a highly influential mathematician, astronomer, and instrument maker. He worked at the University of Leuven and enjoyed the support of Emperor Charles V for whom he made a now lost world map in 1540.[61] In his 1545 edition of Peter Apian's *Cosmographia* Gemma included two ships, one a *galley* with two masts and two sails, both possibly square, and a three-master with a lateen mizzen. The same map and ships appeared in Spanish, French, and Latin versions of the work.[62] He had already published a book in 1533, also connected to Apian's work, where he offered a method useful in executing birds'-eye views. Before that in 1531 with the help of the printer Gaspar van der Heyden he produced a globe, an object whose value he had praised at length in a book on cosmography and astronomy just the year before. His 1536 large globe, 37 cms. in diameter, reflected knowledge brought back by Portuguese explorers about the Indian Ocean. In that ocean the globe had four ships to go with extensive text. Three of the ships are single-masted, one with a big sail set and billowing. The other two are smaller open craft with no decks. One of those seems to have a spritsail to go along with a fore-staysail, odd additions to the rig of a *hulk*, but much like the rig of a *boyer*. The fourth ship is three-masted and the way the yards are canted the sails could all
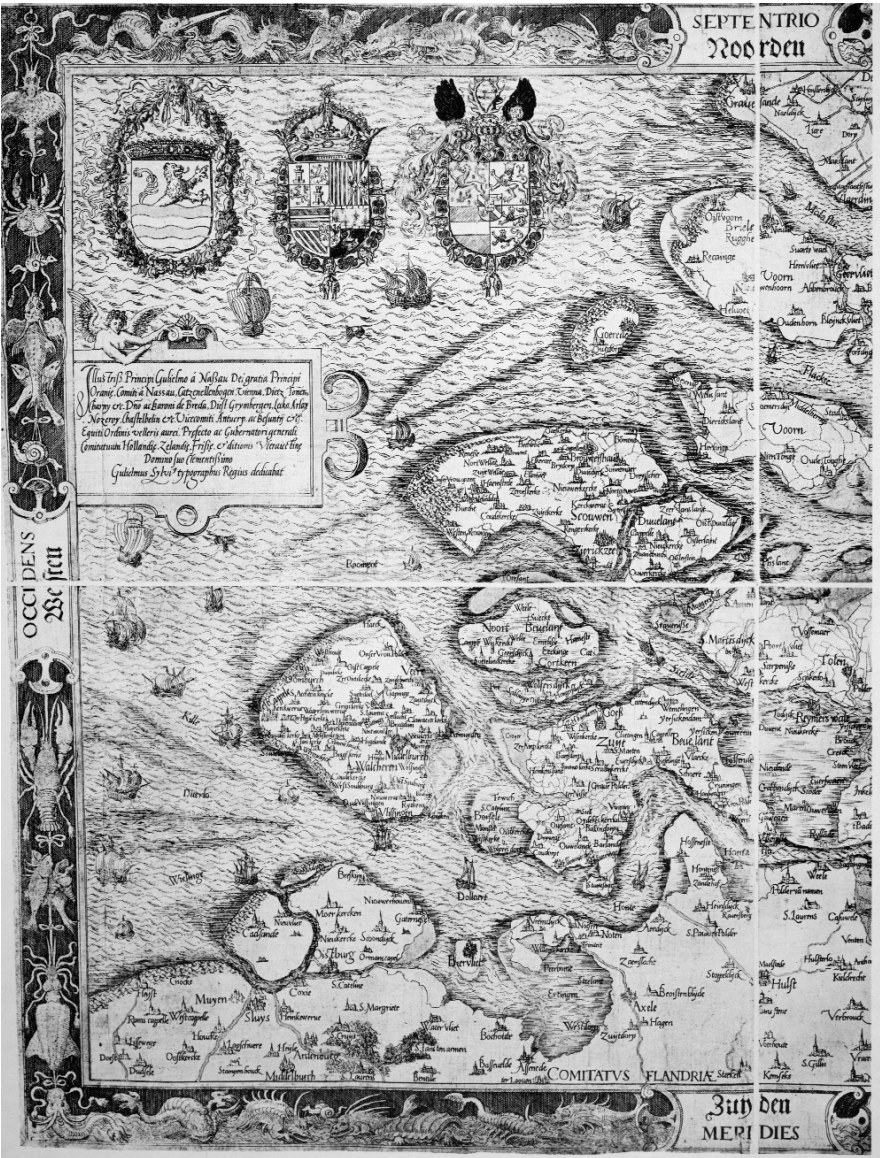
Figure 7.6   Jacob Roeleofs, known as Jacob van Deventer, map of Zeeland, from a 1558 Italian copy. Nationaal Archief, The Hague, Collectie Jacob van Deventer (nummer toegang 4. DEF), inventory number 20.

be lateen, though on one mast there is a topsail which severely limited the possibility of having a lateen sail on the mast. As is common with globes it is difficult to make out the details of design because of the size of the illustrations and the distortion from the medium.[63] Two globes went back to England with John Dee, the cosmographer and later royal adviser, when he left Leuven. He had studied there under Gemma so the geography that the Netherlandic academic proposed had a long lasting effect in England as well.[64]

For the later globe Gemma had help from another of his students, Gerhard Kremer (1512–94). The pupil would be better known by his adopted name of Mercator, the Latin for merchant, which indicated that early on Kremer was interested in the commercial potential of his profession. He did reap rewards as a highly successful atlas publisher in the late sixteenth century, improving the status of geography in the process.[65] Born at a small town near Antwerp, he spent the years from 1530 to 1551 in Leuven before going on to Duisberg in Cleves where he would live out his life. Early in his career he made a map of Palestine and one of Flanders dedicated to the emperor, drawing on the work of men like Waldseemüller and also contemporary Protestant as well as Catholic sources.[66] His distinguishing accomplishment, already hinted at in his own 1541 globe, was the ability to draw true loxodromes, that is lines of the same compass bearing on a plane surface. There are signs that he had worked out the solution, relying on Pedro Nunes' findings, as early as 1546 in studying how to sail from Antwerp to Gdansk. The Mercator projection, seen in his 1569 wall map, showed the problem solved but at the cost of distorting the shape and size of the land masses of the earth. Though there was distortion he did eradicate the misrepresentation of the relative position of sites some distances from each other endemic with portolans.[67] His earlier 1554 wall map of Europe in 15 sheets, 132×159 cms., did correct many faults but still did not completely eradicate the distance errors inherent in earlier portolans. While Mercator's globe might be a modest 41 cms. in diameter and so manageable on board ship and while his projection might deal with the problem of representing the world on a plane chart it would be a long time before his work was of any practical use to mariners.[68] Mercator might be given to more exact drawings of the lands of the globe but he was not so enthusiastic about adding ships to the decoration of his work. In 1554 his Britain has a ship off Land's End.[69] His highly successful and lucrative atlas of 1570–2 did have ships on a very few of the maps, those of Spain, France, Italy, Greece, and Britain, but many of the maps had no ships whatsoever. The ships are either the standard three-master or, in one case, a *galley*. For Mercator ships were acceptable decoration but not required. His interests may have tended more to the theoretical and so there was less desire to include mundane vessels. In the second half of the sixteenth century ships were for him not an integral part of a map but they were certainly good to have and more than acceptable. In that in the Low Countries he was, as in many other things, somewhat unique.

Alongside the academic tradition, devoted to solving problems of projection, there was in the region an abiding interest in the production of practical guides that would serve the rapidly expanding merchant marine. In more and more cases in the Low Countries after 1544 books of sailing directions had coastal views added to the text. The *leeskaarten* were a modest advance on already existing sailing instructions. Still those graphic supplements would continue to appear in rutters well into the eighteenth century. Called maps, the rutters had by the 1530s acquired what would be a standard format. Sailing instructions extended all along the Atlantic coast to Iberia and into the eastern Baltic. Tide tables, information on currents and on distances supplemented new editions. The number and quality and circulation of rutters increased as more made it to the printing press.[70] The 1548 pilot's manual by Guillaume Brouscon even came with a map as an aid for understanding navigation methods. The map had no ships on it as apparently was to be common with the maps in rutters.[71] By the late sixteenth century Amsterdam had become a centre for the publication of an increasingly popular series of pilots' handbooks with instructions especially for sailing in the North and Baltic Seas, supplemented by the 1580s with maps of the mouths of certain major rivers. The future explorer of the Northeast Passage and before that a highly accomplished map maker, Willem Barentsz., added the Mediterranean to the area covered in Dutch rutters in 1595, complete with charts.[72]

It was the remarkable Amsterdam artist and cartographer Cornelis Anthoniszn. who was the first to include coastal elevations in a rutter. Subsequent editions and translations of his book of sailing instructions included a woodcut of a ship on the front cover, probably a *hulk*. A third edition, published in 1558, included instructions on celestial navigation which he presumably got from one of the Spanish or Portuguese handbooks that were appearing in greater numbers.[73] The next step along the path already travelled by Mediterranean map makers was to produce a portolan chart. That Cornelis Anthonisz did in 1543. A previous chart of his, made in 1526, has not survived. The first edition of his *Caerte van Oostlant* has not survived either [Figure 7.7]. A later edition was printed in reduced form as copper engravings at Rome and Venice in 1558 and 1562 respectively and in that form became known across Europe. Cornelis Anthonisz had already made an impressive bird's-eye view of Amsterdam in 1538 and redone it in 1544, contracted to do maps for the city of Amsterdam, had gone to Algiers as an artist in the service of Charles V in 1539 to make a graphic record of the siege of that port, and travelled to the Baltic, something he did again in the 1540s and 1550s. He made the *Caerte van Oostlant* apparently on a commission from Amsterdam which wanted to use it in a dispute with the government of the Low Countries over taxation. The second edition of 1548 done in Antwerp and the third of 1553 show significant improvement based on borrowing from Olaus Magnus' *Carta Marina* of 1539. The artist's voyages to the Baltic may also have helped in improving the cartography. The
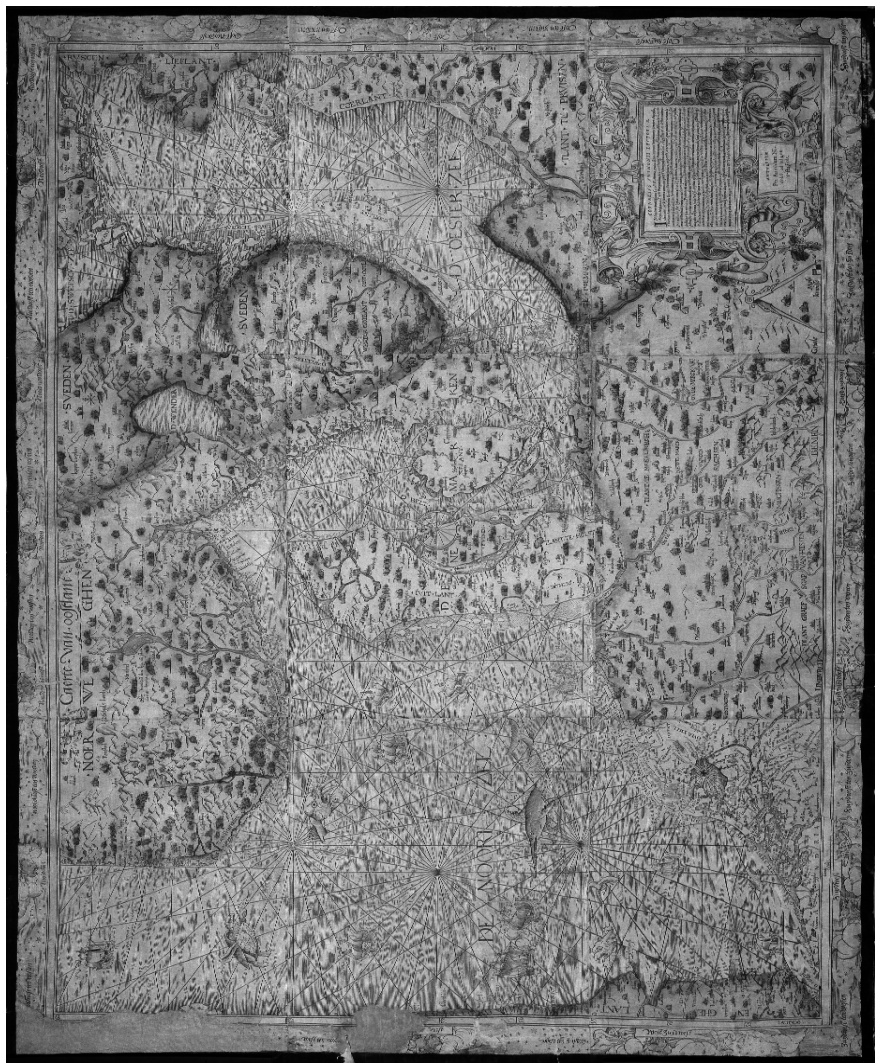
Figure 7.7 Cornelis Antonisz, *Caerte van Oostlant*, Antwerp, c. 1560 based on the original version of 1543 now lost. Herzog August Bibliothek, Wolfenbüttel: K 1,1.

map, done in nine woodcut sheets, is certainly closely tied to a book of sailing instructions he did. Though there is some illustration on land the goal was to show sea routes and so the concentration is on coastlines and ports. There are marks to show dangerous waters and an explanation of the marks in the extensive text on the map.[74] The seas have monsters. They also have ships. There are eight in the North Sea and two in the Baltic. Each is a three-masted *full-rigged ship* with, in at least one case, topsails on the fore and main masts set. Though there are high aftercastles they do not have the dramatic deep waists or curved gunwales of the *carracks* on earlier and contemporary Portuguese maps. Cornelis Anthoniszn.'s ships are another indication of the settling down of ship design and of the move toward a more standard long distance sailing ship. They are a sign that cartographers in the Low Countries, unlike most of those in Germany, had taken up drawing contemporary ships and putting them on maps in places where they truly sailed.

