Porto-Maps

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Emergence of the portolan chart

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Earliest known depicton of a mariner consulting a compass aboard ship (from John Mandeville's Travels, 1403)

European portolan charts emerged around 1300, almost simultaneously with the invention of the mariner's compass. Although the compass had existed and been used long before, the innovation (traditionally credited to Flavio Gioja, a sailor from Amalfi) was to fit a wind rose on the lodestone, so that the navigator-pilot could instantly decipher his bearing or sailing direction.[1] This greatly facilitated nautical steering, and helped pilots plot a course at sea.

However, it is one thing to know what direction one is sailing, and quite another to know what direction one should be sailing. And in this, existing maps were not helpful. In high Medieval Europe, maps were usually mappa mundi, circular "T-O" world maps centered on Jerusalem, drawn from religious inspiration. These maps were geared more to showing the relative location of important locations on land. Little attention or space was given to bodies of water - seas were depicted often little wider than rivers, quite useless for navigators. Nautical plotting, facilitated by the mariner's compass, required the development of accurate nautical charts, with realistically-sized seas and detailed coasts.

It is probably unsurprising that portolan charts probably first emerged in the martime city-states of Italy. At the time (early 1300s), the Republic of Genoa was probably the leading maritime power in the Mediterranean Sea, and the bustling port of Genoa probably the most important commercial seaport. The oldest existing portolan, the Carta Pisana (dated around 1290) was the first realistic nautical map, gridded by compass rhumbs. Portolan-construction during the first half of the 14th C. was dominated by Genoese cartographers, notably the prolific Pietro Vesconte.

(An alternative hypothesis, first proposed by A.E. Nordenskiöld in 1896, was that the first charts emerged in Majorca, possibly with the involvement of the polymath Ramon Llull.[2] This fueled a long, acrimonious debate, often tinged with nationalist sentiments, about the "birthplace" of the portolan chart. [3] But these alternative theories have not gained much traction. Scholars today generally agree that the portolan chart originated in Genoa (or possibly Pisa), and the technique spread to other Mediterranean centers by the way of Genoese commerce and the emigration of individual Genoese cartographers - notably Pietro Vesconte to Venice in the 1310s and Angelino Dulceti to Majorca in the 1330s.[4])

Portolan charts seem to have emerged quite spontaneously and suddenly. They owe practically nothing to earlier maps - certainly not the mappa mundi nor to classical sources (Ptolemy was as yet unknown in western Europe). Although they might owe a thing or two to Arab cartographers like Muhammad al-Idrisi (1154), the European portolan chart is nonetheless quite distinct.[5]. Most known portolan cartographers in Venice were classified as shipowners, captains and navigators, with a practical interest in shipping and sailing directions rather than the whereabouts of Gog and Magog.[6] In Majorca, until recently (1231) ruled by Musim emirs, most cartographers were Jews, unbeholden to Christian academic tradition. Majorcan cartographers are listed as merchants and instrument-makers (bruixoler), and while some also dabbled in astrology and astronomy, it was as a practical endeavour (e.g. constructing calendars). In short, there is hardly a Christian cleric or academic among the portolan cartographers.[7] Portolan chart construction emerged from the docks.

32-wind mariner's compass rose, with traditional names (and traditional color code).

In this respect, the mariner's map mirrored the spontaneous development of the mariner's compass rose. The eight-point mariner's wind-rose (and its 16-wind and 32-wind expansions), also emerged spontaneously in the Mediterranean and also owed practically nothing to classical or academic sources. Medieval academics (since Isidore of Seville) tended to use the twelve classical compass winds. The existence of the mariner's eight-point compass rose is attested by 1250, when the English scholastic cleric Matthew Paris clumsily attempted to reconcile the twelve classical winds he was taught with the eight winds of the "novel" mariner's rose.[8]. The very names of the mariner's winds - "Tramontana" (N), "Greco" (NE), "Levante" (E),"Scirocco" (SE), "Ostro" (or "Mezzodi") (S), "Libeccio" (or "Garbino") (SW), "Ponente" (W), "Maestro" (or "Mistral") (NW) - attests to its emergence in the multi-cultural milieu of the Mediterranean basin, probably developed by southern Italian sailors from Arab-Norman Sicily in the 11th-12th C.[9] The very science and mathematics needed and used for navigation in the Mediterranean in this period - such as the rule of marteloio, based on a simplified trigonometric table, the toleta de marteloio - was not taught in Christian academies, but sourced from Arab mathematics and astronomy, often via Jewish channels.

The nautical chart, the mariner's compass and the science of navigation, seemed to have emerged spontaneously together in the ports of the 13th-14th century Mediterranean. They depended upon and reinforced each other - needle, chart and table were symbiotic. They owe practically nothing to Classical antiquity or Christian academies nor any clear prior sources. They arose from the practical needs of merchants and sailors, a revolution in technology that was

essential to, and propelled, the Commercial Revolution in Europe.

The portolan chart seems to have been constructed from the collective first-hand knowledge of local sailors, pilots, captains and merchants about the distances and directions of their sailing voyages. Much of this information was already available in mariner handbooks or rutters - what the old Greeks called a periplus and Medieval Italians called a portolano ("port book"). These handbooks were compiled by professional mariners and pilots, largely as a mnemonic set of notes for their own personal use, and passed as trde secrets from master to apprentice. Only a few of these handbooks survive or were made public - such as the Compasso da Navigare, written c.1250 and published in Genoa in 1296. Portolan handbooks often contain a wealth of information beyond distances and sailing directions, e.g. instructions on how to use a compass, descriptions of coasts and islands, calendars, astronomical tables, mathematical tables, customs regulations at different ports, medical recipes, ship repair, etc. [10]

The Carta Pisana, the oldest known portolan, c.1290.

The exact transition from handbook to chart is lost in the historical record.[11] Nobody knows who was the first man to convert this morass of sailing notes into a diagram. Nor does it reveal an evolutionary development: there are no extant examples of failed attempts, early drafts or instructions of how to go about it. The first portolan charts appear to have been hatched complete ab avo, with an astounding degree of accuracy already from the start.

