E.T.S de Náutica, Máquinas y Radioelectrónica Naval

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Cartography

From Prehistoric Cartography to Electronic Charts

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Autor: Jordi Garcia Caberol

Tutor: Enrique Melón Rodriguez

Index

Introduction

Cartography is a word coming from joining the Greek Khartēs, meaning map or chart, and Graphein, meaning write. Cartography is the science in charge of studding and depicting maps and charts. Along the pages of this work we will see how the Cartography evolved from the pictograms on the caves tens of thousands of years ago to the sophisticated electronic charts we find nowadays aboard the merchant marine ships.

As we can read on the book *Mapas Antiguos del Mundo by Federico Romero and Rosa Benavides* "There is no evidence of a civilization that did not represent graphically the territory surrounding them; the maps, …, are older than the writing". To see how the maps and charts evolved along the years we will focus on the European and Mediterranean history. We will start with the oldest maps, no better than a schemes of little towns, later proceed with the great improvements of the Greeks and Romans, after that we will stop to see the Medieval Age and the golden age of the navigation, the Age of Discovery, and we will finish with the Modern era and the new advancements of the technology.

To see all the contents of the Cartography history we will inevitably related with other science like Geology, the study of the Earth, which was the outstanding science during the Greco – Roman era or the Cosmology, that was the name that received the Cartography during a period of the Age of Discoveries. We will also see the discoveries and important facts that helped to improve the cartography on each stage of history.

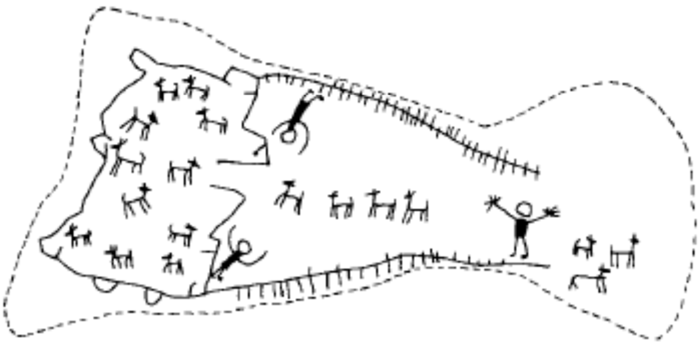
Part 1: The beginning of Cartography

Chapter 1: Prehistoric Cartography

1.1 Firsts Maps

It is believed that the first maps were pictograms on caves back on the Palaeolithic era. We can find examples of what is believed to be hunting maps. One of the oldest is the Rajum Hani stone (Figure 1.1). On it we can see a picture of a hunting area with a large walled funnel and an enclosed space. These men attract the gazelles to the walled funnel, lead them to the enclosed space and kill the gazelles there.

Figure 1.1 The Rajum Hani' Stone "The Cairn of Hani',"



Annual of the Department of Antiquities of Jordan 2 (1953): 8-56, fig. 5, no. 73.

The first form of cartography was just picture maps (fig.1.2). There is a huge controversy on rather they should be considered the first maps or just pictograms. Watching these pictograms we can think of them as a map of a town or a group of pictures representing a town.