The *Caerte van Oostlant* marked the arrival of the portolan chart in northern Europe. The method of production was perhaps more sophisticated than with its Mediterranean predecessors because of the cartographer's use of triangulation in a way improved by Gemma Frisius. Though the technique dated from the 1450s it was not until the early sixteenth century that it came into use and not until the mid sixteenth century that information about how to do it became widely available.[75] As late comers northern European cartographers could exploit many of the solutions to problems already found by earlier portolan makers as well as adapt improved and improving techniques. The *Caerte* was significantly better in the depiction of the Baltic coast than any predecessor. With no knowledge of much of the North and Baltic Seas map makers in the South had simply guessed at the shape of Scandinavia. The poor quality of the coasts north of East Anglia and Bruges they drew may indicate how far Mediterranean ships ventured in the years before the sixteenth century. Cornelis Anthoniszn.'s transfer of sailing instructions to a portolan chart upset the incorrect views of the region held by southern European map makers. The *Caerte van Oostlant* became the source for subsequent maps of the Baltic. In the hands of Mercator, relying on Anthoniszn. and aided by new information from voyages in the region, the shape of the North and Baltic Seas was fixed in European mapping.[76]

The lack of indigenous map making in Poland and in Scandinavia was a contributing factor to the poor descriptions of the region on sixteenth century maps. Influence from the South but also from the Low Countries proved a basis for Polish cartography. With that influence came ideas about how to decorate maps. Patrons for cartography apparently were few and the kings of Poland seem not to have taken an interest in promoting map making. They did call on Nicolaus Copernicus in the first part of the sixteenth century for advice on the preparation of maps, however,[77] and also employed, as a secretary, Bernard Wapowski

(c. 1475–1535) whose maps had a great influence on Polish and on European cartography in general. The topic for his most important and most influential map was the region between the Baltic and the Black Seas, from the Don in the east to the Oder in the west. The map made its way as one of the new maps into Sebastian Münster's 1540 edition of Ptolemy. The Black Sea is decorated with two and possibly three *cogs*, single-masted, single-sail vessels with a very deep waist, a sternpost rudder, flat platforms at the stem and stern, and a big top on the single mast. It is a rather archaic vessel, one at home in the Baltic and not in southern European waters.[78] Later editions of the map, and there were a few, included as many or more ships. A 1535 woodcut edition by Heinrich Zell included at least six ships in the Baltic which may be of two types, some like the ones in the Black Sea and some smaller placed closer to shore. In a 1542 map of east Prussia Zell also added ships and in that case the distinction is clear between the three-masted *full-rigged ships* standing out from shore and the single-masted ships that operate closer to land. Wacław Grodecki did a map of Poland in 1557 and he put two ships in the Baltic. Andrew Pograbka of Pilzno did a map in Padua in 1569, published in Venice in 1570, and it too had two ships in the Baltic.[79] By that date the pattern was clear. Polish cartography, whether done in the kingdom or elsewhere and maps of Poland, whether done by Polish map makers or others, could be expected to have ships as decoration on the nearby seas.

The culmination of trends in Low Countries and indeed in northern European cartography when it came to navigational charts and their decoration came in the last years of the sixteenth century in the work of Lucas Jansz Waghenaer. He was an experienced pilot who took up work on shore and turned his hand to town views and to charts. His *Spieghel der Zeevaerdt*, produced at the new Christoffel Plantijn press in Leiden in 1584–5 had an overview chart and 45 detailed charts to a uniform scale of the coasts of western Europe from the Straits of Gibraltar to Norway and Finland.[80] With each chart there were sailing instructions. A major improvement over previous works, it had the coastal profiles across the top of the double-page charts with both covering the same coasts. The *Spieghel*, published in English in 1588 as *The Mariner's Mirror*, was the precedent for sea atlases of the seventeenth and eighteenth centuries [Figure 7.8]. Waghenaer brought out a modified version, *Thresoor der zeevaert*, in 1592.[81] Not for the collector or for show as was the *Spieghel*, the *Thresoor* was in a more useable format having coast views and navigational instructions to go with the charts. It had much more text relative to the number of charts than its predecessor and it had added information on sailing to Asia. An eminently practical work, it was the model for later sailing guides.[82] Both works contained extensive information on tides and on the sun's declination tied to the new Gregorian calendar. There were symbols for dangerous rocks, markers and buoys, with explanations in the introduction of what the symbols meant. Waghenaer's information came from Portuguese and Spanish as well as Dutch
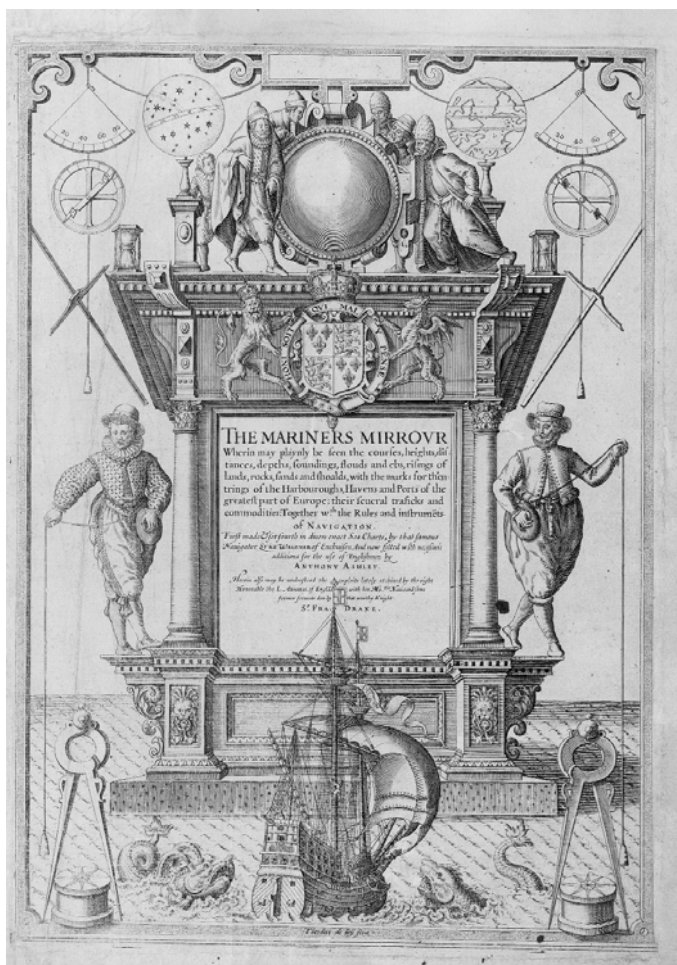
Figure 7.8 The title page of *The Mariner's Mirror*, the English translation of Lucas Jansz. Waghenaer's *Spiegel der Zeevaert*, published in London, 1588. The John Carter Brown Library at Brown University.

sources and while he did not in his maps solve the problem of drawing loxodromes he was able to correct many errors of latitude in earlier portolans. He did incorporate a number of errors of longitude which suggests he relied only on sea charts and rutters and ignored land maps, the opposite of, for example, Mercator.[83] The engravings were done by the highly skilled and experienced contributors to maps, the brothers Jan and Lucas van Deutecum. Waghenaer's works marked a revolution in sea mapping. Both of his books, but especially the *Spieghel*, proved popular enough to warrant new editions and translations,

each one usually retaining the cover by Jan van Deutecum which showed the range of nautical instruments to be used by a pilot.[84]

The sea on Waghenaer's 46 charts was populated with many ships, at least one, more often than not two, and sometimes as many as four per chart [Figure 7.9]. There are some concessions to local circumstances. Off the coast of Portugal twice there are seagoing *caravels* with three lateen-rigged masts and off Andalusia a *galley* with a single lateen sail and off the coast of the Netherlands there are herring *busses* setting out their nets. In general though the ships are three-masted *full-rigged ships*. Off the coast of England, Scotland, the Netherlands and Scandinavia there are a few smaller single-masted vessels and even two-masters. Some of the same types get repeated on different maps and there is consistency in depicting certain types. There can be little doubt that the goal was to fit each type to its proper locale and to show it at work. Waghenaer was an innovator with no real precedent to guide him. He tried in the *Spieghel* to give systematic form to depicting what was then known about navigation in the area frequented by Dutch ships and in a highly useable form. He also followed patterns of depicting ships but, as with his charts, he summarized the direction of the previous century by showing a variety of vessels with accuracy and in places where they were usually found. By the end
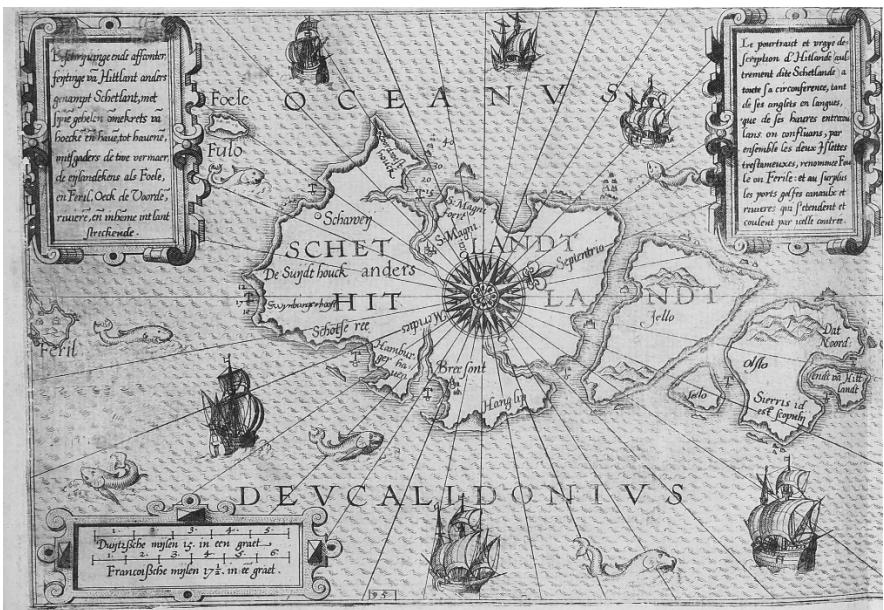
Figure 7.9   Lucas Jansz. Waghenaer, *Thresoor der Zeevaert*, Leiden, 1592, Map of the Shetland Island. Collection Nederlands Scheepvaartmuseum Amsterdam.

of the sixteenth century on Dutch charts vessels were everywhere on the seas, in the harbours and even in the cartouches.[85]

Maps made in northern Europe from England to Poland and virtually everywhere in between got ships as decoration in the course of the sixteenth century. The practices of the Mediterranean and more specifically of Portugal invaded the North and gained acceptance among many cartographers. Map making in the North and the South, separated in methods and goals for some time, was by the late sixteenth century all but indistinguishable. The copying of northern maps by Italian printers and the adoption of Portuguese data and decoration by Dutch cartographers were signs of the extensive cross-fertilization. Northern advances, as exemplified by the work of Mercator in a projection for world maps and Waghenaer in developing effective charts and navigation instructions for sailors at sea, and also exemplified by printers in the Low Countries such as Christoffel Plantijn and engravers and etchers such as Hieronymous Cock, made northern cartography superior to any in Europe.[86] By the mid sixteenth century the pattern of cartographic illustration was being set. Illustrations of Bibles with maps, decorated with ships, were the norm. Though the ships, at least on Dutch maps, were more like the ones sailing the waters near the site of printing than the waters of the eastern Mediterranean or the Red Sea the tendency was to put the right ships in the right places.[87] Topographical maps generated for court cases often had ships on them, that is even though the ships were not necessary and contributed in no way to the argument inherent in the map. Ships showed up even on astrolabes, decorating the seas on the few made with plates showing not the heavens but stereographic projections of the globe. A brass version produced by Gillis Coignet at Antwerp in 1560 had four ships, two single-masted and two with two masts [Figure 7.10]. Because of the medium the quality of the depiction was poor and the ships are somewhat archaic, recalling the ships on the maps of Sebastian Münster.[88] It was not a unique phenomenon since at least one late sixteenth century French astrolabe also had a small number of ships sailing the seas on its plates.[89]

Ships became so much the stuff of maps and any sort of map in almost any medium that cartographers resorted to pattern books as guides for the drawing of vessels and then spread that same ship or ships from their singular source across the waters of their maps. They even copied the ships on the maps of others or from series of prints of ships.[90] Christian SGrooten, a renowned cartographer from the Duchy of Cleves who had King Philip II of Spain as a patron, did an atlas in 1573 and another in 1590. Though the goal of the first atlas may have been military, informing the Spanish monarch and his plenipotentiary in the Low Countries, the Duke of Alva, about Germany, the skilled map maker still felt obliged to include decoration on the waters he depicted. His maps have ships, powerful ships riding the waves of a blue sea with their sails billowing. Often he shows the same ships at a number of different angles.[91] The Catalan practice

Figure 7.10   Gillis Coignet, plate from an astrolabe done at Antwerp, 1560. Museum of the History of Science, Oxford University. http://www.mhs.ox.ac.uk/astrolabe/images/53211/53211_complete_front.jpg.

of adding some decoration to maps had been elaborated and extended by Portuguese map makers and then disseminated along with new geographical information throughout Europe. By the middle of the sixteenth century and even more so in subsequent decades everywhere in Europe the result was the same. Ships became a standard part of decoration even for topographical maps and more and more the dominant decoration for sea charts.