It has been speculated that some of these handbooks might have contained sketches, early nautical charts of small stretches of coast, particularly the difficult ones, to supplement or clarify what was written. These small fragmentary charts, now lost, may simply have been collected and pasted together to construct the grander portolan maps of the 14th C.[12] However, this theory has been doubted as there are no extant examples of partial maps before the appearance of large portolan charts.[13] Nor do they seem necessary. In a famous exercise, Jonathan Lanman (1987) attempted to construct a portolan map solely on the basis of the sailing directions and distances given in the Compasso de Navigare handbook.[14] The results showed it was theoretically possible.[15]

Throwing much of the dating off balance is a more recent finding, the Liber de existencia riveriarum, that seems to suggest nautical charts were being used as early as c.1200. [16] Apparently composed in Pisa, the Liber seems like just another portolan handbook (sailing directions and descriptions), but the introduction suggests it was meant to accompany a existing nautical chart (now lost). Specifically, a priest in Pisa, accustomed to religious mappa mundi, complained about trying to read a "novelty" map in his possession, and the author says he composed the Liber with the purpose of explaining and elucidating the geographic features of this new map to the priest.[17] While there is no explicit mention that the "novelty" map is in fact a nautical chart, the fact that the explanation is in the form of a portolano handbook makes it very likely.

Nautical Design

The term "portolan" (pedantically, "portulan") comes from the Italian portolano (plural portolani), a reference to ports. Originally, the term portolano meant only a local harbor book, and was extended to the general pilot's handbook with written sailing directions from port to port - roughly equivalent to the English rutter. A map giving the same information would usally be called a carta nautica, carta de navegar or simply a carta.[18] The extension of the term "portolan" to refer to nautical charts really only emerged in the late 19th C., when scholars, attempting to distinguish between different types of nautical chart, began referring to those constructed on the basis of portolani in the 14th & 15th C. as "portolan charts" or simply "portolans".

Coastal features and labels

Portolans were designed to meet the practical needs of navigation. It is sometimes said that portolan charts are the first maps to be regularly oriented with the north on top, as that is where the magnetic needle pointed (Christian mappa mundi were usually oriented east, Roman and Arab charts south). [19] However, that statement should be qualified, as the portolan chart legends are written along the coast with no single orientation - the chart was supposed to be swung around and read as needed while sailing, the real orientation was the position of the ship and coast.[20]

After passing Cape Blanc (red), there is water & supplies available (red) at Arguin island, but watch out for the shoals (crosses) at the entrance of Arguin bay! (Detail from 1571 Dourado map.)

Portolan charts are rather sparse. The sea coasts are minutely and carefully detailed, but the inland regions are usually left quite empty (although this varies between cartographic school). The labels of locations along the coast are always written perpindicular to the shoreline, and inland, to avoid obscuring the coastal details.[21] Most location labels are written in black ink, but some in red. The red labels are believed to indicate important places (albeit not always of political importance, but rather important for nautical reasons, e.g. safe harbors where water and supplies are readily found, etc.)[22] Later portolans also mark major headlands (like capes) in red.

The language of the labels itself is a hodge-podge - much of it Mediterranean lingua franca, the Italian-tinged patois commonly used by Medieval sailors, a mixture of Ligurian, Venetian, Sicilian, Provençal and Catalan, with a smattering of Greek and Arabic terms, from around the Mediterranean basin. There was little or no effort by cartographers of different nationalities to translate labels into their own native language - most labels were copied without change from map to map.

The coasts themselves are drawn to emphasize nautical information - minor irregularites are rounded off, major headlands and bays exaggerated.[23] Although water depths are not explicitly recorded, dots and crosses were usually added to denote the presence of shoals, reefs and rocks, and a region of shallow banks usually generally demarcated. A stylized roundel (sometimes mistaken for an island) is frequently added at the mouths of important rivers, to indicate the opening clearly and warn of mouth bars.

Scale and tilt

Detail of a distance scale

According to cartometric scholars, the early normal portolan chart typically used three differing map scales - one for the Atlantic region, another for the Mediterranean Sea, and a third for the Black Sea, with the result that the distances in the Atlantic were understated and in the Black Sea relatively exaggerated.[24]. This might be an error interpreting data, or deliberate (as the Black Sea was frequently sailed by merchants, and needed to be "zoomed" in for detail). Portolan charts usually have a small distance scale drawn somewhere on the map - usually a small bar with spaced lines and dots. However, this scale is usually unlabelled and its correspondence to actual distance measures (leagues, miles, etc.) left unspecified.[25] The scale bar drawn in a normal portolan seems to correspond best with the Mediterranean scale.

Rhumb lines

A 15-simplex, or projection graph of a hexadecagon with 16 equidistant points

Portolans were criss-crossed by an intersecting web of compass rhumb lines. The rhumb lines were used to articulate

sailing directions from point A to point B. While the rhumb line web may seem arbitrary at first sight, it is actually a quite carefully constructed grid. They are the orthogonal projection of a large hexadecagon, or a 15-simplex graph (15 edges, 16 nodes). The method of construction was not difficult. The cartographer simply drew a large "outer circle" covering as much of the map as possible, and then used dividers and straight edge to inscribe a hexadecagon (see example of hexadecagon construction). The cartographer essentially drew a very large "outer circle", in the form of a hexadecagon, that covered as much of the map as possible. The rhumb lines are created by simply connecting all the sixteen nodes to each other with a straight lines. The result is that each node of the hexadecagon becomes a collection point of lines from the other nodes, and turns into a local 32-wind compass rose.

Construction of a rhumb line grid on anonymous Genoese portolan chart, c.1325-50 (Library of Congress; see plain chart here)

Finding this graph on a portolan chart is not difficult. On every map, there is at least one "focal circle" (sometimes two), that can be detected by scanning the map visually for a "wheel with spokes" (usually in the center Mediterranean in a normal portolan). On the circumference of this "focal circle" are 16 equidistant "points" (formed by intersections of rhumblines), and within the circle no intersections at all (just the collection point at the center, thus the "wheel with spokes"). From the center of this focal circle emanate the lines of a 16-point compass, each of which leads outwards to another collection point, usually a 32-point compass rose. These compass roses are not not arbitrarily located, but themselves form equidistant circumference points of a large "outer circle" (the hexadecagon) that covers most of the chart.