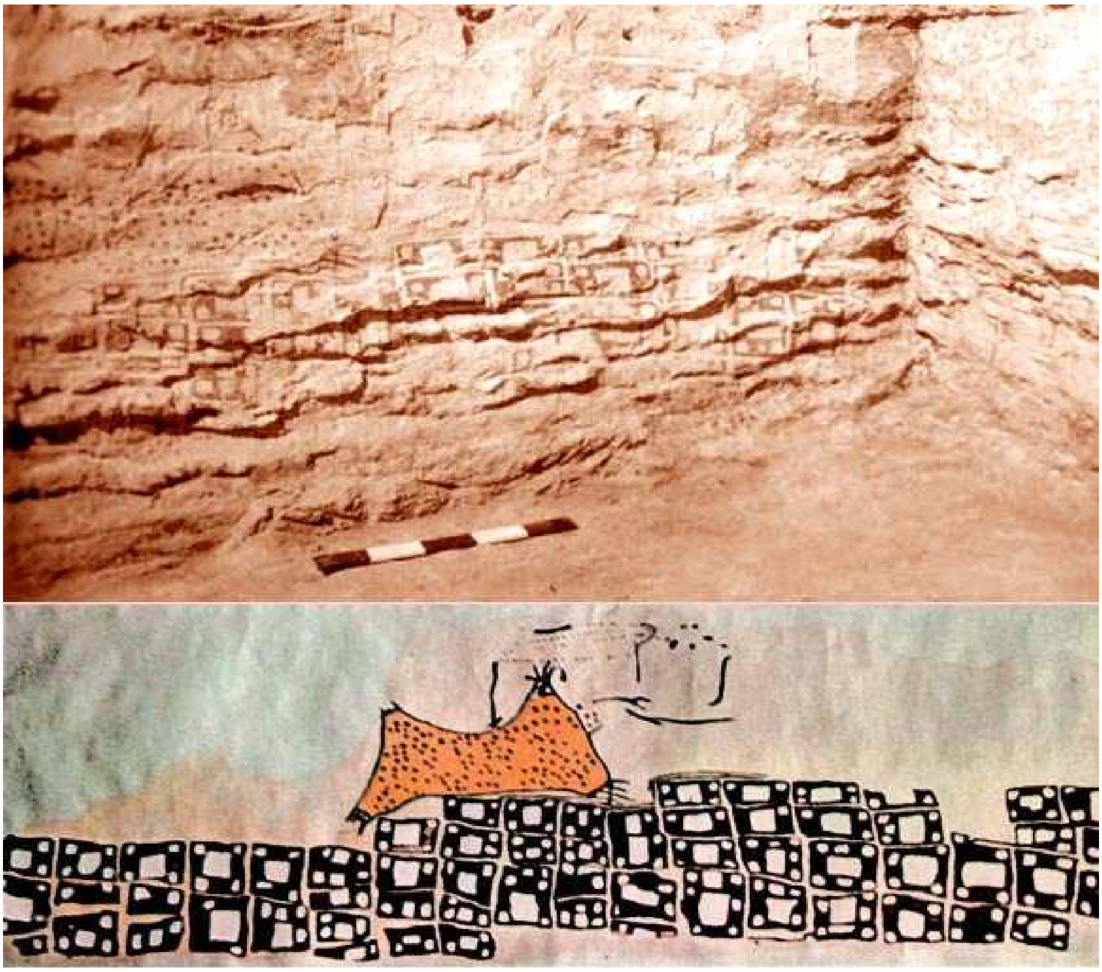
Figure 1.2 Village scene from the late Bronze Age Rock Engravings in the Middle Yenisei Basin

(Moscow: Nauka, 1976), fig. VI.

1.2 Çatal Hüyük

Çatal Höyük is a Neolithic town established in Turkey about 7.500 BC. It is the largest and best preserved Neolithic town discovered up to date. It is also a very important landmark on the history of the Cartography, because it is believed to be

Figure 1.3 Neolithic mural representing the Çatal Höyük map



http://www.sci-news.com/archaeology/science-catalhoyuk-map-mural-volcanic-eruption-01681.html

found the world oldest map (fig. 1.3). On this picture we can see a plan of the town, the layout of the houses of this Neolithic town, and two mountain peaks which are provably of Mount Hasan, found on the vicinity. Other sources, a team of scientists led by Dr. Axel Schmitt from the University of California Los Angeles, wrote in the PLoS ONE paper, that they may be other options like that of the two mountain peaks representing a leopard skin and the possibility of another town represented on the plan of the houses.

1.3 The Bedolina Map

Figure 1.4 Bedolina Map

Luca Giarelli / CC-BY-SA 3.0

Another example of prehistoric cartography is the Bedolina Map, found in the valley of Valcamónica one of the largest in the Alps, and dated about 2000-1500 B.C. On it we see a group of about 6 buildings and 30 fields. According to Craig Alexander, from University of Cambridge, “one of the most fascinating things about this piece of rock-art is that so many of the elements are explicitly linked by lines that, in the eyes of many viewers, suggest pathways. The extent of these linkages suggested to me that investigation using the tools of network analysis – itself an application of graph theory – might yield insight into the relative importance of different landscape elements in the minds of the image’s creator(s)”. So here, as Mr. Alexander mention, we have the first map. I rather say it is a closer approach to what maps are likely to be nowadays and with any doubt another step on the human ability for cartography their surroundings.

Chapter 2: Greco-Roman Geographers

Introduction

During this period we start to see maps as we know them nowadays. This period is also the beginning of the documented history, and many more things are preserved. For that reason in this chapter we will focus on the most significant maps and cartographers.

We will divide this period in four parts:

- Classical era
- Hellenistic era
- Greco-Roman era (era when the two civilizations coexist)
- Ptolemy

2.1 Classical era

The classical era comprise the period between the start of the Greece civilization (8th century) to the first half of the 4th century B.C. It is characterized for being more speculative rather than practical.