8
Ships, Geography, and Humanism

The mid sixteenth century marked a watershed in the character of maps and their place in the thinking and practices of Europeans. So too did the second half of the thirteenth when the Oxford Franciscan Roger Bacon described the use of a grid of latitude and longitude, when Raymond Lull in the Balearics called for the greater use of maps, and when the first surviving portolan chart was made.[1] In the period between about 1250 and about 1550 European cartography changed beyond all recognition. While the later date is not definitive and should be understood somewhat loosely, still in the middle of the sixteenth century the pattern was set in the production of maps and in the forms and types of decoration for those maps, including having ships on the oceans. In those years up to 1550 the bringing together of scholarly work on geography and the practical experience of navigators combined with information generated by voyages of discovery to create new kinds of cartography and to change what had been charts for sailors into world maps with claims to universality. While, 'The sixteenth-century world map became known as a *cosmographia,* and the oval world projection became a pervasive cosmographical icon for modernity, universality, and the integration of heaven and earth.'[2] that transformation in the scope, the use, and the assessment of the value of maps applied not just to charts or world maps but to all maps no matter their topic or coverage.

The fifteenth and early sixteenth century saw a *furor geographicus*, a massive increase in the interest in and use of maps.[3] In the period new functions multiplied with cartographic representations pressed into service for property management, settling land disputes, government administration, defence planning, military operations and many other things. Few people saw or used maps in the fourteenth century but by the sixteenth they were essential tools in a number of professions. They especially became tools of government and very rapidly in the half century after 1500. Prominent political thinkers like Machiavelli and Castiglione in Italy, Juan Luis Vives in Spain, and Thomas

Elyot in England urged an expansion of geographical knowledge and of education in the use of maps for good government and for success in battle. They were inspired in part by what classical authors such as Strabo said but also by contemporary military developments. The sheer growth in the size of armies, their greater range and the need to plan logistics on a grander scale coincided with and contributed not only to the ideas of those men about maps, but also to the willingness of rulers to take their advice.[4] The same was true for navies. Artists put together more and more extensive collections of maps and especially sea charts. While books of portolans had been known for some time the scale of production changed. The career of the Venetian Battista Agnese from the 1540s to the 1560s offers an extreme example.[5] 'Globe' came to mean not just the geometrical shape but the terrestrial globe, the first and easiest representation of the entire world. Maps became the standard fare of room decoration for public and private spaces with whole programmes of maps generated to illustrate the compilation of human knowledge or the scope of activity of the patron who decided on the interior.[6] The massive increase in map production created much more chance for variety. While the range of topics for maps did expand instead of becoming diverse maps tended to move toward greater standardization in the ways they were made, in the signs and symbols on them, in the way they represented the world, and in their decoration.[7]

A series of skilled people each with different talents made maps by the mid sixteenth century. The division of labour, which had prevailed in varying degrees for centuries, became more obvious in subsequent decades. The map maker did a drawing based on his best knowledge, the artists added what was deemed necessary, the wood block maker or engraver translated the work of the others to a form the printer could use, perhaps the colourist added highlights to the printed work, the bookseller made the result available to potential customers and the publisher took responsibility for arranging, financing, and coordinating all the activities of the others.[8] With manuscript maps the cartographer and artists might be the only ones involved but they too would need a source of finance, a patron or buyer who would contract in advance for the map they were to create. A man as prolific as Battista Agnese could and did make manuscript maps on the expectation of finding a buyer later. The market was good enough for his work that he could leave space blank for a coat of arms, to be filled in when the new owner paid. Prominent cartographers and their publishers logically and of necessity always maintained close ties with elite merchants and government officials.[9] Maps reflected what the cartographer was capable of doing, what the limits of his knowledge were. Maps also reflected the views of buyers about what they wanted, and what they thought was proper and fitting.

The rise of printing from the mid fifteenth century led to changes in the conception and execution of maps. Printing enhanced the social status of

maps, promoted interest in maps among people of higher status, and made possible the production of more maps more quickly and ones which were uniform. The ability to print maps increased the frequency of their appearance in various works from books to broadsides. Press runs might still be small, running in the hundreds, but certainly they were much greater than the output for manuscript maps which was one, with perhaps a very few copies. The task of scholar and engraver, the tasks of conception and execution which had often been handled by one individual became increasingly separated as printed maps replaced manuscript ones. Those producers with the versatility and precision of engraving and with the greater potential speed in getting from conception to final result, tended in their haste more than before to imitate predecessors. They might make modifications to be up-to-date but they also copied what was common and increasingly standard practice.[10] Cartographers could produce maps or collections of maps for potential buyers, hoping to reach more people. In doing so they had to respond to different and varied expectations. They did not escape patronage. They still needed financial backing to make the product for potential sale. The shift to copper plates increased the fineness of lines and the general impression made by maps. That improved the market for them and also brought the price to the point where there were more potential customers. There was more concentration on the commercial aspects of cartography, on marketing maps through booksellers. In fact there were no chart sellers in Europe before the introduction of printing.[11] Rather than creating trends printing accelerated ones already evident. The larger number of maps meant wider ownership with more people having maps and those maps having a greater range of information on them. A sign of the changing market was a shift to the use of vernacular titles and legends in place of Latin. Another sign was the tendency to replace words with pictograms, to use signs and symbols to convey ideas so there was a confusion of language and image or rather a combination of the two to convey ideas. The cumulation of technical changes led to the production of collections of charts to uniform scale covering lengthy portions of the world's coasts and in different forms to suit different groups of buyers. The two books of charts by Lucas Jansz. Waghenaer brought together all the advances and exploited the opportunities created by new methods of making and marketing maps.[12] Waghenaer had his successors in the Dutch Republic and they, like he, covered their maps with ships and in all parts of the world.

In the 100 years on either side of 1500 Europeans struggled with the problem of representing new data about the rest of the world. Authors and thinkers searched for ways to describe and categorize the peoples, plants, and lands European travellers found as they sailed around the world. Cartographers faced as great a challenge in trying to incorporate a mass of new geographical information into traditional forms that could not accommodate new evidence.

The problems for cartographers trying to represent the world were compounded first by the discovery of Ptolemy's *Geography* in the early fifteenth century, by the discovery of new lands and then new continents in the fifteenth and sixteenth centuries, by improved measuring instruments and methods, and by the new technologies of creating maps. A whole range of fresh data and novel methods challenged map makers to represent the world in different ways, all without losing the threads of established traditions, including religious ones. The 'discoveries' gave maps a new role not just as reflecting the information explorers brought back but as confirmation of what the real world was like.[13] Just as the map makers worked to find ways to represent latitude and longitude or symbolize dangerous waters they and the artists who worked with them struggled with identifying what sort of decoration was proper, apt, and effective in the context of the new cartography. Decoration is often treated as trivial but in fact it did have a purpose and it was a topic of concern to those who sponsored and those who made the maps.[14] As with trying to establish how to show where land masses were, so too with decoration map makers were trying to establish standards or norms.

'The evolution of…graphic depiction on charts should be seen as one of the most striking features of Renaissance cartography.'[15] Ships became part of that decoration. By the middle of the sixteenth century ships were not an integral part of maps but many cartographers felt obliged to follow common practice and include them. Not only did ships become standard but they also drove out other decoration. On land the towns and castles and kings that had appeared increasingly on charts through the fifteenth century slowly gave way to depiction of physical features. At sea the various monsters that had appeared before decreased in frequency. Ships on the other hand were the continuing and increasing choice to appear on maps. There may have been an increase in religious decoration and manuscript maps may have kept the variety of decoration to suit the market. Overwhelmingly, though, as other items were driven off the surfaces ships stayed and if anything increased in number. After 1550 cartographers must have used pattern books since the same ships often recur. The numerous world maps which from 1511 got ships on them, and more and more frequently, clearly indicated how map decoration had changed.[16]

There is no single explanation for why sailing ships become the common decoration for charts and topographical maps and world maps. The success of ships taking the leading place in ornamenting Renaissance maps depended on varying forces converging and diverging at different times. The background to map making, the history of cartography and the varied cartographic traditions of Europe that came together in the period contributed directly to the inclusion and then the popularity of ships as decoration on maps. Map users understood certain signs and forms and it was those initiated and informed

people that map makers had to accommodate. Rapid radical change was impossible. All novel aspects of maps had to have roots in the existing standards. The late antique circular maps that accompanied the works of Isidore of Seville of three continents had no decoration. Interest in those T-O maps was centred in schematic representation of the land and not the surrounding sea. The disc was all but filled with Asia, Africa and Europe and the surrounding sea took up the narrow space at the edge. Some maps showed the *oikumene* as an oblong but there too room for an encompassing ocean was limited. Still map makers could if they chose add decoration to the sea in early medieval maps. Following the tradition begun by Beatus of Liebana fish filled the waters around the land on some maps. That feature somehow struck the fancy of illustrators of the manuscript the maps were made to accompany.[17] The fish were the only decorative feature, with the exception in a few cases of six open boats mixed in among the fish. That isolated occurrence of boats was an oddity, did not fit larger patterns of medieval cartography, and seems to have existed in only a limited area for a limited time. In sharp contrast to the T-O tradition were the encyclopaedic summaries of Christian knowledge done in large and even giant circular form in the high Middle Ages. *Mappaemundi* were made to recount inherited tradition, to put on one surface as much as possible about Christian history, and decoration bore the burden of the essential purpose.[18] The roots of what appeared were Biblical, accommodated to observation. Animals, part of Creation and mentioned by late Antique Christian writers, were standard fare on land and in the waters.[19] Since ships at sea, with the exception of Noah's Ark, did not figure in the Bible they had no place on *mappaemundi.*

Portolans had different goals and different roots. They had no connection to Christian thought or history. They were based entirely on contemporary information or, at least in the late twelfth and early thirteenth century, information collected within recent memory. Portolan charts were summaries as well but of written sailing instructions, of the collected observations of pilots and sailors who, as they made their way from port to port, recorded distances and directions sailed. Portolan charts were a visual representation of those verbal descriptions of coastlines and so did not have to have decoration. The earliest surviving examples which come from Italy consistently show that the central purpose of the chart was served effectively without any additions. If in fact '…the sailing ship painted on the sea indicates the maritime expedition that made it possible to represent the coastlines'[20] and that was the function of having them on maps then the earliest portolans should have had vessels on the seas. That was far from the case and it took some time before map makers added ships or much of any decoration at all.

The area covered by early portolan charts was the Mediterranean and Black Seas. As Italian sailors ventured into the Atlantic, as maritime contact between

southern and northern Europe increased, and as other mariners explored more of the western front of both their own continent and that of Africa, map makers had to adjust and extend the limits of what their charts described. Portolans remained popular as items less and less for seafaring than as objects for people in ports, for the libraries of collectors and as gifts to impress powerful recipients. One of the reasons for the continued interest was the decoration which they had acquired in the course of the fifteenth century. As the function of portolans as sea charts for navigation declined other secondary functions came to the fore. They were to be informative about geography and also works of art pleasing to the eye. 'Between the time of the earliest surviving sea chart…and the early eighteenth century, when the production of portolan charts ceased, the genre progressed in an interesting manner. In the early centuries, portolan charts encapsulated pioneering technology in the field of hydrography… During the sixteenth century, the portolan charts and atlases responded to the general geographical crisis of the time caused by the new discoveries and the problem of how to produce a flat representation of a spherical reality. Furthermore, their contents were enhanced, the breadth of their subject-matter was extended, and portolan atlases came to foreshadow the cartographic unification which printed world atlases would bring. In their closing centuries…in contrast, portolan charts were gradually sidelined into the sphere of art…'.[21] Before they were sidelined decoration became common on portolan charts, important for various reasons to both makers and buyers.