The rumb lines emanating from a compass rose are usually color-coded: the eight principal winds (N, NE, E, SE, S, SW, W, NW) were usually in black, the eight half-winds (NNE, ENE, etc.) inked in green and the quarter-winds (N by E, NE by N, etc.) are in red. [26]

Detail of an unadorned wind rose on anonymous Genoese portolan, c.1325-50, with color-coded rhumb lines (black for principal winds, green for half-winds and red for quarter-winds).

In early Italian maps, the compass roses are unadorned and unlabelled, just a gathering of color-coded rhumb lines. The Catalan Atlas of 1375 was the first to introduce the familiar image of a single compass rose card on a map. But it is only in the late 15th C., particularly with emergence of the Portuguese school (e.g. Pedro Reinel, , Cantino planisphere, 1502) that we really see the system of multiple adorned compass rose cards placed on the rose points of the outer circle.[27]

The web of rhumb lines do not seem to have been guides to construction - many were added at the end, superimposed on a drawn map.[28] However, this was not always the case. [29] One suggestion is that frequently the main winds were added first, the geographic chart drawn, then the half and quarter winds added at the end.[30] Curiously, while two maps may seem copied from each other, identical in all respects (coasts, labels, etc.), the rhumb lines almost never are. The web of rhumb lines on almost every map are unique, giving every portolan its own "fingerprint", as it were.[31]

The portolan is not gridded by latitude and longitude lines. In the 16th C., some maps attempt to depict a few parallels, like the equator, the Tropic of Cancer and the Tropic of Capricorn, but often imprecisely. However, the presence of

mysterious square grid lines tucked in the corners of the Carta Pisana and a few others have led some to speculate that square grids might have been used to aid in the copying of portolan maps.[32]

Portolan maps, especially the early ones, often exhibit a 'skew' on account of their failure to account for "compass error", i.e. magnetic declination, the difference between the magnetic north and geographic true north).[33] In the Mediterranean latitudes, the compass error was an 8 to 10 degree angle of difference.[34]. This skew makes locations in the east (e.g. Constantinople) appear too far north geographically. This was not too problematic for navigation in the Mediterranean, especially as pilot instructions were also articulated by compass directions rather than geographic coordinates [35] However, it could cause conflict if mariners tried to orient themselves by both the Pole Star and the compass. Later 16th C. maps tried to correct the skew.[36]

32-point compass rose with fleur-de-lis northmark, from the portolan of Pedro Reinel (1504).

(Curiously, when compass rose cards are drawn, Italian charts tend to use an arrowhead or circumflex "hat" (^) to mark the north on the windrose, suggesting a compass needle, and thus that the map is oriented to the magnetic north, while Majorcan maps use a stylized Pole Star (*) for their northmark, suggesting the true north. The customary use of the fleur-de-lis as northmark was introduced in Portuguese charts in the late 15th C.[37])

Navigating by compass lines rather than geographic coordinates required some mathematics. The portolan may tell you Athens is so many miles away on a northwest line from Alexandria, but the island of Crete is in the way. To circumvent the island, the ship must switch winds and then return again to the right path. To calculate these traverses and how to get back to the desired path, a mathematical table was necessary - what was called the toleta de marteloio ("Rule of Marteloio").

Purpose

There is some uncertainty surrounding whom or what these portolan charts were made for. They are evidently designed to give navigational information and the choice of vellum (more resilient than parchment) indicates they were probably supposed to be taken on board ship.

An early reference to the use of a chart to guide navigation at sea relates to the Eighth Crusade of 1270: when the ships carrying the crusaders seemed lost in the sea around Sardinia, the captain pulled out a map to show a worried King Louis IX of France of their proximity to port. [38]

Nonetheless, it is doubtful that the finer specimens of these portolans, so costly to make, were actually taken on board and exposed to the natural elements. Naturally, the portolans that have survived to this day are not a random sample. They were probably of better quality than most, otherwise they would not have likely have been preserved by collectors over the centuries. The nautical portolan to be taken aboard ship may not have been as elaborate.

It has occasionally been suggested the elaborate portolans we have today were largely ornamental, relished by wealthy families and princes as an object of status and curiousity. Later portolans, particularly those of the Majorcan school, with their rich colors and intricate illustrations, may have had this in mind and several portolans were known to be made to be presented as gifts to princes and kings. But most portolans, unpleasingly bereft of illustration and focused on intricate nautical detail, seem to doubtlessly had practical objectives and use. [39]

There is some question as to how useful these maps were to actually guiding navigation while at sea. Portolan charts squeeze an entire imprecisely-drawn continent on a relatively small page, which may not be the most useful scale for plotting at sea.[40] In this regard, the portolan might only supplement, but not substitute, for the pilot's accumulated knowledge and notes. Another possibility is that at least the more intricate portolans may have been intended for harbor use, e.g. to be kept in the offices of commercial houses, to enable merchants to lay out trade routes and relay instructions to (& interpret reports from) their captains. They may have also been reserved for pre-journey consultations by captains, pilots and ship-masters, to take note of the general sailing directions and maybe take only a smaller, rough

copy with them.[41] They might also have been used for teaching, a "textbook" in the training of new ship pilots.[42]

Types of Portolan
Normal Portolan

One of the earliest Genoes portolans (Giovanni da Carignano, early 1300s), showing the "Normal Portolan" range (Mediterranean, Black Sea, and Atlantic Coast up to Flanders), on a single calfskin. Northern details are vague and scrunched at the top.

Typical early portolans were drawn on a single piece of vellum, and usually covered only the navigable areas needed by Italian sailors - the Mediterranean Sea, the Black Sea and the Atlantic Ocean coast as far as Flanders. A single map which covers this range is often called a "Normal Portolan" in scholarly literature.[43]

There was usually little or no effort made to depict the areas beyond it - although the boundaries were occasionally pushed to include the Baltic Sea and Caspian Sea and (as they became known or heard of) the north Atlantic islands (real and legendary) and the West African coast.