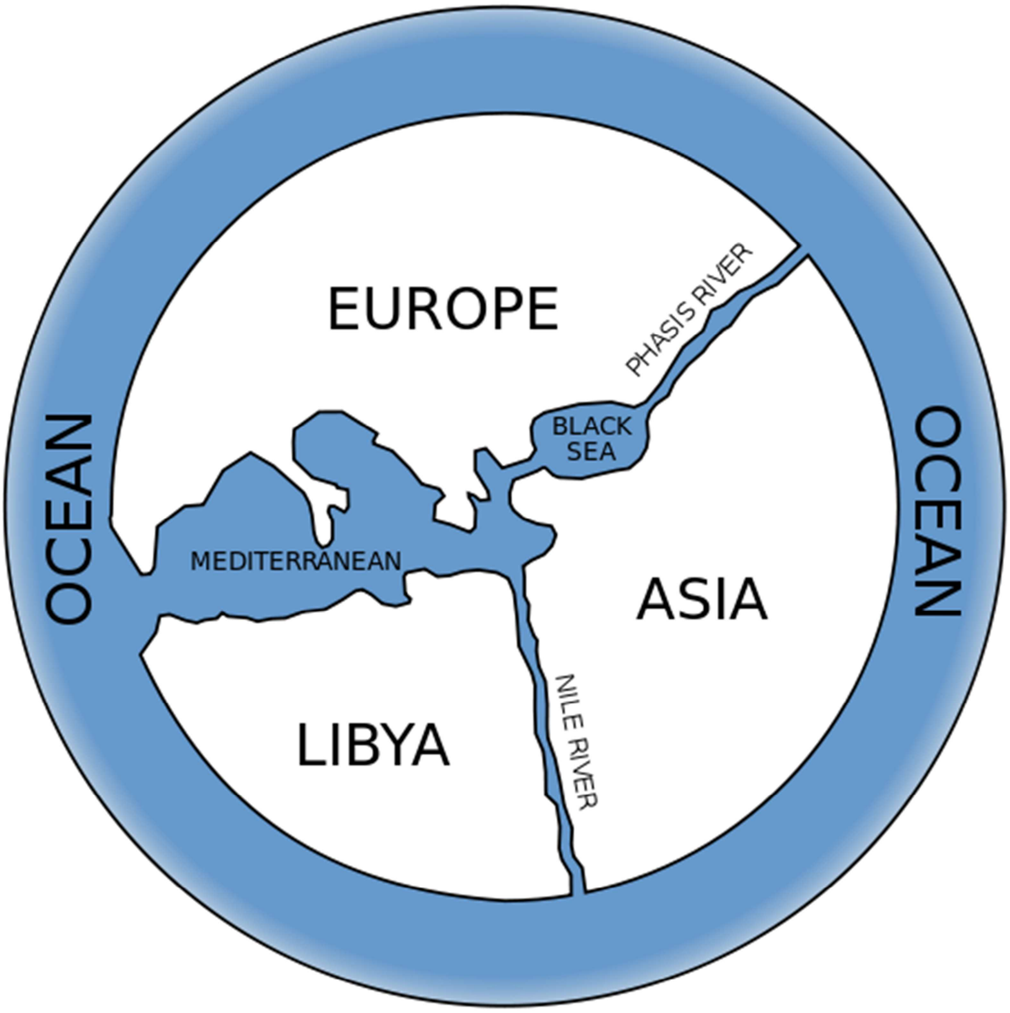
2.1.1 Homer

The first reference to cartography that we find on the Classical era is the Homer's Iliad, believed to be written in the 8th century B.C. On it we see a description of the whole universe as Homer understood it. For some it was considered as the father of geographical science but Homers' map is more of a mythological kind of description, because it actually do not describe any of the known parts of the earth, just the distribution of the universe stating that the earth, sea, sun, moon and stars where the in the middle of it, surrounded by what he called the shield of Achilles.

2.1.2 Anaximander – Hecataeus of Miletus

Anaximander (610-546 B.C.) drew the first map of the whole known world (Figure 2.1) though anyone knows exactly how he did it. He was the disciple of Thales (624-

Figure 2.1 Representation of Anaximander's Map of the world



http://en.wikipedia.org/wiki/File:Anaximander_world_map-en.svg

547 B.C.) a well-known Astronomer, but not particularly famous on the Cartography. We know about his work on Cartography for more recent authors which books did survive over the years. He also was one of the first to imply that the earth was actually a curve, rather than a flat surface. The earth being curve was something that sailors, astronomers and people with a knowledge on the field started to believe, but

Anaximander drew his world map on a metallic surface that have some curve, not being completely a sphere.