The translation into Latin of Ptolemy's *Geography* in 1406 added another type of map and mapping in western Europe which had wide-ranging implications.[22] Numerous editions of the work in the fifteenth and sixteenth centuries had maps accompanying them presumably in imitation of the reconstruction of a world map done by Byzantine scholars in the thirteenth and fourteenth centuries based on the procedures Ptolemy described. The method he laid down combined with the influence of portolan charts changed maps. 'Maps no longer needed to present a stable image of a world into which the history of salvation could be incorporated, as in the medieval tradition. They became provisional documents, showing, for a specific moment in time, a world that needed to be constantly redrawn in the light of further discoveries.'[23] Maps were in flux and no place or event deserved special consideration. Maps reflected what was going on when they were made rather than recording some transhistorical events. Like T-O maps the Ptolemaic world maps concentrated on land masses. Ptolemy concentrated on methods of establishing coordinates and of projecting those findings on to a plane surface. There was for him and for the editors of the medieval Greek and Latin versions, unlike with the makers of *mappaemundi*, no need to add decoration.

The functions of the different types of maps and the different approaches to map making in western Europe came together in the late fifteenth century.

Portugal was not the first site of the merger of the varied cartographic traditions but it was the most obvious. Portuguese map makers and, to a lesser degree or with delay, cartographers elsewhere in Europe faced the pressing problem of what to do with the varied approaches to maps in the face of a rising flood of new information about the geography of the world. 'Merchants and navigators on the one hand, scholars and philosophers on the other inhabited much the same cosmos, imagined much the same history, and saw no necessary conflict between the lessons of experience and those of books.'[24] The practical pilot and the professor of astronomy could cooperate in putting together a method of mapping to deal with the changing circumstances. The result of the full convergence of the two came embodied in the first true atlases of the second half of the sixteenth century. The merger led to the production of standardized works which served as compendia of knowledge but of a different sort from the encyclopedic *mappaemundi*. Though it took some time for all the varied types of mapping to come together cross-fertilization and the process of merger was already underway in the late fourteenth century. Catalan map makers made sea charts which also included features of places and of people inland. The Catalan Atlas of 1375 had kings and travellers on land as well as illustrations of stories from the Bible, the type of
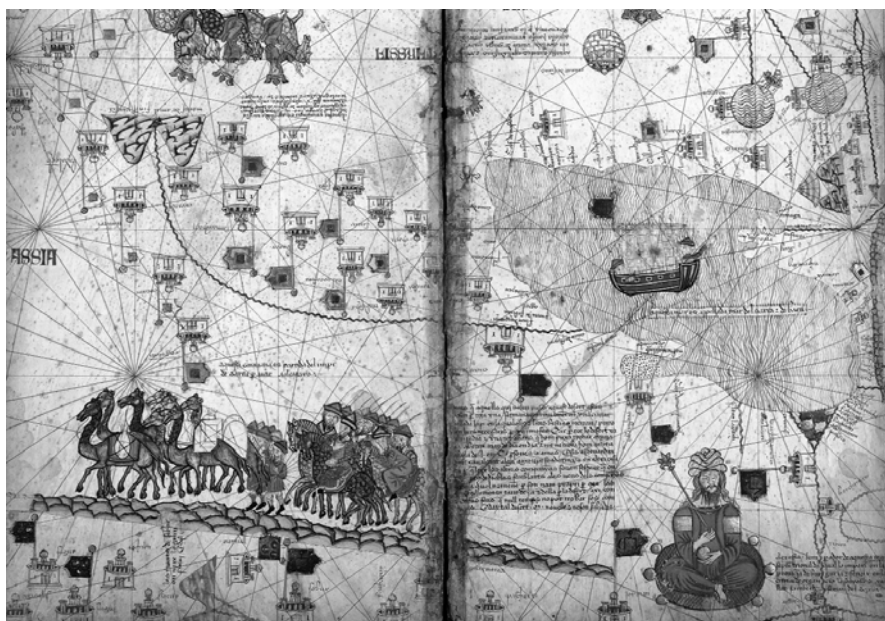
Figure 8.1   Abraham Cresques, Catalan Atlas, 1375. Marco Polo and the rest of the family crossing Central Asia with a ship sailing an inland sea. Bibliothèque nationale de France, Espagnol 30, Planche V.

thing that the makers of the Ebstorf *mappamundi* thought essential to their work [Figure 8.1]. The cartographers of the Catalan school, by including a range of aspects of life on land, put the portolan chart on the road to becoming a world map and began a process of interaction among map traditions which ultimately created a uniform standard for cartography.[25] Catalan cartographers added decoration to portolan charts. In the fifteenth century in their wake a number of world maps got detail taken from a variety of sources including travel accounts and that invited more and different ornamentation. Portuguese cartographers in the early sixteenth century followed their Catalan predecessors, incorporating extensive decoration. They concentrated on the oceans because they were reporting the accomplishments of sailors in finding new sea routes and new lands.[26] They also had the advantage of knowing the work of Ptolemy and so added his methods to their understanding of what they were to do and how they were to go about it. The result in Portugal and in a short time throughout Europe was impressive atlases and large wall maps. The maps had ships and not just the charts in the luxury atlases or the big maps that replaced tapestries on walls in the houses of the wealthy but also on little maps and maps with all sorts of functions.

The merger of the varied map traditions promoted the inclusion of ships as decoration on maps. The geographical discoveries and the need to give graphic representation to the new knowledge also promoted including ships on maps in another and more direct and practical way. Voyages out into the Atlantic already in the fifteenth century changed the conception of the sea and so ideas about the way to depict it on maps as something more than closed, marginal, and limited.[27] On Ptolemaic maps and on earlier T-O maps there had been little room for the waters of the earth. Maps to accompany the *Geography* covered only about 180° of the globe. The voyages to the New World in the years around 1500 led to an expansion of that range to about 250° and then the Magellan expedition forced cartographers not only to include the full 360° on world maps but to include a very large, unexplored and, therefore, empty Pacific Ocean. Suddenly artists had a great deal of space to fill. Martin Behaim in making his globe in 1492 was the first to face the problem of nothing between Europe and Asia but ocean and he filled the empty space with text, largely from the writings of travellers. By the 1530s though the Americas filled part of the great surrounding sea the gaps with open space were even more massive thanks to the ongoing discoveries. Such blank spaces were most likely bad for business. While there may be no such thing as empty space on a map and it may be that blank space should be seen not as a gap but as a silence, the fact was that cartographers had more surface open to them, more room to decorate if they chose to, and with potential commercial advantages if they did something with the gaps. Just as the changes in world maps in the fourteenth and fifteenth centuries created space for the New World when Europeans found it so too the transformation made room

for ships as decoration.[28] The ships on the open seas offered 'fill'. Leaving oceans blank was of course an option and many map makers did. The large expanses could easily accept something to break the monotony, however, and ships were a logical choice. They were plastic, able to expand or contract to any convenient size. They could be shown at different angles so the same ship, repeated, could indicate the nature of navigation as well. There were potential benefits from using ships just simply to meet a practical need and with possibly positive by-products.

The inclusion of ships also fulfilled another purpose found in the fourteenth and even in the thirteenth century for decoration. Ships could tell a story and one important to the larger purpose of the map. Just as Matthew Paris added ships off to the coast of Palestine in the mid thirteenth century or the anonymous artist added a shipwreck indicating the loss of Margaret of Norway to the Gough Map in the middle of the fourteenth so too Diogo Ribeiro included a ship on his 1529 planisphere which suggested the route of the first circumnavigation of the globe. Johann Schöner on a 1523 globe like Battista Agnese in the mid sixteenth century put in a black line showing the route of the ships that started out under the command of Magellan and returned to Europe under the command of Sebastian del Cano. Others like Georg Hartmann and Sebastian Münster in Germany in the first half of the sixteenth century used ships to chronicle or indicate the story of a momentous event. The storytelling function was not always a prominent part of the purpose of ships on maps but it was one which carried on into the late sixteenth century when artists needed no special purpose or reason to include what was standard matter. The story might not be a report of a past or real event. Observers looking at the decorative ships on the maps could ponder sailing the open ocean on voyages to distant places, the vessels being the vehicles for those imagined travels.[29]

'The painter…fulfilled an important role in Renaissance map-making.'[30] The decorative elements were typically done by specialist artists, men different from those who drew the coastlines and rivers. If indeed the illustrators were professionals whose task it was to represent the world in an engaging manner then even more the sheer entertainment value of the ships and other objects would have been a central reason for their inclusion. The extra art work added to the value especially of manuscript maps, putting them further into the category of luxury items and differentiating them from more commercial printed ones. Painters were prone to follow existing practice. The pressure from patrons and their expectations to have something recognizable and similar to what they knew helps to explain adherence to tradition. Laziness on the part of the artist is another excuse. Inventing something new required imagination and experiment. The former meant work and the latter meant risk. Artists often copy what is known and therefore what is acceptable. That was especially true

in an era that was not familiar with the Romantic vision of the struggling artist in conflict with society. If it was the tradition and standard form to include ships as decoration on maps then artists would include ships on maps. The expectation guaranteed the result. Conversely if the tradition was no ships then there would be none. The many islands books generated from the early fifteenth century on and expanded in the sixteenth century to include islands around the world still did not have ships sailing around the subjects of the books. Once the trend began to put ships on maps and especially world maps there were strong pressures to reinforce the tendency. Decoration with ships became a sign of quality of a map. That sort of illustration could easily make the map a luxury good. It was in the interest of artists to promote such a tradition. They had no reason, artistic or commercial, to change the trend. In fact, it served them to promote it.

The period when ships became a standard part of European maps was also a period of a massive increase in all sorts of scientific illustration. That is not to say that ships on maps were the same as that type of work but it is more than coincidental that the sixteenth century was a time when new books describing varied technologies began to appear accompanied by sketches of ever greater clarity, complexity and precision. Maps were similar in that they too were devoted to describing. They were by definition graphic but with science and engineering graphic depictions were often a novel addition. Scientific illustration embarked on the road to developing a standard set of signs, symbols, and conventions. Naturalism was not an invention of the period but interest in showing the particular with accuracy and in great detail was. Most notably in the courtly culture of Italy the illustration of technology took on a new character at the end of the Middle Ages. It became both informative and charming, both didactic and elegant, designed to report developments in ways of doing things, to entertain the uninformed observer and to convince the viewer of the value of the technique depicted. In this transformation pictures took on some intellectual authority. The new ways of drawing technology, and especially machinery, spread to all kinds of illustration and that included the representation of the physical world.[31] The expression of naturalism in precise drawings of machines or the human body and for a number of manuals was new as was the development of novel projections and different ways to represent the objects of illustrations. Improvements in printing and in the fineness of line that wood block makers and then engravers could generate promoted the use of those projections and varied views in collections about machines. Works like Dr. Georg Bauer's 1556 *De Re Metallica* or Agostino Ramelli's 1588 *La Diverse et Artificiose Machine* marked the success in putting illustration to use in explaining engineering and mechanical as well as chemical processes [Figure 8.2].[32]

The depiction of ships on maps was something similar to or was part of the larger effort to improve the quality of scientific illustration. The success of
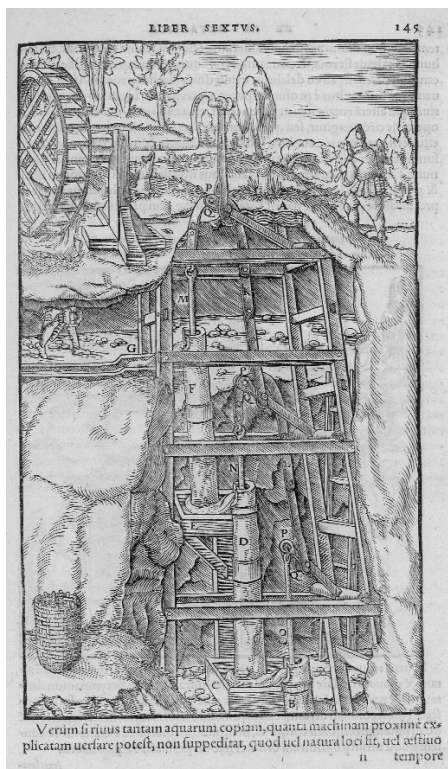
Figure 8.2   Chain of pumps in use in mining, an illustration for *De Re Metallica* by Dr. Georg Bauer, known as Agricola, from a Basle edition of 1561. The John Carter Brown Library at Brown University.

cartographers is confirmed by other sources, written but more recently available archeological sources. The vessels excavated in recent years tend to confirm what the artists drew. To satisfy the predominating classicising tendencies of Renaissance thought and art some painters might clothe their vessels in ancient garb. But even underneath the scroll work like that of Roman sculpture they were still very clearly contemporary ships. The lines of the vessels, like the form of the machines or the drawings of the human body, were intended to be accurate.[33] One reason to put the ships on the maps was to offer descriptions of contemporary vessels. The different types that did appear and did recur, vessels often of the latest and most novel designs, indicates that many artists, cartographers, publishers and patrons wanted their maps to be a medium for presenting another form of scientific illustration showing how an extremely complex and highly effective machine worked. In the era before artists came to rely on pattern books for the depiction of ships, before the vessels became standardized, those people were free to draw particular types of vessels. The custom-made manuscript maps offered a

chance to represent certain ships of specific designs. The same was true but to a much lesser extent with early printed maps. Artists producing charts could respond to and had every reason to respond to clearly defined requests for certain items. There was not only freedom to be precise about the technology of ships but also presumably pressure from buyers to do something unique and up-to-date rather than something ordinary. Ships were illustration as well as being decoration.