A.E. Nordenskiöld famously conjectured that all "Normal Portolans" - from Pietro Vesconte (1311) down to Vicentius Demetrius Volcius (1593) - were all copies of each other, and can be traced back to a single original master map (now lost), composed around 1300 by an unknown Majorcan cosmographer, possibly with the involvement of Ramon Llull.[44] He noted that the distance scale of all normal portolan maps was identical, the coastal lines unchanged, that the labels were frequently replicated in toto, with only some variations in the language used and the occasional addition of new entries (although curiously, as already pointed out, every map has a unique web of rhumb lines).[45]

While the hypothesis of a single proto-map will probably remain unproven, the near-identical resemblance of geographic contours and toponyms of Normal Portolans does suggest a high degree of copying and deep conservatism among cartographers. The near-exact replication of the coasts suggests the method of construction was probably by tracing from another (probably by "pouncing" with black ink powder through pinholes in a master map).[46]

Atlas

A sheet of the atlas of Pietro Vesconte, 1325, covering the west Mediterranean, part of a 5-sheet atlas. Notice the lack of internal features, and illustrations limited to sovereign flags.

The geographic boundaries were limited not only by interest and knowledge, but also by natural size of the calfskin. The latter barrier was broken early with the development of the atlas already by the 1310s, certainly by the 1320s. An atlas (atlante) was a set of maps, several sheets of vellum or parchment. Sometimes the various sheets could be pasted together into a single grand portolan map (e.g. the Catalan Atlas (1375)); other times, the sheets were simply distinct nautical charts, unrelated to each other. Atlases allowed cartographers to extend boundaries and include more detail, without worrying about the space constraints of a single calfskin.

World Maps
An atlas of distinct maps might contain within it a cover sheet with a "world map", i.e. often a summary map of the rest of the specific maps contained in the atlas. Often (as in the Medici Atlas of 1351) this summary map was drawn in the

portolan style (but not as detailed). But at times, possibly an acknowledgement of religious authority, the summary map was drawn as a traditional circular mappa mundi (e.g. in the Vesconte atlases of the 1320s). The atlas of Andrea Bianco (1436), contains three summary maps, each in a different style (mappa mundi, portolan, and Ptolemaic). Some later maps (e.g. the Columbus map in Paris, c.1490) embedded the circular mappa mundi alongside the portolan on the same vellum.

Ptolemaic Maps

The rediscovery of Ptolemy's Geographia, its translation to Latin in 1410 and publication in the 1470s, were a mixed blessing. Mapmakers attempted to construct maps on the basis of Ptolemy's instructions, but the results were not very encouraging. A conic projection, Ptolemy's distances were frequently poor, with the result that Ptolemaic maps were quite less accurate than portolan charts. One estimation calculates that the distances in the Mediterranean Sea in Ptolemaic maps tended to be off by 20%, whereas portolan charts exhibited an error rate of 1% or less.[47] As a result, 16th C. portolan charts that attempted to incorporate Ptolemy's information tended to be more inaccurate than their 15th and 14th C. predecessors.

The knowledge contained in Ptolemy's Geographia, written c.150 C.E., was not particularly useful either. Place names are all from classical antiquity, some of which no longer exist, and, of course, it omits many important places that matter now. Many classical assumptions - such an enclosed Indian Ocean - were also erroneous. Ptolemaic maps had little more than academic interest.

Ptolemy's great novelty was the introduction of geographical coordinates - latitudes and longitudes.

varies in the literature. Some scholars restrict the term "portolan" to refer only to maps on a single vellum, and "atlas" for the other multi-sheet maps. Other scholars use the term "portolan" to encompass any map (single or multi-sheet), so long as the composite map covers the usual "range" (Mediterranean, Black Sea, Atlantic coast). Still others use the term "portolan" to denote any realistic nautical chart in the compass-gridded style, regardless of its geographical coverage (e.g. a map of the Aegean Sea alone, could be called a "portolan" by this criterion).

The latter half of the 15th C. saw the rise of the Majorcan school of cartography. Scholars are divided as to whether it represents an autonomous movement, or a derivative branch of the Genoese school. The critical transitional figure is the mysterious Angelino Dulceti, probably a cartographer of Ligurian descent working in Majorca, responsible for two charts ("Dalorto" 1325 and "Dulcert" 1339) which seem to bridge the two schools. The Majorcan school departs from the restrained, sparse style of the Genoese school by including a lot more inland detail, and many colorful illustrations (often of miniature people). The resplendant Catalan Atlas of 1375, attributed to Abraham Cresques of Majorca, is considered the apotheosis of the Majorcan school. It includes the first depiction of a wind rose on a portolan map. It also includes all the quintessential elements found on nearly all Majorcan portolans - e.g. the Red Sea painted red, the Atlas mountains as a palm tree, Bohemia as a horse-shoe, the Alps shaped as a chicken's foot, the Tagus as a shepherd's crook, the Danube as a linked chain, etc. Among the miniature people are the ship of Jaume Ferrer, trans-Saharan trade caravans and the Emperor of Mali sitting on a gold mine.

Illustrations, albeit far more restrained and limited, had already begun to emerge in Italy - particularly in Venice, which was less beholden to the sparse tradition fostered in Genoa. The Pizzigani brothers map of 1367 contains the first known depiction of ships on a portolan map - as well as dragons.