Hecataeus of Miletus (550 – 476 B.C.) was aware of the Anaximander's map, and travelled around the known world to finally improve it. Documenting his voyages we have the *Circuit of The Earth* a collection of two books. The first one was about Europe and the second one about Asia and Libya (Africa). On them Hecataeus based the improvements he made on Anaximander's map (Figure 2.2)

Figure 2.2 Representation of Hecataeus's Map of the world

http://en.wikipedia.org/wiki/File:Hecataeus_world_map-en.svg

2.1.3 Pythagoras

Pythagoras (570 – 495 B.C.) was a well-known mathematician and philosopher. Though he was not directly related with the cartography, and none of his writings had survived the ages to prove it, we know from his teachings that he suggested for the first time that the Earth is a sphere. Germaine Aujac said in this article The Foundations of Theoretical Cartography in Archaic and Classical Greece "The first description of a spherical earth has been attributed sometimes to Pythagoras himself (fl. 530 B.C.) and sometimes to Parmenides, a native of Elea (Velia)" Parmenides who was a follower of the Pythagoreans religion. They based this theory on the geometric perfection of a circle, and they also believed that all the stars and planets had to be spheres. They also somehow knew that the Earth have to have a hot zone in the middle, two template zones, and to cold zones on the poles.

2.1.4 Other authors and facts during the Classic era

During the Classical era we find evidences that the maps begun to be something widely used among the society. We find stories about common citizens speaking about maps with philosophers (the intellectual standard of the time), like the one between a student and a farmer called Strepsiades (a well-travelled farmer) talking over a cadastral map or a map of the world.

More known philosophers like Plato or Socrates have also some references as how the Earth may be, like the ones suggesting that it have to be spherical, in the center of the known universe and surrounded by first the moon and the sun, secondly by the known planets which were Venus, Mars, Mercury, Jupiter and Saturn and finally by the stars.

2.2 Hellenistic era

If the Classic era was characterized by the speculation, the Hellenistic era is characterized by the acquisition of empirical knowledge. As the Greek empire grows and more people decide to travel around the world, the knowledge of the known world also increases. During this period was also created the biggest library the world had ever seen in Alexandria. That library will compile a lot of the contemporaneous work on the Cartography field and will be used later by many cartographers and geographers.

2.2.1 Alexander the Great and Pytheas of Masalia

Alexander the Great (356 – 323 B.C.) was one of the responsible of the great conquests of the Greek empire (mostly in western Asia and north of Africa where he will have a city named Alexandria). During that time on the Greek empire the world west of Greece till the Atlantic sea was well known, but they only had some papers from Xenophon describing Minor Asia and some of Ctesias of Cnidus work on Persia and India. So he decided to command an expedition and ordered many others, mostly in Asia.

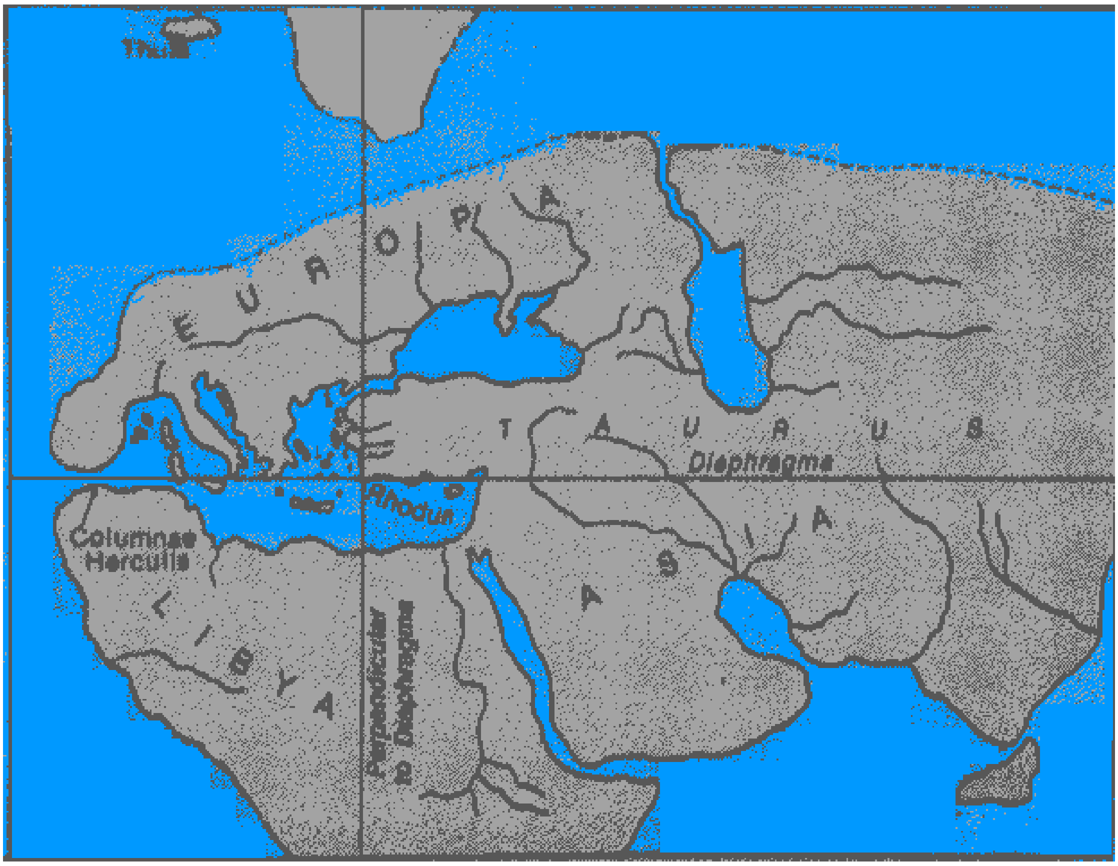
With Alexander the Great we found a general of particular importance, Ptolemy Soter (367 – 283 B.C.) that will later be king of Alexandria and start a dynasty of great kings known for embracing and promoting science.