The most common ship artists placed on the seas of the world up to 1550 was the *carrack*. Developed in the fourteenth century in its larger and refined version, it became the workhorse of Portuguese trade with India and with northern Europe. It was the obvious favourite for Portuguese map makers and so the model for others as they turned to add ships to maps. The vessels were three-masted *full-rigged ships* but four-masters with an added bonaventure mizzen often turned up. The deep waists of so many of the vessels were a sign of the size of the *carracks*. Artists wanted to make clear that the vessels on the maps should be impressive. In the process they indicated that shipbuilders, to get greater size, did not build *carracks* longer or wider but higher, giving them multi-level castles both fore and aft. Their size presented problems and limited their use and map decoration indicated that by the apparent decreasing frequency or rather the decreasing dominance of big *carracks* among the ships on maps by the mid sixteenth century.

One type that increasingly figured on the maps of the Atlantic was a three-masted *full-rigged* vessel with lower castles than a *carrack*, a shallow waist and straight or almost straight gunwales. Some could possibly be *galleons*, sailing ships which developed rapidly from the 1530s to the 1550s to carry a heavy cannon forward in the middle in imitation of the *galley*.[34] Some could possibly be precursors of that type and the map illustrations indicate that ships used to cross the Atlantic were already taking on *galleon* lines in the early days of the development of the type. The vessels are certainly smaller than the heavy *carracks* that show up in the Indian Ocean and it may be that artists were simply trying to show a relatively smaller three-masted, and in a few cases four-masted, ship. Vessels that made the voyages from Seville to the New World could be and often were smaller than the ones that made the much longer and more arduous journey from Lisbon to India. The map illustrations often reflect the difference and also suggest that shipbuilders were already refining the design of the *full-rigged ship* to suit Atlantic trades before or at the same time as they added powerful armament. In any case the maps show the precursors of the standard Spanish, and for that matter European, warship and heavily armed cargo ship of the late sixteenth century. All the *full-rigged ships* hint at an increasingly divided sail plan with the incidence of topsails on main and foremasts growing and the size of the mainsail relative to that of all other sails decreasing. Maps show the trend was underway in the first half of the sixteenth century. That evidence is invaluable

since the wrecks explored by nautical archeologists have lost rigging and so can not contribute to understanding the evolution of sail plan.

A map is the source of the oldest surviving illustration of a Portuguese *caravel*. Each of its masts carries a lateen sail. It has a low profile and appears to be relatively long. While the *caravel* shows up often along the African coast where it gained a reputation for value as a vessel for exploration artists put such ships in different seas suggesting that its success in the fifteenth century led to widespread use in the sixteenth. The maps also show another kind of *caravel*. The large *caravel*, often called a *caravela redonda*, with lateen sails on three masts and a square sail on a small foremast is recognized as a ship in use in Portugal through the sixteenth and seventeenth centuries and one that made voyages to India from the beginning of the opening of the all sea route. Not only the rig but a distinctive prow set the large one apart from the smaller and presumably earlier one.[35] Maps of the fifteenth and early sixteenth century add another large *caravel* to the range of the design. In many parts of the globe, from the Atlantic and Caribbean to the Indian Ocean, cartographers included a three-masted *caravel* carrying only lateen sails. The type appears so frequently as to suggest that it was common, that captains preferred in a number of instances to use nothing but triangular sails on their vessels in place of full-rig. The depictions suggest that an all lateen rig appeared not just on vessels with high ratios of length to breadth. The depictions suggest that builders could anticipate captains choosing that option for the rig on three-masted sea going ships. The illustrations suggest that there was a form of *caravel*, perhaps tubbier than the two-masted versions but shorter and smaller than the four-masted version and suited for sailing almost anywhere in the world. In that case the map decoration gives new and distinct information to supplement written and archeological sources about ship types of the period.

Map artists included *galleys*, a type that was long in use in the Mediterranean, on the seas of virtually all parts of world with the exception of east Asia. Though *galleys* appear infrequently and even less outside of European waters the maps do show that mariners used the type in the Caribbean and Arabian Seas in the first half of the sixteenth century. In those early days of a European presence in unfamiliar waters the cartographers implied that the newcomers tried out what they knew in terms of ship design in those novel surroundings. Along with the *galley* those same cartographers now and again showed *galleasses*, sailing ships of some size which were also equipped with oars. In fact that type is often the rowed vessel that map makers chose to include in decoration. It was able to survive in the open ocean and it was there, usually in waters around Europe, that it turned up on maps.

Cartographers often showed *cogs* and *hulks* and often in places where they were not used. The two, descended from Celtic prototypes that plied northern European waters in the early Middle Ages, became closely related in the late fourteenth century when shipwrights in North German towns combined fea-

tures from both to create a type that could go by either name. The simpler and earlier *cog* design did persist. It had much sharper posts at both the stem and stern than did the *hulk* and had planking which ended in the stempost, something not true on the *hulk*. The larger cargo ships of fifteenth century northern Europe carried more of the features of a *hulk* and that became the common term to describe heavy, slow moving cargo carriers with a single square sail on a single mast. *Hulks* appeared on maps everywhere in the world, that is on the works of German cartographers working in inland cities such as Strasbourg and Nuremberg and Basle. It was a standard type in the first half of the sixteenth century for the waters of the North and Baltic Seas but those map makers transplanted it to other parts of the world, incorrectly. Their error was an exception to the tendency among cartographers to put ships where they were used. Men like Martin Waldseemüller and Sebastian Münster got their geographical information second hand and apparently they got their information about ship types second hand as well. That explains their limited knowledge of ship design and their putting a type well known in Germany on the oceans all over the world. The fact that not just German but also English, Polish and Low Countries cartographers put *cogs* and variants like the *hulk* on so many of their maps and so often in northern European waters, however, does indicate that in many places such as the Baltic and the estuaries and tidal waters of the North Sea the type held on for some time in the face of competition from *full-rigged ships*.

Cartographers included vessels they knew but also vessels they did not understand. The depiction of exotic vessels started, along with the depiction of European ships, already in the 1375 Catalan Atlas. The appearance of vessels of non-European shipbuilding traditions was part of a more general interest in ethnography. That fascination turned up in illustrations of people and buildings on land, depiction of them flourishing in early sixteenth century maps and especially on Portuguese ones. Signs of an interest in exotic ships, though considerably less than the interest in exotic flora and fauna, recurred a number of times in the early sixteenth century. The most common type that made it on to European maps was some form of a *junk*. It was a type Europeans must have encountered often off the coast of China but even more in Southeast Asia where those vessels served as vehicles for commerce with mainland East Asia. *Junks* would have impressed Europeans with their size and also their qualities as sailors and as cargo carriers. The cartographers in their depictions of junks did not begin to approach the accuracy or detail that they did with European ships but those map makers fared even worse with the rare smaller exotic vessels they tried to draw, vessels which they typically misunderstood.

Maps also got small rowed boats and fishing boats. Their numbers on maps were small relative to their number in use. Obviously cartographers did not find them as interesting nor often as worthy of accurate depiction. With smaller

craft the record of map makers is mixed. With so many other aspects of ships as decoration by the time Waghenaer was publishing charts in the 1570s even fishing boats and relatively small coastal traders were getting something much more like the treatment of scientific illustration that larger *full-rigged ships* had been getting for at least a century. Those lesser vessels indicated too that ships were on maps as part of an effort to illustrate effective machines and ones significantly better than predecessors. Ships were part of the move toward more accurate illustration of technology with ever greater and clearer detail. There were a number of reasons for that and one of the principal causes lurking behind the increased numbers of ships on all sorts of maps in Europe in the sixteenth century was the growing sense of accomplishment in matters maritime.

Ships for cartographers and for their patrons and for those men who thought about and wrote about geography could serve as signs of the conquest of the sea. One task map makers had thrust upon them was to give graphic expression to the accomplishments of the Renaissance and with that they played a role in the transformation of Europeans' ideas about themselves and about the world.[36] While in voyages to the Canaries Portuguese and Spanish and Italian sailors were imitating the classical past, recreating Roman travel to what the ancients called the Fortunate Isles, by the mid fifteenth century matters had changed dramatically. It was already obvious and became more so with virtually each passing year that modern Europeans had geographical knowledge greater than that of Ptolemy or of any Greek or Roman writer. By the mid sixteenth century editions put Ptolemy's maps in a volume separate from the volume devoted to modern maps. By the late sixteenth century cartographers produced atlases with only new maps and no concessions to the classical world. The reason Europeans knew more about the world was because they had found ways to navigate the Ocean Sea. They could travel where they chose, more or less, and increasingly so. The oceans were a part of the world which they dominated politically. The ships on maps served as graphic proof of that conquest and also showed the vehicles that had given Europeans their new authority over the oceans. Over time people put on maps what they thought was important. Ships on maps in the years around 1500 were there because people involved in making maps from governments that commissioned them to the artists who decorated them understood that ships gave Europe new status relative to other peoples of the world and relative to their ancient forebears. It was much more than colonies that kings added to their realms in the first half of the sixteenth century. Up to 1550 the colonies that Europeans established overseas were few and not highly successful. The Portuguese in Asia had what was little more than a string of trading posts. The Spanish in the Americas had settlements on Hispaniola and Cuba which required continued support and they had only recently conquered Mexico. The English and French could boast little more than temporary fishing

stations in Newfoundland. Over time those colonies would expand but up to the mid sixteenth century what was colonized and colonized first was the sea.

European and especially Portuguese sailors in the sixteenth century went places which, with the exception of certain fellow Europeans, other peoples could not. Greeks and Romans had never succeeded. Chinese mariners presumably could but they or their government chose not to try. Malaysian seaman travelled across the Indian Ocean at will long before Europeans arrived but did not venture beyond the Cape of Good Hope or into the Pacific. There Polynesian sailors, possibly drawing on Malaysian practice, travelled widely populating islands spread out across a broad expanse of ocean. They could, like navigators from other parts of the world, cover great distances and make landfalls after long periods out of sight of land and they did that long before Europeans developed the necessary skills. When in the late Middle Ages and the Renaissance the people on the Atlantic littoral of the far west of Eurasia developed the necessary navigational techniques the results were very different from the pattern that dominated among other peoples and societies which had developed ocean sailing to a high level long before those Europeans. Once they learned how to navigate and once they had the vehicles for long distance voyages, Europeans did not conquer lands as had been the pattern and the goal in the Middle Ages. They conquered the sea and, in the case of the Portuguese, claimed something more or less like conditional sovereignty over it. They even charged fees for using the Indian Ocean through a system of licenses as if the sea were the property of the Portuguese king. Not only did Asians accept the claims, very much under duress and with extensive evasion of the Portuguese regulations which grew from those claims, but so did other Europeans. It was novel to assert authority over the ocean or rather over so much ocean so far from home but it set a precedent which all other western European states were to follow. 'The politicization and militarization of oceanic space, as much as its globalization, distinguished European oceanic expansion from that of other seafaring peoples.'[37] What Europeans and especially the Portuguese had taken by 1550 was the sea.