Both Majorcan and later Italian portolans were less restrained by strict accuracy and nautical needs, and became willing to depict rumors and legends, particularly in areas just beyond the contemporary limits of geographic knowledge. The popularity of 14th C. travelogues, whether the real travels of Marco Polo and Ibn Batuta, or the fantastic tales of John Mandeville and the anonymous Libro del Conoscimiento, began to be reflected in the maps. The 1341 mapping expedition to the Canary Islands, confirming the existence of the hitherto only rumored Fortunate Isles, spurred confidence in old tales of other phantom islands. The legendary islands of St. Brendan and Hy-Brasil, drawn from Irish immrama tales, appeared regularly after the 1340s. The large legendary Atlantic islands of Antillia and Satanazes, which first appeared in the 1424 map of Zuane Pizzigano, were to remain on maps through the end of the century. Rumors sourced from Arab geographers and trans-Saharan traders prompted the semi-mythical depiction of areas of sub-Saharan Africa - notably the gold mines of Mali, the "River of Gold", Prester John, and the great gulf of Guinea (Sinus Aethiopicus) - appeared with regularity in 15th C. and early 16th C. maps. Legends and rumors captured by portolan maps were understandably confused with facts, and helped spread them further. Maritime adventurers, spurred by the promise of riches just beyond the edge, set out to look for them. They were an important factor behind the Portuguese prince Henry the Navigator decision to send ships down the West African coast in the 1430s and 1440s, thereby launching the European Age of Discovery. It is alleged that the mapping of Antillia gave Christopher Columbus confidence that Asia was reachable by sailing west.

The Medici Atlas and Pizzigani brothers find their appearance in x; Antillia and Satanazes appear for the first time in the 1424

sufficiently confident to depict the approximate geographic locations

became less restrained by geogra incorporated and repeated several geographic legends - notably of areas just beyond the contemporary limits. Atlantic islands were featured with The 1341 mapping expedition of the Canary Islands

The legendary island of Brasil of Spanish The 1339 map of Angelino Dulceti (Dulcert) indicates the first

(in portolan style, but not as detailed) of the rest of the specific maps contained in the atlas. The anonymous Medici Atlas of 1351 is such an example. As a tip to religious authority, an atlas might depict the summary cover map also contain a mappa mundi among its

The second half of the 14th C. saw the emergence of the Majorcan school.

leading cartographers of the

In the first half of the 15th C.,

The portolan chart was developed as result

said to have been invented by Amalfitan sailor Flavio Gioja around this time (although compasses were used by Chinese, Arabs, Italians beforehand, Gioja's innovation was placing the magnetic needle on a wind rose, facilitating nautical steering).

with water bodies frequently contracted

The first portolan chart was the Carta Pisana (dated around 1290), the first realistic nautical map gridded by compass angles. The development of portolan charts in the first half of the 14th C. was principally centered at Genoa, notably the profilic Pietro Vesconte.

Early portolan charts were usually drawn on a single piece of vellum,

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The British Library has images of Matthew Paris's manuscript pages online. One one page, there is a normal 12-wind rose (copied by Matthew from Elias of Dereham, with the notes on the northwest corner of the page giving his tentative list of new classical names for 16 winds), the second is the 16-wind rose, where he assigns the classical names to various points on the mariner's compass. For a review of Matthew Paris's efforts, see Taylor (1937; 1957: p.99-100).
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Lanman (1987)
Winter (1947)
This story is related by chronicler Guillaume de Nangis (before 1300). It is mentioned in D'Avezac (1874: p.36). Pujades (2007: p. 444-6) found 24 references in Medieval literature, between 1270 and 1501, to the use of maps for navigation. It is sometimes asserted that there is a 1352 edict of John I of Aragon ordering each ship to have at least two portolans on board (e.g. Diffie and Winius, 1977: p.131). However, Pujades (2007: 447n21) has demonstrated conclusively that this was a misreading, that there is in fact no mention of "charts" in the edict.
Campbell (2011: p.238-45)
Falchetta (2008)
In examining the owners of portolans, Pujades (2007: p.456a) concludes '"Nautical charts were the property above all of people who were either professional seamen or who, by virtue of their condition as merchants or war fleet officers, often took to the sea themselves or provided others at their service with all the accoutrements they needed" (as quoted in Campbell, 2011)
Campbell (2011: 438-45) cites Falchetta in this regard.
The term "normal portolan" was introduced by Nordenskiöld who defines it as "a map of the coasts of the Mediterranean and Black Sea, and of the Atlantic coast from Cape Bojador to the southern part of Great Britain and the mouth of the Elbe." (Nordenskiöld, 1896: p.688),
Nordenskiöld (1896, 1897)
Nordenskiöld (1896: p.689)
Campbell (2011: P.392)
Sevenson (1911: p.19-20)

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STUFF
Nomenclature:

Mappa mundi - circular map of the world, usually of religious inspiration, centered on Jerusalem.
Portolan (portolano) - a rectangular nautical chart, gridded by compass lines, traditionally drawn on a single piece of vellum. Some scholars reserve "portolan" label to refer to a grand map covering all the navigable areas around Europe (Mediterranean Sea, Black Sea and Atlantic coast) on a single page, and refer to a map covering a specific area simply as a "nautical chart". A grand map that takes several pages to construct is usually referred to as an "Atlas" rather than a portolan.
Atlas (Atlante) - set of maps, several sheets; sometimes the sheets can be combined into a single map; other times sheets are distinct maps. An Atlas of distinct maps might contain within it a cover sheet with a "world map", i.e. a summary map (either in mappa mundi or portolan style) of the rest of the specific maps contained in the atlas.
Ptolemaic map - a map based on Ptolemy's Geographia, usually a conic projection with labels and names as given in classical antiquity. Emerged after translation of Ptolemy c.1410.
Italian style - a restrained style, focused on water and carefully delinineated coastlines; largely ignores land interiors and contains few (if any) illustrations.
Majorcan style - a more effusive style, with inland details given and replete with colorful illustrations, notably miniature people. Some illustrations are "standard" across Majorcan maps (e.g. Red Sea painted red, Atlas mountains as a palm tree, Tagus as a shepherd's crook, etc.)