Another explorer that helped expanding that empirical knowledge was Pytheas of Masalia (3rd century B.C.). He was known as a navigator and astronomer, and he explored further the Atlantic cost of Europe. None of his work survived the ages, but we know of him through other authors. He started in Cadiz and travelled by ship the entire coast stopping in Great Britain and the Baltic Sea.

2.2.2 Dicaearchus

During this period we also have Dicaearchus (350 – 285 B.C.), a student of Aristotle. He tried to improve some of the existing maps (Figure 2.3) and he also drew a new map of the world, but he is known for the fact that he started to put latitude and longitude to some cities, in Rhodes to be more specific. There's a controversy on rather they shall be considered geographical coordinates or just reference lines, but what is sure is that we have to look back on the Hellenistic era to find the antecedents of the modern coordinates.

Figure 2.3 Representation of Dicaerachus map with reference lines

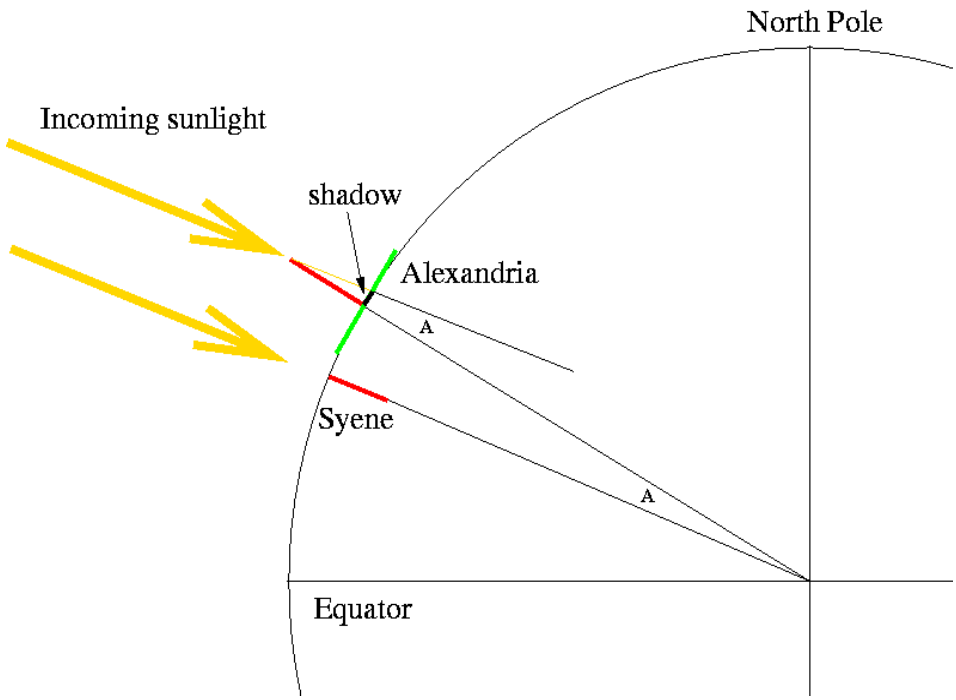


http://s155239215.onlinehome.us/turkic/btn_GeographyMaps/MapsAntiqueWorldEn.htm

2.2.3 Eratosthenes

We already know that the Greeks knew that the Earth was somehow curve or a sphere, but Eratosthenes (276 – 194 B.C.) was the first to measure the circumference of the Earth quite precisely. Eratosthenes was a geographer, for some even called the father of geography. He was called to Alexandria to be the tutor of the king's son and to take over the direction of the library (the biggest of the world). With access to all the data on the library he determined an exact day when the city of Syene (a city on the same latitude than Alexandria) was in zenith with the sun. Knowing that and other data like the distance between Alexandria and Syene he measured the length of a shadow in Alexandria and obtain that the angle for that distance between two points of the Earth was 1/50th of a circle. So if we do the mathematics, 50 times the distance between Alexandria and Syene which was 5.000 stadia we have 250.000 stadia, but Eratosthenes corrected it later for 252.000 stadia that equals 24.192 miles (1 mile = 10.41667 stadia). Compared with the figure that we use today, 24.860 miles, it is fair to say that he was precise.