The conquest of the sea coincided with emerging ideas about sea power. In the sixteenth century European states developed their own navies and set the pattern for modern naval warfare which began in the Baltic as the century came to a close. States developed a new understanding of their relationship to the sea and their ability to control the traffic on it.[38] Cornelis Duplicius de Schepper (1501–55), an accomplished humanist and servant of the Habsburg government in the Low Countries, articulated a new policy of naval dominance of the seas in mid century. He gave strategic vision to a newly emerging naval policy, inspired in part by his reading of the classics. He urged his sovereign, the emperor Charles V, to make himself master of the sea. Doing so was tied up with Charles' reputation and his honour but also with making the

North Sea safe for commerce and for enhancing his authority.[39] The Habsburg court was not the only one which sought power over the seas. At the end of the Middle Ages the ocean was not a place controlled by any political power or authority. While some medieval rulers had claimed authority over certain waters close to their shores no one had ever claimed large expanses of the world's oceans as their domain whether on their own or backed by the pope. The papal bull *Inter caetera* which gave rise to the Treaty of Tordesillas and divided the world and its oceans between Spain and Portugal in 1494 was a significant expansion on established papal claims to ultimate authority over newly discovered lands. The bull and the Treaty of Tordesillas would lead to debate, conflict, and ultimately to arguments for the freedom of the seas but it was not until the early seventeenth century that the Dutch jurist Hugo Grotius made claims that the seas should be free for communication. Up to 1550 freedom of the seas was a concept unknown or certainly never discussed.[40]

Maps were indicators of that new dominance over the waters of the world. Ships on maps were indicators of dominance of the seas. Renaissance cartographers used symbols on maps to convey whatever political purpose they may have had. Not all maps and not all symbols had a political purpose but in some instances the intention was obvious.[41] Maps were convenient since they could serve to support a sense of territorial entitlement, to announce claims of sovereignty even though giving those claims any content, considering the distances involved and existing technology, was virtually impossible. It seems highly likely that patrons as well as map makers understood when there was political content and intent in the results of their efforts.[42] The Miller Atlas combined symbols on land and sea. For the former there were many banners and shields bearing the arms of Portugal. For the latter there were ships sailing the oceans, to advertise the proposed empire of King Manuel I. The Atlas itself appears to have been a vehicle to gain approval for his imperial status.[43] Saxton's book of county maps had a portrait of Elizabeth I and royal arms on each of the maps just as the 11 provincial maps of Lazius' 1561 atlas of Austrian Hapsburg lands had an imperial eagle on each.[44] Even Jan Lucas Waghenaer's set of charts had a political purpose. He dedicated the first volume to William of Orange, the defender of the Netherlands against the monarch Philip II. The second volume he dedicated to the government of Holland and individual maps got indications of their political overlord, that is except the provinces of the Dutch Republic which got their own shields asserting their independence from any higher authority.[45] The ships on maps from their first appearance in the Middle Ages down to the mid sixteenth century were not immune from performing some symbolic political function. After all, 'Just as honorifically decorated land maps could instill and reinforce a sense of power and authority, so fine examples of charts of the oceans of the world could allow a sense of transoceanic power to develop in the recipient.'[46]

The pre 1375 illustration of a ship on a map is of the Holy Land, an area of conflict which Christians were desperately trying to hold against an irresistible long term campaign by Muslims. The map was unique as was the map maker. Matthew Paris was precocious and out of the ordinary. His work did not fit in with the norms of the day. The ships just off the coast were almost an afterthought and the map itself was hardly a necessary part of the work it accompanied. The ships illustrated a phase in some of the first efforts of Europeans to push out the borders of that part of the world where their practices, religion and culture predominated. The tradition of adding ships to charts and world maps began with the Catalan Atlas in 1375. In the same way that Abraham Cresques decorated the land with depictions of kings who dominated their realms on land so too he decorated the sea with ships.[47] The choice for the European ship was that of a traveller and explorer, Jacme Ferrer, engaged in a voyage of exploration to discover new lands. The cartographer from Majorca borrowed from other traditions in making his large map and that contributed to his ability to include decoration. He chose, among other things, to add ships and especially one involved in an experiment to master the sea. His successors through the rest of the fourteenth but even more so in the fifteenth century followed his lead.

Forms of decoration other than ships proliferated in the sixteenth century to show that Europeans were in the process of conquering the seas. Just as kings appeared on land as early as the Catalan Atlas in the late fourteenth century to show they were rulers there, in the early years of the sixteenth kings appeared on the sea. Within a very few years of Vasco da Gama's first voyage to India around the Cape of Good Hope King Manuel I of Portugal turned up on Martin Waldseemüller's second world map off the southern tip of Africa, riding a fish or dolphin [Figure 8.3]. The map was called a marine chart to record Portuguese voyages and the knowledge about land and sea that came from those voyages. It was a large wall map and perhaps only the second large cartographic work – the first was Waldseemüller's earlier world map – thrown on the market complete with legends and pictures to try to attract buyers. On land there were depictions of animals and of regal figures. At sea there was only one king. The inscription above the monarch reads *Critianissimi emanvlis regis portogalie victoria*. The conquering most Christian king of Portugal holds the reins guiding a sea beast who has a bit in its mouth. The king has a crown on his head, a sceptre in his right hand and a staff with a cross and a flag flying from it in his left.[48] The image of a ruler of the seas may have had its roots in illustrations of the classic ruler of the oceans, Neptune [Figure 8.4]. Jacopo de' Barbari's massive 1500 bird's-eye view of the city of Venice was a wall map. It included, prominently, a large image of the god complete with trident and a label identifying him as residing in the port and calming its waters. He is shown at the confluence of the navigable canals riding a fish.
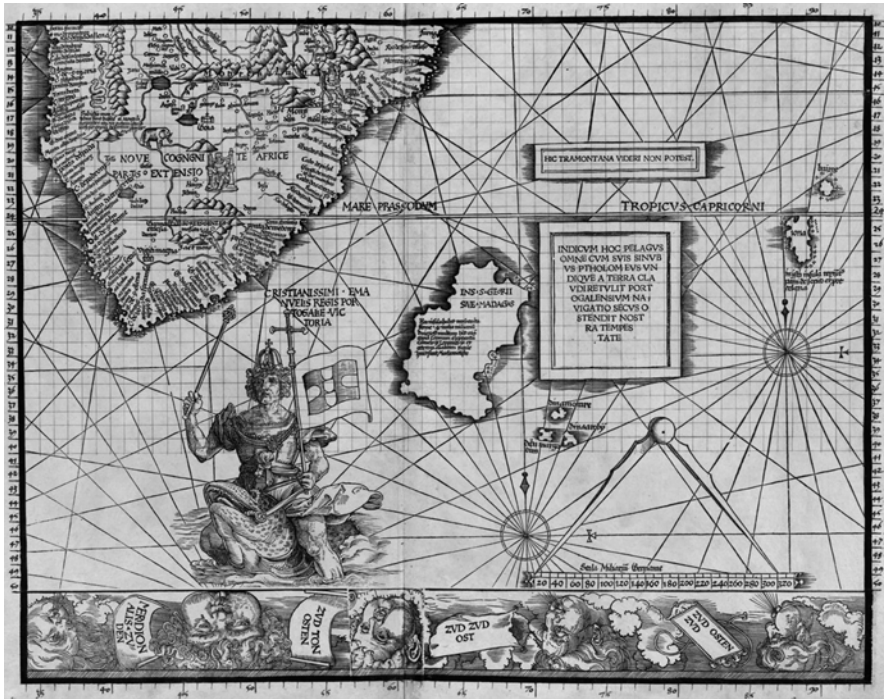
Figure 8.3   King Manuel I the Fortunate of Portugal mounted on a fish off the Cape of Good Hope, detail from Martin Waldseemüller, world map from his *Carta Marina Navigatoria Portugallen Navigationes Atque Tocius Cogniti Orbis Terre Marisque…*, 1516. Courtesy of the Library of Congress, Kislak Collection.

The harbour is filled with ships, intended to show the prosperity of the city but also to indicate the close ties between Venice and the sea.[49] In his 1540 world map Sebastian Münster as much as described the battle to win command of the oceans of the world with two ships under attack, one from Neptune and the other from a sea monster. It is the battle to conquer the seas, to overcome the dangers and rule the waves stated in one image.

In 1493 a copy of Columbus' letter describing his first voyage, published at Basle, carries an illustration with the explorer in a small boat meeting the natives of Hispaniola. He has left his main ship, a *galley*, that sits off shore and which looks much like the *galleys* of the almost contemporary works on pilgrimage published at Mainz and Lübeck. At the end of the publication is a two-masted *carrack* almost certainly based on an illustration in Breydenbach's *Peregrinatio*.[50] A 1505 broadside intended to introduce Amerigo Vespucci's description of the New World shows islands populated by indigenous people and at sea two single-masted and one *full-rigged ship* [Figure 8.5]. Repeated in a number of forms and in different languages, the covers of the first works about the discovery of what the authors and cartographers would deem to be
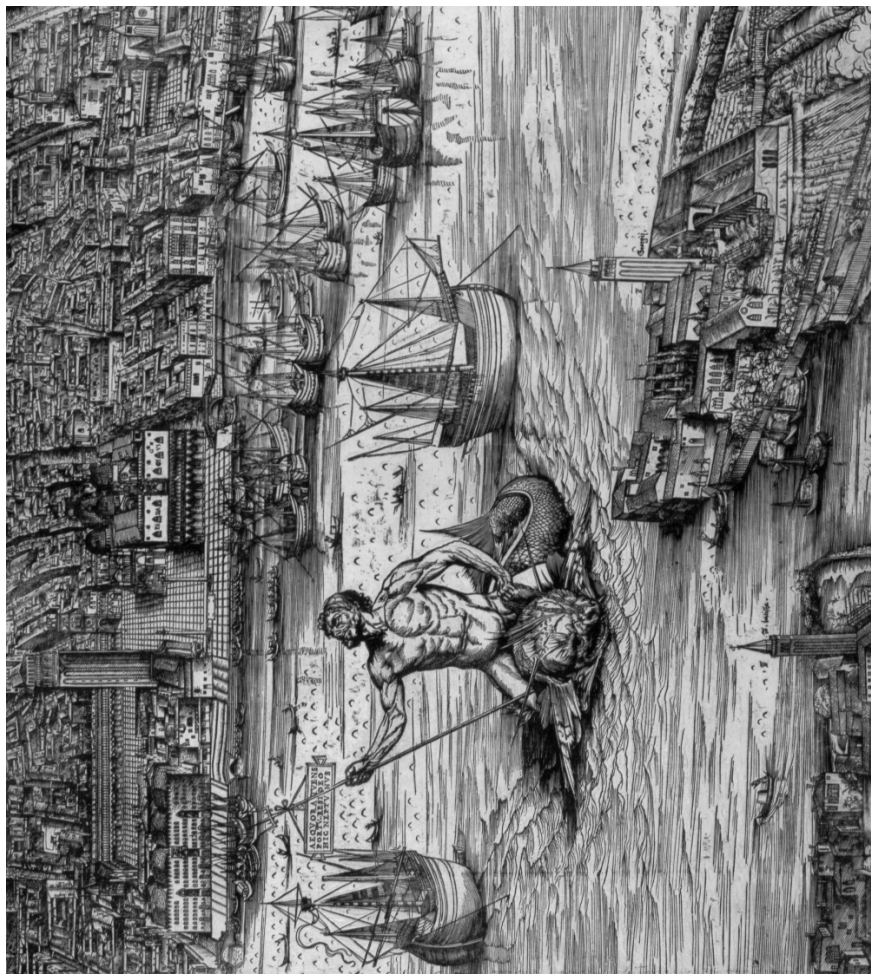
Figure 8.4 Neptune, riding a large fish, from Jacopo de' Barbari's bird's-eye view of the city of Venice, 1500. Courtesy Novacco Collection, The Newberry Library, Chicago, Vault drawer Novacco 8F 7 (Sheet 5).

Figure 8.5   People of the New World as seen by the Christian King of Portugal, from a work by Amerigo Vespucci, Leipzig, 1505. Herzog August Bibliothek, Wolfenbüttel: QuH 26 (5).

America had ships and in at least one case a royal figure, probably Ferdinand the Catholic, sitting on a throne surveying the new found lands across the sea.[51] In a similar vein was the tapestry designed by the Flemish painter, Bernard van Orley, to commemorate the 1525 marriage of the king of Portugal to a Habsburg heiress. The newlyweds are shown as Jupiter and Juno standing over globes which show the world or the large part of it including the seas where the king claims sovereignty. Globes long had symbolic meaning but they appeared more frequently not just to chart voyages of exploration or trade routes but also to indicate areas of rule.[52] They did not always have ships on them but they did appear with kings.