Walsperger (1448), the Catalan-Estense map of 1450, the Borgia map, the Genoese map of 1457, and Fra Mauro's map of 1459

Viladestes 1413 Pizzigano 1424 Beccario 1426 Beccario 1435 Bianco 1436 (Bianco 1448?) Leardo mappamundi (1452-53) Pareto (1455) Genoese World Map (1457) Benincasa (1467) Benincasa (1468) Benincasa 1470 Toscanelli (1474) Benincasa (1482) Macrobius (1483) Soligo Ginea Portogalexe (1485) Cornaro (late 15th) Paris map or Christopher Columbus chart (1489-1500) La Rocneire Christophe Colomb Yale-Henricus Martellus (1489) Henricus Martellus 1489 Jorge de Aguiar (1492) Behaim (1492) Francesco Rosselli (1492) Alba sketch (1493) of Hispaniola Juan de la Cosa (c.1500-1510

C.R. Beazley (1906) Dawn of Modern Geography vol.3

C.R. Beazley (1897?) "Introduction" to Chronica p.121

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Nordenskiold's 1896 list (wind roses appearance table)

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Tom Campbell's census of maps, xls explanation, webmaps
Henry Davis Index
Portolan blog (with images) blog
Another site

Rough notes:

"Eastward bound" on Sanuto editions
Dalorto at Italian cultural site
Northern mists on Dalorto

c.1283 Hereford mappa mundi of Richard of Holdingham
c.1290 Carta Pisana of anonymous author
c.1300 discovery of the mariner's compass by Flavio Gioja of Amalfi.
1311 Mediterranean map of Pietro Vesconte - first signed protolan
1321 mappa mundi of Pietro Vesconte (for Sanudo)
1339 portolan map of Angelino Dulcert of Majorca
1350 map of Palestine of Domenico Pizigano of Venice
1350 (prob. 1385) Libro del Conoscimiento of anonymous Castilian friar - no map, just description.
1351 (prob. 1370) Medici Atlas (Laurentian) of anonymous Genoese author
1367 map of Domenico and Francesco Pizzigano ("Pizigani brothers') of Venice
1373 Mediterranean map of Francesco Pizzigano
1375 [{Catalan Atlas]] attrib. to Abraham Cresques of Majorca
1380 map of Guglielmo Soleri of Majorca
1385 map of Guglielmo Soleri
1397 arrival of Ptolemy in Florence

1410 translation of Ptolemy's Geographia by Jacopo Angelo Scarparia
c.1411-15 world map of Albertino de Virga of Venice
1413 portolan of Mecia Villadestes of Majorca?
1424 map of Zuane Pizzigano of Venice
1435 map of Battista Beccario of Genoa
1436 atlas (mappa, portolan, Ptolemaic) of Andrea Bianco of Venice
1439 map of Gabriel de Vallseca
c.1440 Vinland map (probable fake)
c.1444 travels of Niccolò de' Conti - manuscript
1448 atlas of Andrea Bianco
1455 map of Bartolomeo Pareto of Genoa
1457 anonymous Genoese map - based on Conti
1459 mappa mundi of Fra Mauro
1463 map of Grazioso Benincasa of Ancona
1463 map of Pedro Roselli of Majorca.
1466 map of Pedro Roselli
1468 map of Pedro Roselli
1460s anonymous Weimar map (attrib. to Conte di Ottomano Freducci of Ancona)
1470 map of Grazioso Benincasa
c. 1475 map of Cristoforo Soligo of Venice
1474 "map" of Paolo Toscanelli - map missing, but described in letter.
1476 map of Andrea Benincasa of Ancona (son of Grazioso)
1480 map of Albino de Canepa of Venice
1482 map of Grazioso Benincasa
c.1482 map of Grazioso Benincasa (different from above)
1482 map of Jacme Bertran of Majorca
1484 map of Henricus Martellus Germanus
c.1485 map of Pedro Reinel of Portugal - first Portuguese map
1487 map of anonymous Majorcan cartographer
1489 map of Henricus Martellus Germanus
1489 map of Albino de Canepa
1492 map of Jorge Aguiar of Portugal
1492 Nuremberg globe of Martin Behaim
1493 anonymous Laon globe
1497 map of Conte di Ottomano Freducci of Ancona
c. 1500 Paris map ("Columbus map") of anonymous Poruguese/Genoese author (Bartholomew Columbus?)
1500 1500 map of Juan de la Cosa
1502 Cantino planisphere by anonymous Portuguese
1504 map of Pedro Reinel
1505 Caverio map of Nicolo de Caveri of Genoa
1507 world map of Martin Waldseemüller - first use of "America".
1507/08 world map of Johannes Ruysch
1513 world map of Piri Reis

List of maps
Attributions and dating of anonymous authors follow Campbell (2011).[1]

Year Map Author Nationality
Notes Held

c.1290
Carta Pisana
Anonymous
Genoa?

first portolan chart
(B.1118), Bibliotheque Nationale de France,
Paris, France

c.1300
Cortona chart
Anonymous
Genoa?

sometimes dated 1232-1258, but prob. early 1300s.[1]
(Port.105), Biblioteca dell'Accademia Etrusca,
Cortona, Italy

c.1300-1325
Riccardiana chart
Anonymous
Genoa

Once thought to be 16th C. (as late as 1588)[2]
Now dated much earlier, maybe even pre-1311[1]
(3827), Biblioteca Riccardiana
Florence, Italy.

1311
Vesconte chart
Pietro Vesconte
Genoa

first signed portolan chart,
east Mediterranean only
(C.N.1), Archivio di Stato,
Florence, Italy.

1313
Vesconte Paris atlas
Pietro Vesconte
Genoa

6 sheets,
First to depict Atlantic coast, including part of British isles.
(DD 687),Bibliotheque Nationale de France,
Paris, France

1318
Vesconte Venice atlas
Pietro Vesconte
Genoa

7 sheets
(Port. 28), Museo Correr

Venice, Italy

1318
Vesconte Vienna atlas
Pietro Vesconte
Genoa

10 sheets
(MS 594), Österreichische Nationalbibliothek,
Vienna, Austria

c.1320
First Sanuto atlas
Pietro Vesconte
Genoa

Vesconte's first mappa mundi, signed,
plus five-sheet atlas, for Marino Sanuto's Liber secretorum
(Pal.Lat.1362A),Bibliotheca Apostolica,
Vatican City

1321
"Perrino" (Zurich) atlas
"Perrino Vesconte"
(attrib. Pietro Vesconte or relative)
Genoa