Fig. 2.4 Demostration of Eratosthenes calculations



http://www.eg.bucknell.edu/physics/astronomy/astr101/specials/eratosthenes.html

2.3 Greco - Roman era

During the Greco – Roman era (2nd century B.C. – 1st century) both civilizations start to share their knowledge on the subject of Cartography. The Roman republic start to grow by conquering territories, and by doing so the Romans collect a lot of information and recorded a lot of data from everywhere they went. They started they own schools and the centres of knowledge went to Rome and Rhodes.

The Greeks continued with less practical sciences, like mathematics or philosophy, but they were still the ones that hold more information and did the best maps. There was a will from the Romans to know more about the Greek science, and some scientists moved to Roman cities, sometimes with the pretext of some job and sometimes just kidnaped.

We see the story of Polybius who has taken to Rome and became a cartographer for the Roman republic. He is accounted to be a great cartographer of Europe, thanks to the conquests of the Roman republic. Crates was one of the other Greek scientists that stayed in Rome after some inspections he agreed to do on the sewage system. With the information existing in the field of the actual size of the Earth he states that

Figure 2.5 The Glove of Crates

http://www.clipart-technical.com/Maps/img635-R the Earth contains four parts (Figure 2.5), two in the north hemisphere and two in the south hemisphere. He also said that the inhabited world is only part of the north-east hemisphere. At the time there was not many information of Africa below the latitude of the Red Sea or the Arabic peninsula, so that idea was wildly accepted and repeated in next theories.

2.3.1 Strabo

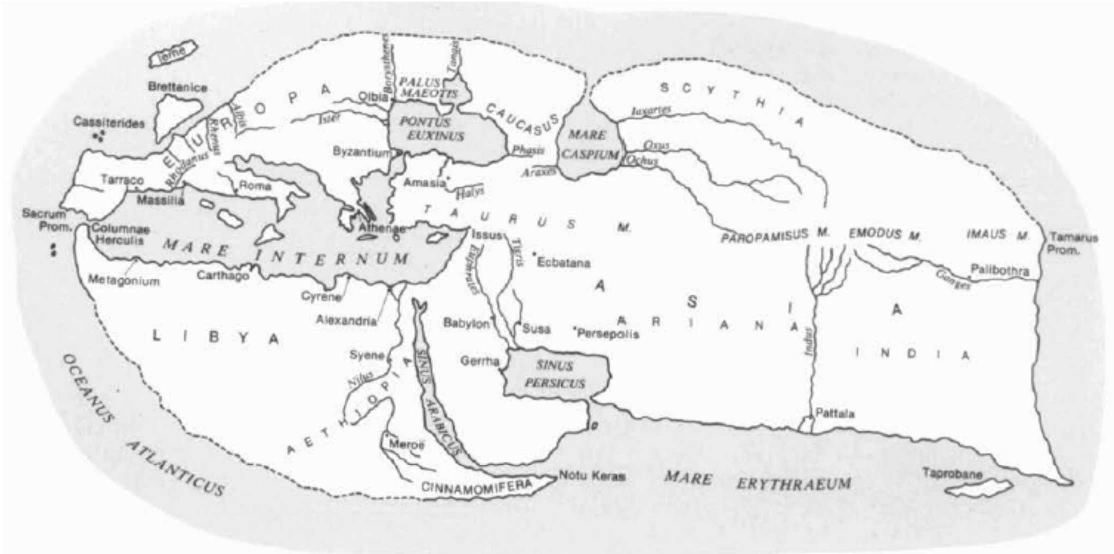
Strabo (64 B.C. – 24 A.D.) was a Roman citizen born in a Greek family in the city of Amaseia (Amasya, Turkey). He was son of a wealthy family and on that account he became a scientist, geographer, philosopher and historian. He is important to the cartography history because of his encyclopedia *Geographica. Geographica* is a compilation of seventeen volumes containing information about the whole inhabited world at the time.

During his life, Strabo visited Rome and Alexandria, the biggest sources of knowledge at the time. He spends some of his early life in Rome, he moved there at the age of twenty, and spends about thirteen years writing and studding. From his books we know that he had access to a lot of the Roman data on the field (from wars and conquers) and he based his books on the need for an improvement of the existing books of Cartography.

Later on Strabo moved to the other great cultural centre of Alexandria, where the biggest library on the world was still placed. Thanks to that, he could look over the books and studies of some of the greatest Cartographers and Geographers of the past eight centuries, like Eratosthenes (on whose map he based his own), Polybius, Crates, Hipparchus and Posidonius, and we know of them because of Strabo's quotes and critics on his books.