John Dee, the English cosmographer, on the title page of his *General and Rare Memorials pertayning to the Perfect Arte of Navigation* in 1577 placed an illustration of land and sea with a large *full-rigged ship* on the right called the *Europe*. Seated in majesty and holding a sceptre at the stern of the ship is Queen Elizabeth I, clearly identified with a banner above her head. Beside the ship is Europa riding the bull who is Jupiter, connecting the ship to the classical myth. The implication is that the queen should command Europe just as she commands the seas from the throne set on the aftercastle of the vessel.[53]

Not long after the government of the Netherlands developed a policy seeking mastery of the seas, in 1557, Hieronymus Cock off the coast of Holland, Zeeland

Figure 8.6 Philip II riding on a shell drawn by horses controlled by Neptune off the coast of the Netherlands, from a 1557 map by Hieronymus Cock. Courtesy Novacco Collection, The Newberry Library, Chicago, Novacco 4F 155.

and Flanders in his map of the region, placed Philip II sitting on a shell drawn by horses [Figure 8.6]. In a caption Neptune addresses the monarch, telling him that the sea god's maritime realm belongs to the king as far as the world extends. At some point the whole world shall serve the king and the rights of the trident shall be his, Neptune declares. The allusion is to Philip dominating the oceans of the world.[54] The addition of the monarch at sea asserted, even more dramatically than Waldseemüller's King Manuel I the Fortunate on a sea creature, the idea that Europeans had gained command of the oceans and that the conquest could be depicted by placing someone or something in the middle of the sea. A Habsburg riding the waves was a persistent image. When Cock printed a copper plate of the Spanish cartographer Diego Gutiérrez' map of America in 1562 [Figure 8.7] he put a large number of ships in the Atlantic, including four involved in a naval battle south of the equator, and in the middle of the North Atlantic Neptune carrying his trident driving three horses pulling a chariot in which is seated a regal figure with crown and sceptre. It is the image of Phillip II again.[55] Willem Jansz. Blaeu (1571–1638) in the middle of the Dutch Revolt against Spain in 1608 published a map of America complete with many ships all over the world's oceans and in mid Atlantic there is a canopied cart with paddle wheels floating in the sea pulled by three horses with three Indians attending a regal figure riding under the canopy. The man in majesty holds a sceptre and though he is not identified the Habsburg jaw confirms it is a king of Spain. As late as 1686 in an atlas Joan Blaeu (1596–1673) had the same king in mid Atlantic being pulled along by three horses with Indians around him. Neptune
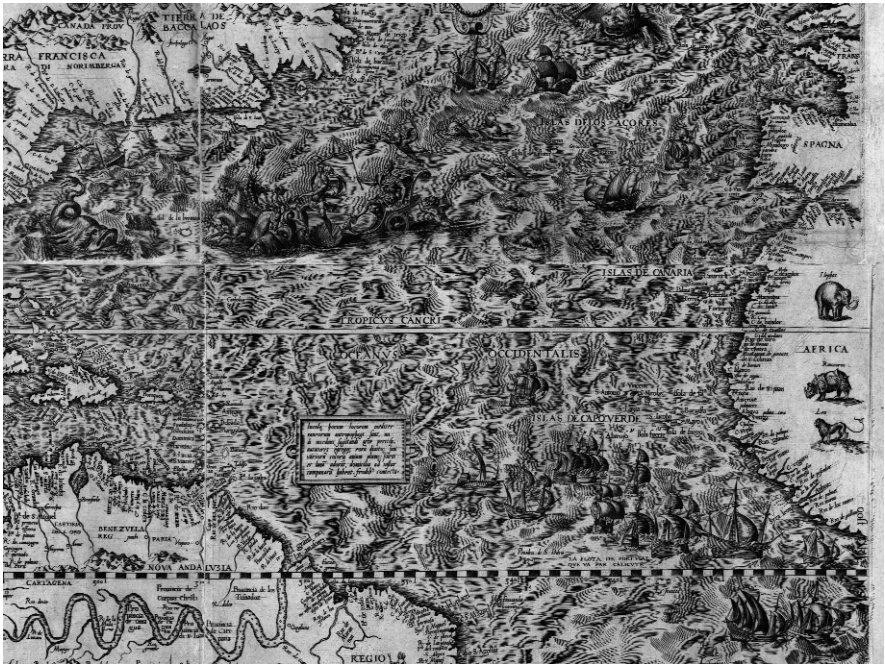
Figure 8.7   Diego Gutiérrez, compiler, Hieronymous Cock, engraver, *Americae Sive Quartae Orbis Partis Nova Et Exactissima Descriptio* [Antwerp]: 1562, North Atlantic with monarch riding a chariot over the sea. Courtesy of the Library of Congress, G3290 CT000342.

was off in the Pacific along with others riding sea beasts.[56] The Dutch Revolt against Spanish rule had long been successful yet the image of the king ruling the seas remained in an atlas produced in Amsterdam. The kings shown at sea from the early sixteenth century on were there, like the ships that preceded and accompanied them, as symbols of the conquest of the world's oceans by European sailors and of their novel technology in navigation and in ship design.

Oceanic control and in all parts of the world was to become, even if slowly, a defining characteristic of power for Europeans.[57] A principal source for the uniqueness and of the ultimate precedence of European states and their off-shoots around the world in subsequent centuries was success at sea. Even in the early sixteenth century many contemporaries already perceived how important those voyages over the open ocean were. People at the time could not appreciate the full long term consequences of the conquest of the sea but they could realize how the ability to sail the world's oceans and to explore the lands bordering them set Europe apart from any past people and from others of their time. '…the map is the most powerful of all power-filled rhetorical tools…'[58] and the pictures that were maps generated a composite of perceptions and ideas inseparably woven together making an argument. Cartographers in producing those of necessity imprecise impressions of the world accommodated their patrons. Map makers

told their paymasters what they wanted to hear, or more precisely put on the surfaces of their charts what their audience wanted to see. They did that in many ways and one of the them was by putting ships on the oceans of the world. It was not just the patrons who determined that ships should be on maps. It was not some emerging centralized political power that enforced the decision. All kinds of individuals involved in the conception and execution of maps over time concluded that decoration with ships was proper and for a number of different reasons. Map makers struggled with ways to show the now-much-larger world. They also had to address the very practical needs of pilots and of all sailors who needed help in finding their way. The diverse pressures and demands fed the shape and character of maps and mapping.[59] One response to the range of pressures and ideas that fed Renaissance cartography was the decision to include more and different ships on maps.

The ability to accommodate the mass of new data and to represent it along with a range of ideas about the world and what was going on in it gave cartography a prominent place in the intellectual and cultural life of Renaissance Europe. Erasmus of Rotterdam in his 1522 colloquy *The Godly Feast* (*Convivium religiosum*) describes how after lunch the host, Eusebius, showed his guests around his house. After visiting the summer room with its view of the garden and scenes on the wall including a Last Supper, a story of Antony and Cleopatra, and one of Alexander the Great among others, he takes them to the final room, the library, with analogous decoration. Eusebius points to the central object of the room saying, 'This suspended globe puts the whole world before your eyes. Here on the walls every region is painted in a larger scale.'[60] The library has, he says, the main part of his wealth and in that he means the carefully chosen few important books. 'An abundance of pictures and images, both sacred and profane, with quotations or mottoes attached, gives Eusebius' villa an emblematic character enhancing the pleasure of the guests and the significance of such a house for thoughtful readers.'[61] Among those objects and indeed one of the principal objects was the suspended globe. It, along with wall maps offering greater detail of what was on the globe, was given pride of place among portraits of famous authors and even precedence over scenes from classical history. Geography for northern Europe's most famous writer and prominent humanist in 1522 was a topic to be lauded and respected and one worthy of a place in the discussion of Christian liberty and the correct interpretation of Scripture, the topics of the colloquy.

Erasmus' close friend from England, Thomas More (1478–1535), took advantage of the voyages of exploration and the interest in geography to frame an attack on contemporary politics and society. His *Utopia* of 1516 became justly famous, going into a second edition in 1518. Both the first Leuven and the second Basle versions had an accompanying map of the island More described. On the map there were three ships, one large three-master and two smaller vessels. Island maps, going back to those fifteenth century island books, did not get ships. In the case of *VTOPIAE INSVLAE TABVLA* the artists, in 1516 probably

Gerhard Geldenhauer and more elaborately and precisely in 1518 Ambrosius Holbein, Hans the Younger's brother, provided vessels very much of contemporary European type.[62] The ships were simply a part of a humanist work, a form of decoration which fit comfortably into the understanding those thinkers had of the world in the period when explorers were conquering the seas.

The study of geography and its graphic expressions in maps were part of learning by the time More and Erasmus wrote. The discoveries gave geography a new importance. They also gave map making new status as the making of modern maps took on a new urgency. The trend toward greater respect for map making and greater value given to the products of cartographers which started in the high Middle Ages accelerated rapidly in the fourteenth, fifteenth and early sixteenth centuries.[63] In Eusebius' library the role of the medieval *mappamundi* was taken over by the globe. Erasmus' interest in maps and globes and in geography in general was something shared by other humanists, especially in the wake of the Latin translation of Ptolemy's *Geography* and its subsequent widespread dissemination. Humanists were not alone. Nobles and monarchs took an ever greater interest in geography, in owning globes and in decorating their palaces with maps from popes to kings to emperors. Those men liked maps because of their immediate and practical uses but they also liked maps because of their beauty and as objects to collect and be enjoyed.[64] Maps were an expression of scientific findings and enjoyed enhanced and growing status because of it. They summarized and presented a range of information and so served the purpose of any accumulation of unique and interesting items. They became part of collections of curiosities, those assemblages of odd strange items that filled the very popular *studioli* in Italy and their equivalent, the *Wunderkammern* in northern Europe.[65] They were even more a graphic representation of the contemporary understanding of the physical world. The sales of giant world maps which came off the presses in both northern and southern Europe in the early decades of the sixteenth century and of the prototype atlases which followed them along with the profusion of new topographical maps indicate that cartography was important to many people. Maps were common enough by the mid sixteenth century to show that Renaissance Europeans thought about and had an interest in geography and its presentation. The images were a way for them to understand their place in what was a much changed world and gave them ways to understand their own identities.[66] Putting ships on the maps that presented the new and varied geographical knowledge was a way to express the sense of accomplishment that came with the greater ability that Europeans demonstrated from the thirteenth century on to travel the waters first close to the continent and later beyond and even far beyond. The ships on maps filled space, offered illustration of emerging technology, reflected existing artistic traditions, and added more beautiful components to works of art. The ships also indicated the conquest of the sea or at least the technical ability of Renaissance Europeans to go where no people had ever gone before.

Epilogue

Ships virtually disappeared from maps in the eighteenth century. Some still appeared but rarely. At least those few were, as in previous years, always of the latest designs.[1] The reasons for the abandonment of ships as decoration are even harder to discern than those for the appearance of vessels in the Renaissance. There is certainly no single explanation for ships vanishing just as with their relatively sudden proliferation. Technically cartographers could produce more refined maps over time as they shifted from engraving to etching. The lines were finer, the writing more legible and the drawings more varied. Though etching did not produce the elegance of engraving it did produce about twice as many maps per plate which made the move in a business sense more reasonable.[2] The drive toward standardization which began with the introduction of printing to map production was a tyranny by the eighteenth century. The disappearance of manuscript portolans, the last of the entire Mediterranean marking the end of an era in 1688,[3] eradicated the artistic flexibility and impetus to variation which had been under siege from around 1500. By the eighteenth century cartographers were better at depicting ships than they were in the fifteenth and the drive toward precise drawing of technologies was stronger than ever, as Denis Diderot's *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers* of 1751–65 demonstrated. The interest in depicting technologies did not diminish but representations now had a proper place in a confined and defined literature. Using maps as vehicles to show the latest developments in ship design was no longer necessary and in a sense improper.

Artistic trends of the eighteenth century were toward clean, unobstructed and straightforward depictions of nature. Maps typically followed the latest trends in ornamentation. Cartographers moved from something like a semi-abstract mannerism in the late sixteenth century to more naturalistic baroque imagery in the seventeenth century. They borrowed heavily from prints, including maps, by other artists for decoration through the sixteenth and

seventeenth centuries. Ornamentation in the period became more complex as well as symbolic. That meant greater reliance on figurative prints and the shift contributed to the erosion of decoration with ships.[4] In the eighteenth century the increase in classicism in art and the drive toward simplicity affected cartography and took decoration in the opposite direction. Rococo concentration on lightness and elegance and a desire to escape some of the more ponderous excesses of baroque style influenced all artistic work, and especially in France, and maps did not escape the trend. The physical landscapes, and not just in parks and gardens, became more orderly. So too did their artistic representation. Illustration of farms reflected changes in writing about their management. Concern in works in England, for example, turned more toward discussion of ways to improve efficiency, to measure and record and track income and outgo. Vignettes of the countryside show a shift away from depictions of farmers at their tasks and, following the pattern in the texts, a turn toward a more orderly lay of the land.[5] What was true of landscapes was also true of seascapes. The move toward simplicity and directness made depictions of ships more refined and precise but the ships appeared in paintings of ships and not as part of the decoration of maps. The change in style came earlier and was more pronounced in France. In the early eighteenth century Amsterdam lost its place as the centre of cartographic production. The shift to Paris and the domination of the market for maps of high quality by French cartographers certainly made a significant contribution to pushing decoration off maps and that included decoration on the oceans.