5 sheets
(R.P.4),Zentralbibliothek,
Zurich, Switzerland

c.1321
Vesconte Lyons atlas
Pietro Vesconte
Genoa

9 sheets
(MS.175), Bibliothèque municipale,
Lyons, France

c.1321
Second Sanuto atlas
Anonymous
attrib. Pietro Vesconte
Genoa

mappa mundo plus 5 sheet atlas
for Marino Sanuto's Liber secretorum
(Vat. Lat. 2972),Bibliotheca Apostolica
Vatican City

c.1325
Third Sanuto atlas
Anonymous

attrib. Pietro Vesconte
Genoa

10 sheets, including mappa mundo,
for Marino Sanuto's Liber secretorum
(Add MS 27376), British Library,
London, UK

1327
"Perrino" chart
"Perrino Vesconte"
(attrib. Pietro Vesconte or relative)
Genoa

(Med.Palat.248), Biblioteca Medicea Laurenziana,
Florence, Italy

c.1327
Carignano chart
Giovanni da Carignano
Genoa

variously dated beween c.1305 to 1333, but prob. 1327.[1]
Destroyed 1943,
formerly at Biblioteca Nazionale Centrale
Florence,Italy

c.1325-1350
Genoese Paris atlas
Anonymous
Genoa

7-sheet atlas (partially missing)
(MS Lat.4850),Bibliotheque Nationale de France,
Paris, France.

c.1325-1350
Genoese Washington chart
Anonymous
Genoa

(Rist. & Skel.3), Library of Congress,
Washington, DC, USA.

c.1325-1350
Genoese Paris chart
Anonymous
Genoa

Prob. same author as Washington chart[1]
(MS Ital. 1704),Bibliotheque Nationale de France,
Paris, France.

c.1325/30
Dalorto map
"Angelinus Dalorto"
(attrib. Angelino Dulceti)
Genoa?
Majorca?

Commonly dated 1325, but prob. 1330.
Private collection of Prince Corsini,
Florence

1339
Dulcert map
"Angelino Dulcert"
(attrib. Angelino Dulceti)
Majorca

first to depict Lanzarote
(B.696), Bibliotheque Nationale de France,
Paris, France

c.1340
London Dulceti map
Anonymous
(attrib. Angelino Dulceti)
Majorca?

(Add.MS.25691), British Library,
London, UK

1351
(prob. 1370)
Medici Atlas
(Laurenziano)
Anonymous
Liguria
(Genoa?)

Explicitly dated 1351, but prob. 1370, with emendations as late as c.1425-50.
8 sheets, world map up to India, Caspian Sea closed, show nearly complete Canary islands, Madeira and Azores, and speculative gulf of Africa.
poss. as late as 1425-50.
(Gaddi.Rel. 9), Biblioteca Medicea Laurenziana,
Florence, Italy

1367
Pizigani brothers map
Domenico and Francesco Pizzigano

Venice

maybe first to show Canary islands and Senegal River
(Ms.Parm.1612), Biblioteca Palatina,
Parma, Italy

1373
Pizigano Mediterranean
Francesco Pizzigano
Venice

(SP10,29),Biblioteca Ambrosiana,
Milan, Italy

c.1375
Catalan Atlas
Abraham Cresques
Majorca

6 sheets, first to incorporate wind rose
MS.Esp.30), Bibliotheque Nationale de France,
Paris, France

c.1375-1400
Cresques Venice chart
Anonymous
(attrib. Cresques atelier)
Majorca

portolan chart (missing northern Europe)
(It.IV,1912), Biblioteca Marciana,
Venice, Italy

c.1375-1400
Cresques Florence chart
Anonymous
(attrib. Cresques atelier)
Majorca

portolan chart (west Mediterranean only)
(Port.22), Biblioteca Nazionale Centrale,
Florence, Italy

c.1375-1400
Cresques Naples chart
Anonymous
(attrib. Cresques atelier)
Majorca

normal portolan
(ms.XII.D102), Biblioteca Nazionale Vittorio Emanuele III,
Naples, Italy

c.1380
Soleri Paris chart
Guillem Soler
Majorca

Normal portolan igned Guillelmus Soleri,
commonly dated c.1380,
but range est. 1368 to 1385
(B.1131),Bibliotheque Nationale de France,
Paris, France

1385
Soleri Florence chart
Guillem Soler
Majorca

Normal portolan
, signed & dated.
(C.N.3),Archivio di Stato,
Florence, Italy.

1384
(prob. c.1385-1410)
Pinelli-Walckenaer Atlas
Anonymous
Venice

7-sheet atlas,
same author as Corbitis Atlas;
Explicitly dated 1384, but poss. later
(Add MS, 19510),British Library,
London, UK.

c.1385-1410
Corbitis Atlas
Anonymous
Venice

4-sheet atlas,
same author as Pinelli-Walckenaer atlas
(Ms. It. VI 213), Biblioteca Nazionale Marciana,
Venice, Italy.

c.1400
Cresques Paris chart
Anonymous
(attrib. Cresques atelier)
Majorca

normal portolan
(AA751), Bibliothèque nationale de France,
Paris, France

Early 1400s

Bodleian-Douce Atlas
Anonymous
Venice?
Genoa?

6 sheets
(MS Douce 390) Bodleian Library
Oxford, UK.

1400-1420
Tammar Luxoro Atlas
Anonymous
(Attrib. Francesco de Cesanis)
Venice?

8 sheets, smallest portolan
Prev. dated early 1300s, now attrib. to Cesanis, pre-1421
Biblioteca Civica Berio
Genoa, Italy.

1403
F. Beccario chart
Francesco Beccario
Genoa

(Art Obj. 1980.158) Beinecke Library, Yale University,
New Haven, Connecticut, USA.

1409
Virga chart
Albertinus de Virga
Venice

(D.7900), Bibliothèque nationale de France,
Paris, France.

1413
Viladestes 1413 chart
Mecia de Viladestes
Majorca

(AA.566), Bibliotheque Nationale de France,
Paris, France

1421
Cesansis chart
Francesco de Cesanis
Venice

(Port.13), Museo Correr,
Venice, Italy

1423
Viladestes 1423 chart
Mecia de Viladestes
Majorca

(Ashb. 1802), Biblioteca Medicea Laurenziana,
Florence, Italy

1424
Zuane Pizzigano chart
Zuane Pizzigano
Venice

First to depict Antillia
(B1424mPi), James Ford Bell Library,
University of Minnesota,
Minneapolis, USA.