Finally around year 23 A.D. (We don't know the exact year because some sources claim he was dead by year 21 A.D.) he delivered the final edition of *Geographica.* His first book was about definitions and history of Geography, the second book was about the mathematics of Geography and the fifteen left were an exhaustive definition of the known world, both by maps and descriptions. From the descriptions he made we can see how they saw the world at the time.

Figure 2.6 Reconstruction of Strabo’s map of the inhabited world from the descriptions in his books



A History of Ancient Geography among the Greeks and Romans from the Earliest Ages till the Fall of the Roman Empire, 2d ed., 2 vols. vol. 2, map facing p. 238.

2.4 Ptolemy

Ptolemy (90 – 168) is the culmination of all the Greco – Roman period of the cartography history covering from the 8th century B.C. Ptolemy was a Roman citizen on Alexandria, Egypt, but it is believed that he was of Greek ethnicity, and his books were also wrote in Greek language. He was, like most of his colleagues, a polymath and also stands out in mathematics, astronomy, astrology and he even wrote poetry. During his life he wrote two of the most important collection of books that we can find today the *Almagest* and the *Geography.* The *Almagest* is a treaty in mathematics and astronomy, and the *Geography* is a compilation of five books on cartography that survived until today through copies made along the history.

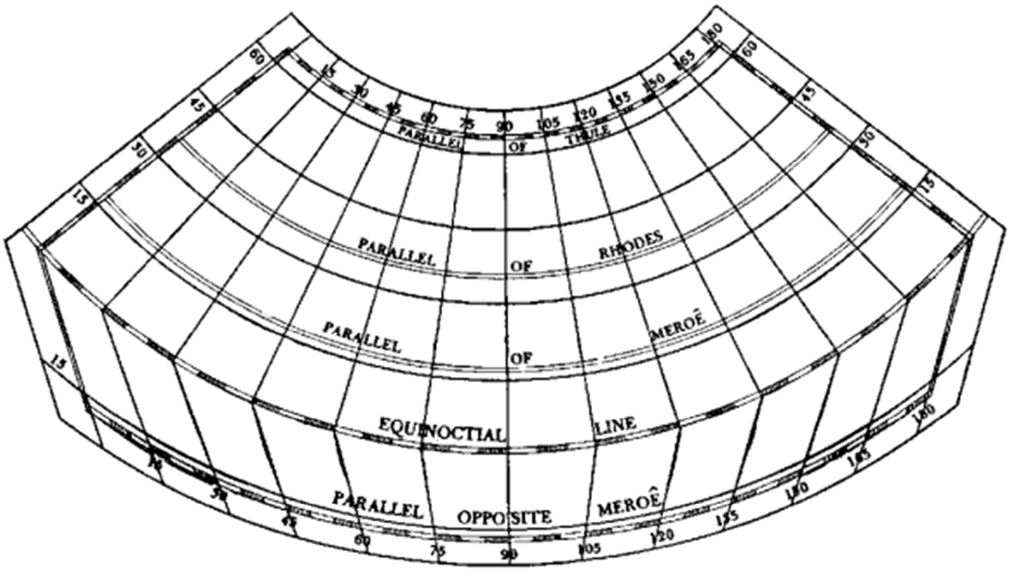
Along the five books of *Geography* we find on the first one the data and the methods used to make the books from two to five which are an Atlas of the known world. He based his books on a critic to a one of his contemporary authors Marinus of Tyre

(100 – 150) and information given by the Roman Empire in gazetteers or sailing logs form the trade established between Roman provinces.

Ptolemy, like Crates, also defines the world as two hemispheres with two parts on each hemisphere, and also knew and later define on the Atlas that we lived in one of the parts of the north hemisphere (Figure 2.5). On the copies of his books we find today none of the picture maps survived (except for a part of a map of Britain), but we can draw precise reconstructions of his maps because he established a system of fixed coordinates similar to the used nowadays. On Ptolemy's coordinates the equator line is the same as it is nowadays but his 0º meridian is set on the farthest west location known at the time, the Fortune Islands, which are believed to be the Canary Islands or Madeira. Another advantage was that Ptolemy digitalized most of the knowledge rather than expressing it on a graphic form so it survived more easily.