Sea monsters lost a place on maps even before ships, probably a sign of '…contemporary confidence in man's ability to achieve dominion over the seas…' Once there was no more terror of the ocean there was no more need for sea monsters.[6] Once ships had overcome the dangers of the sea there was no more need for them on maps. As voyages, both short and long distance, became more routine the drama declined. Europeans had not won the battle with the sea but the heroic days in the struggle were over. 'Between the fifteenth and the seventeenth centuries, the map became more autonomous. No doubt the proliferation of the 'narrative' figures that have long been its stock-in-trade (ships, animals, and characters of all kinds) still had the function of indicating the operations – travelling, military, architectural, political or commercial – that make possible the fabrication of a geographical plan.'[7] By the eighteenth century that was no longer the case. Cartographers did not typically use ships as symbols of the origins of maps in describing voyages but the decorative vessels did indicate what voyages were possible and where people might go. That disappeared over time and in the eighteenth century map makers divorced their products from any process of their creation in story-telling, in travellers tales, in reports of way-finding. The maps were intended as statements rather than part of some unfolding saga. The map in

the eighteenth century, '…a totalizing stage on which elements of diverse origin are brought together to form the tableau of a 'state' of geographical knowledge, pushes away into its prehistory or into its posterity, as if into the wings, the operations of which it is the result or the necessary condition. It remains alone on the stage.'[8]

The vessels in the eighteenth century themselves were less interesting than they had been in the previous three hundred years. Design variations decreased and sea going sailing ships became more standardized in terms of size, hull shape, and rig. Variation in naval architecture among parts of Europe declined as well. Warships even more than merchant vessels became fixed in design as admiralties, a product of the sixteenth century, fixed dimensions and armament in a series of rates.

On maps the seas of the world became more crowded with islands and coastlines of continents discovered and charted by Europeans. The great expanse of the Pacific that faced sixteenth century cartographers now had lands of varying sizes spread around and each had a name which also took up space. The labels everywhere in the world found a place in the seas, pushing out other objects like sea monsters and ships.

The strongest explanation for why ships no longer appeared on maps is that by the eighteenth century there was no need to demonstrate or assert sovereignty over the seas. In 1686 Joan Blaeu still included an anachronistic monarch riding the waves of the North Atlantic but by then the need to show a European ruler dominating the oceans was waning. It had disappeared entirely by the time Parisian map makers were turning out clear and refined representations of geography. By the eighteenth century the novelty of sailing around the world had waned as frequent scientific expeditions and commercial venturers circumnavigated the globe. The Treaty of Tordesillas which had divided the world and its oceans between Spain and Portugal was a dead letter. The ideas of the Dutch jurist Hugo Grotius about freedom of the seas were widely accepted by European states. No crowned head claimed the oceans as his so any need for symbols of domination had disappeared. When the need for signs of control vanished the ships vanished too.

Notes

Preface

1 Buisseret, *The Mapmakers' Quest*, xi
2 Ingold, *Perception of the Environment*, 242.
3 Certeau, *The Practice of Everyday Life*, 119–20; Ingold, *Perception of the Environment*, 219, 241–2.

Introduction

1 Olsson, *Abysmal*, 10.
2 Muehrcke *et al.*, *Map Use*, 15.
3 Wood and Fels, 'Designs on Signs', 99.
4 Wood and Fels, 'Designs on Signs', 54.
5 Harley, 'The Map and the Development of the History of Cartography', 1–5; Ingold, *Perception of the Environment*, 235; Rees, *Historical Links*, 60–2.
6 Delano-Smith, *Maps as Art and Science*, 65.
7 Topper, *Towards an Epistemology of Scientific Illustration*, 243.
8 Buisseret, *The Mapmakers' Quest*, 32.
9 Harvey, *Maps in Tudor England*, 7; Woodward, 'Cartography and the Renaissance', 11.
10 Akerman and Buisseret, *Monarchs, Ministers, and Maps*, 1; Black, *Maps and History*, 1997, 5; Buisseret, *European Antecedents*, 55, 65, 177–9; Smail, *Imaginary Cartographies*, 5; Tyacke, 'Introduction', 17–18.
11 Alegria and Garcia, 'Aspectos da evoluçao da Cartografia portuguesa', 27; Campbell, 'Portolan Charts', 438–9; Kagan and Schmidt, 'Maps and the Early Modern State', 662–6.
12 Cortesão, *History of Portuguese Cartography*, 4–5, 23 (quote); the Greek root of *geography* had the meaning of drawing the earth so the word did not just mean making or studying maps. A descriptive treatise, a drawing in words was as much a geography. See Jacob and Dahl, *The Sovereign Map*, 370.
13 Alegria and Garcia, 'Aspectos da evoluçao da Cartografia portuguesa', 30; Cortesão, *History of Portuguese Cartography*, 7–22; Dainville, *Le langage des géographes*, ix; Jacob and Dahl, *The Sovereign Map*, 18–21.
14 Le Vicomte de Santarem, *Essai sur l'Historie de la Cosmographie*.
15 For example, Kammerer, *La découverte de la Chine par les Portugais*; Wauwermans, *Histoire de l'école cartographique belge*, I, 137.
16 Crone, *Maps and Their Makers*, 13.
17 Burnett, *Masters of All They Surveyed*, 776; Randles, 'The Atlantic in European Cartography'.
18 Gautier Dalché, 'The Reception of Ptolemy's *Geography*', 286.
19 Harley, 'The Map and the Development of the History of Cartography', 5–39; Turnbill, 'Cartography and Science', 5–7.
20 Harley, 'Deconstructing the Map', 152.

21 Harley, 'Maps, Knowledge, and Power', 277 (quote); Harley, 'The Evaluation of Early Maps', 68–70.
22 Harley, 'Maps, Knowledge, and Power', 303.
23 Harley and Woodward, *The History of Cartography*, 1987; Harley, 'Silences and Secrecy', 57–9, 65; Harley, 'Deconstructing the Map', 150–2.
24 Harley, 'Silences and Secrecy', 57, 70–1; Delano-Smith, 'Why Theory in the History of Cartography'; on mental mapping see for example Smail, *Imaginary Cartographies*, 9.
25 Boelhower, 'Inventing America', 479, 484; Brotton, *Trading Territories*, 25; Edney, 'Theory and the History of Cartography', 188.
26 Wood and Fels, 'Designs on Signs', 96 (quote and authors' emphasis); Burnett, 'The History of Cartography and the History of Science', 778–80; Jacob and Dahl, *The Sovereign Map*, 325, 370.
27 Akerman, 'The Structuring of Political Territory in Early Printed Atlases', 144–6; Smail, *Imaginary Cartographies*, 224–5.
28 Harley, 'Deconstructing the Map', 166.
29 Harley, 'Maps, Knowledge, and Power', 282.
30 Harley, 'Maps, Knowledge, and Power', 283.
31 Harley, 'Maps, Knowledge, and Power', 289, 292–7.
32 Jacob and Dahl, *The Sovereign Map*, xv.
33 Jacob and Dahl, *The Sovereign Map*, 9.
34 Barber, 'England I: Pageantry, Defense, and Government', 26–9; Campbell, 'Portolan Charts', 373; Delano-Smith and Kain, *English Maps: A History*, 3–4.
35 Barber, 'England I: Pageantry, Defense, and Government', 26; Buisseret, *The Mapmakers' Quest*, 5, 32; Campbell, 'Portolan Charts', 440; Jacob and Dahl, *The Sovereign Map*, xiii.
36 Grafton, *New Worlds, Ancient Texts*, 74.
37 Skelton, 'A Contract for World Maps at Barcelona', 107–8.
38 Delano-Smith and Kain, *English Maps: A History*, 30.

Chapter 1

1 Dainville, *Le langage des géographes*, 319, 330–5; Delano-Smith, 'Cartographic Signs on European Maps', 10.
2 Delano-Smith, 'Signs on Printed Topographical Maps', 529, 542–3.
3 Topper, 'Towards an Epistemology of Scientific Illustration', 225–6.
4 Campbell, 'Portolan Charts', 393; Ewe, *Schöne schiffe auf alten karten*, 8; George, *Animals and Maps*, 23–5.
5 Harley, 'Maps, Knowledge, and Power', 298.
6 Harley, 'Maps, Knowledge, and Power', 298–9.

Chapter 2

1 Boelhower, *Through a Glass Darkly*, 477; Dainville, *Le langage des géographes*, x; Morse, 'The Role of Maps in Later Medieval Society', 26–7.
2 Mukerji, 'A New World-Picture', 85, 96–102.
3 Berggren, Jones and Ptolemy, *Ptolemy's Geography*, 32–3, Buisseret, *The Mapmakers' Quest*, 12–13; Woodward, 'Medieval Mappaemundi', 299, 330.

4   Berggren, Jones and Ptolemy, *Ptolemy's Geography*, 3–4, 17, 19–24; Buisseret, *The Mapmakers' Quest*, 15–19; Nordenskiöld, *Facsimile-atlas to the Early History of Cartography*, 1973, 1–9.

5   Berggren, Jones and Ptolemy, *Ptolemy's Geography*, 26–7; Harvey, *Medieval Maps*, 12, 17–19; Brincken, *Kartographische quellen* , 42–4.

6   Woodward, 'Reality, Symbolism, Time, and Space', 514–15.

7   Woodward, 'Medieval Mappaemundi', 318 (quote); Brincken, '*Mappa mundi* und chronographia', 143.

8   Edson, *Mapping Time & Space*, 159–63; Olsson, *Abysmal*, 60; Woodward, 'Medieval Mappaemundi', 334–5, 342; Woodward, 'Reality, Symbolism, Time, and Space', 513.

9   Brincken, *Kartographische quellen*, 97; Edson, *Mapping Time & Space*, 164–5.

10 Goss, *The Mapmaker's Art*, 36.

11 Edson, *Mapping Time & Space*, 164; Edson, 'World Maps and Easter Tables', 27–30; Gautier Dalché, 'L'Heritage Antique de la Cartographie Médiévale', 66; Meuree, *La cartographie de l'antiquité au XVIe siècle*, 6.

12 Scafi, *Mapping Paradise*, 170–1; Woodward, 'Medieval Mappaemundi', 299.

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47 Ewe, *Schöne schiffe auf alten karten*, 14; Harvey, *The History of Topographical Maps*, 56–7; Lewis, *The Art of Matthew Paris*, 360–1; Unger, 'The Northern Crusaders'.
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49 Arentzen, *Imago mundi cartographica*, 118; Woodward, 'Medieval Mappaemundi', 342.
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Chapter 3

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3   Albuquerque, 'Portuguese Navigation', 35; Bozzano, *Antiche carte nautiche*, 18–19; Harvey, 'Medieval Maps', 284; Sphyroeras, Avramea and Asdrahas, *Maps and Map-makers of the Aegean*, 23–4.

4   Albuquerque, *Historia de la navegación portuguesa*, 32–4; Goss, *The Mapmaker's Art*, 40–1; Sauer, *Das 'Seebuch'*, 64–71; Zandvliet, *Mapping for Money*, 15.

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34 Filgueiras and Barroca, *O caique do algarve*, 28, 44–6; Skelton, 'A Contract for World Maps'; Koeman, 'The Chart Trade in Europe', 350–1.

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40 Andrews, 'The British Isles', 476; Akerman, 'The Structuring of Political Territory', 5, 16; Bozzano, *Antiche carte nautiche*, 21–2; Cortesão, *History of Portuguese Cartography*, 220–2; Filgueiras and Barroca, *O caique do algarve*, 34–7; Guarnieri, *Il Mediterraneo nella storia della cartografia nautica medioevale*, 56–8; Kretschmer, *Die italienischen*

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41 Fall, *L'Afrique à la naissance de la cartographie moderne*, 36–43; Martín-Merás, *Cartografía marítima hispana*, 31; Nordenskiöld, *Periplus*, 47.

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54 Newberry Library Ayer MS Map 3; http://bell.lib.umn.edu/map/PORTO/ROS/medit.html; Putman, *Early Sea Charts*, 13.

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80 Astengo, 'The Renaissance Chart Tradition', 199.

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Chapter 4

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2   Bennett, *The Divided Circle*, 14–16; Cortesão, *Contribution of the Portuguese*, 13, 18; Waters, *The Art of Navigation in England*, 45–6, 56–7.

3   Albuquerque, *Os descobrimentos portugueses*, 84; Bennett, *The Divided Circle*, 17–20; Crone, *Maps and Their Makers*, 74, 97–8; Maddison, *Medieval Scientific Instruments*, 14; Zilsel, 'The Genesis of the Concept of Scientific Progress', 343–4.

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5   Gautier Dalché, 'The Reception of Ptolemy's *Geography*', 287–95; Edgerton, 'Florentine Interest in Ptolemaic Cartography', 278–80; Edgerton, *The Renaissance Rediscovery*, 97–8; Pelletier, *Couleurs de la terre*, 64–5; Woodhouse, *George gemistos plethon*, 151.

6   Edson, *The World Map, 1300–1492*, 114–20; Gautier Dalché, 'The Reception of Ptolemy's *Geography*', 285; Buisseret, *The Mapmakers' Quest*, 71.

7   Edgerton, 'Florentine Interest in Ptolemaic Cartography', 289; Edgerton, 'From Mental Matrix to mappamundi', 39; Edgerton, *The Renaissance Rediscovery*, 92–3, 101–5; Gautier Dalché, 'The Reception of Ptolemy's *Geography*', 335–6.

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