1426
Beccario Munich chart
Battista Beccario
Genoa

(Map.XXV,ly),Bayerische Staatsbibliothek,
Munich, Germany.

1428
Joan Viladestes chart
Joan de Viladestes
Majorca

(1826),Topkapi Palace,
Istanbul, Turkey

1435
Beccario Parma chart
Battista Beccario
Genoa

(II,21,1613), Biblioteca Palatina,
Parma, Italy

1436
Bianco atlas
Andrea Bianco
Venice

10 sheets (incl. mappa mundi, portolan and Ptolemaic projection)
(It.Z.76(4783)) Biblioteca Marciana,
Venice, Italy

1439
Vallseca 1439 chart
Gabriel de Vallseca
Majorca

Depicts Henrican discoveries in Atlantic,
intr. "Diogo de Silves"
owned by Amerigo Vespucci
(inv. 3236) Museu Marítim,
Barcelona, Spain.

c.1440
Vallseca c.1440 chart
Anonymous
(attrib. Gabriel de Vallseca)
Majorca

Undated and unsigned.
(Port. 16) Biblioteca Nazionale Centrale
Florence, Italy.

1447
Vallseca 1447 chart
Gabriel de Vallseca
Majorca

Mediterranean only
(Rés. Ge. C4607) Bibliothèque nationale de France,
Paris, France.

c.1447
Vallseca c.1447 fragment
Anonymous
(attrib. Gabriel de Vallseca)
Majorca

undated and unsigned
fragments of portolan chart,
covering east Mediterranean only.
(Rés. Ge. D 3005) Bibliothèque nationale de France,
Paris, France.

1449
Vallseca 1449 chart
Gabriel de Vallseca
Majorca

Mediterranean only
(CN 22) Archivio di Stato,
Florence, Italy.

c.1471-82
Portuguese Modena chart
Anonymous
Portugal

Oldest Portuguese nautical chart,
est. after 1471, but before 1482.[3]
(It.Z.76(4783)) (C.G.A.5c), Biblioteca Estense, Modena, Italy

1489
Canepa 1489 map
Albino de Canepa
Venice

James Ford Bell Library,
University of Minnesota,
Minneapolis, USA.

c.1400
Cornaro Atlas
Anonymous
Venice

Venetian copies of earlier atlases, e.g.
F. Beccario, Pasqualini, F. de Cesanis, P. Rosell, G. Benincasa, C. Soligo, etc.
(Egerton MS 73) British Library
London, UK.

1492
Aguiar chart
Jorge Aguiar
Portugal

first signed Portuguese portolan
Beinecke Rare Book and Manuscript Library,
Yale University
New Haven, USA

References

Aczel (2001: p.76).
Nordenskiöld (1896, 1897)
For a taste of the controversy, see (for one side) P. Amat di S. Filippo (1888), A. Magnaghi (1909), R. Almagià (1945), G. Caraci (1959), and (on the other side), A.E. Nordenskiöld (1896, 1897), A. Blázquez (1906), Heinrich Winter (1958) Sureda Blanes (1969). The page on Angelino Dulcert contains more references.
Pujades (2007: p.515b), Campbell (2011: p.388).
See Pujades (2007) and Campbell (2011: p.380-84) for an evaluation of possible Classical, Arab and other antecedents.

Falchetta (2008)
Edson (2007)
The British Library has images of Matthew Paris's manuscript pages online. One one page, there is a normal 12-wind rose (copied by Matthew from Elias of Dereham, with the notes on the northwest corner of the page giving his tentative list of new classical names for 16 winds), the second is the 16-wind rose, where he assigns the classical names to various points on the mariner's compass. For a review of Matthew Paris's efforts, see Taylor (1937; 1957: p.99-100).
Taylor (1937: p.25)
Edson (2007: 51)
Pujades, 2007; Campbell, 2011; Brown (1949: p.139)
Brown (1949: p.139)
Pujades (2007: p.511-12), Campbell (2011: p.387)
Lanman (1987)
Lanman (1987); Monmonier (2004:p.23)
Uncovered by Patrick Gautier Dalché (1995), its full name is "Liber de existencia riveriarum et Forma Maris Nostri Mediterranei ("Book of the position of the coasts and the form of our sea, the Mediterranean").See also Pujades (2007) and Campbell (2011).
Edson (2007: p.43-44)
Stevenson (1911: p.16)
Monmonier (2004: p.24)
Casey (2002: p.178)
Wallis and Robinson (1987); Monmonier (2004)
Brown (p.139)
Wallis and Robinson (1987); Monmonier (2004)
Campbell (2011: 390-92)
For an early attempt to calculate the bar scale on a normal portolan, see Nordenskiöld (1896).
Wallis and Robinson (1987); Brown (p.140)
Nordenskiöld (1896: p.693)
At least according to Bartolomeo Crescenzio Nautica Mediterranea (1607). See Nordenskiöld (1896).
Pujades (2007), Campbell (2011)
Campbell (2011:390-92)
Nordenskiöld (1896: p.689)
Lanman (1987); Monmonier (2004)
Lanman (1987), Pujades (2007: p.510-11), Campbell (2011: p.384)
Campbell (2011: p.384)
Suárez (1992: p.31)
Lanman (1987)
Winter (1947)
This story is related by chronicler Guillaume de Nangis (before 1300). It is mentioned in D'Avezac (1874: p.36). Pujades (2007: p. 444-6) found 24 references in Medieval literature, between 1270 and 1501, to the use of maps for navigation. It is sometimes asserted that there is a 1352 edict of John I of Aragon ordering each ship to have at least two portolans on board (e.g. Diffie and Winius, 1977: p.131). However, Pujades (2007: 447n21) has demonstrated conclusively that this was a misreading, that there is in fact no mention of "charts" in the edict.
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Nordenskiöld (1896, 1897)
Nordenskiöld (1896: p.689)
Campbell (2011: P.392)
Sevenson (1911: p.19-20)