We represent Ptolemy's maps on what we call Ptolemy's projections. First Ptolemy's projection (Figure 2.7) is a simple conical projection, parallels are concentric lines and meridians are straight lines getting together at 90º, so due to not representing the spherical shape of the Earth and only the curve we have errors on the distances (except on the parallel that he is taking as reference). Those errors are obviated on

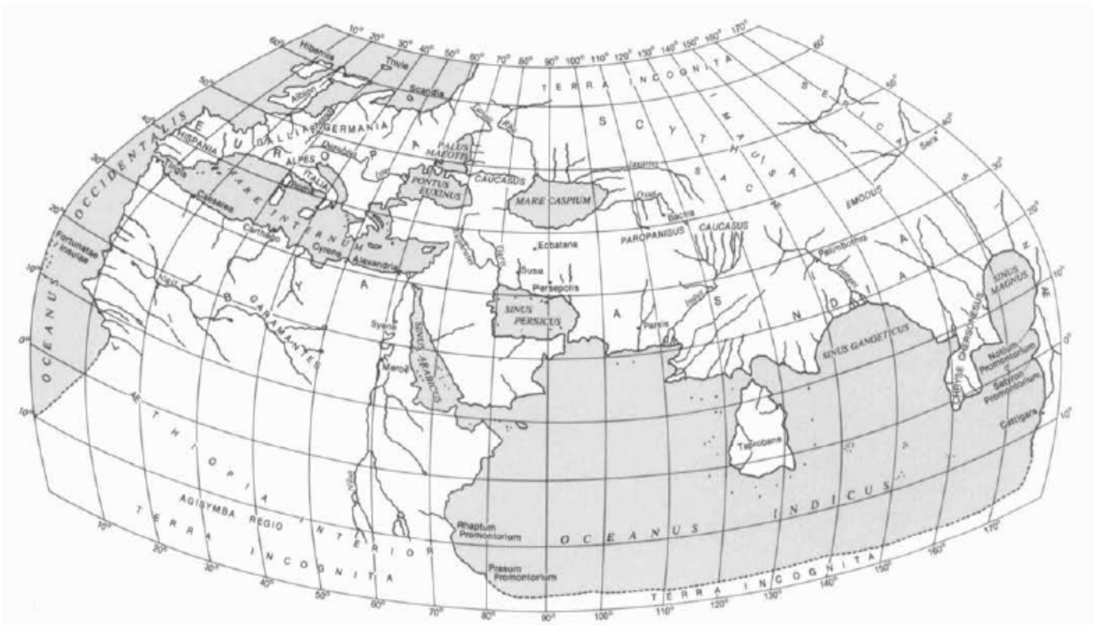
Figure 2.7 Ptolemy's first projection



http://regardingmeasurement.wordpress.com/2010/10/31/considering-maps-ii-virtual-lines/

the north hemisphere, but Ptolemy, aware that there would be bigger errors on the south hemisphere, simply drew straight lines from the equator below. Second Ptolemy's projection (Figure 2.8), which he called superior method, keeps the size of a sphere curving parallels and meridians.

Figure 2.8 Ptolemy's map of the inhabited world over his second projection



A History of Ancient Geography among the Greeks and Romansfrom the Earliest Ages till the Fall of the Roman Empire, 2d ed., 2 vols. (1883; republished with a new introduction by W. H. Stahl, New York: Dover, 1959), map facing p. 578.

To fulfil the projections Ptolemy needed information of the world he obtained from early Cartographers and from the Roman gazetteers and sailing logs. To read latitudes and longitudes at the time he had two assets that gave him indicators. First to calculate latitudes he used a quadrant, a navigation instrument that measures the latitude if you direct it to the polar star. Secondly he used a clever but no so precise technique, which was estimate the latitude knowing the durations of the day and night. For the longitude calculations some say that he may know it from eclipses. In the library of Alexandria there was information about eclipses and he believed that calculating the time that elapses an eclipse from one place to another he could calculate distances, so longitudes. He described that technique, but some believe that he worked out the longitudes calculating distances from the Roman data. Now with all the data he compiled he wrote his 4 books of Atlas (Books 2 to 5). The result of plotting all the points he described down is his Mappa Mundi (Figure 2.8).

Part 2: Medieval Cartography

Chapter 3: Early Medieval Cartography

Introduction

After Ptolemy delivered his *Geography* books, we find a gap that last for at least over a thousand years. During the period while the barbarian kingdoms (Byzantines, Lombards, Visigoths and Franks) took the control over Europe we don't find real attempts to improve the cartography that was delivered during the Greco – Roman era. During the thousand years that followed Ptolemy there was a strong will in the world for the religion (Christian mostly) to destroy everything that were against "the word of God" meaning that the religion fixed some new standards to believe. Only a few books survived, like Ptolemy's or Strabo's books, because they were copied and kept in the Middle East.

We find some maps over those centuries, but we never find a pattern, we don't find a "school" like the Greek school. It is not until the era of the Portolan Charts that we find now again the pattern lost years ago.

3.1 Vinland Map

The Vinland map (Figure 3.1) claims to be the first map to cartography part of the coast of America, more specifically the north east region of Vinland (now Newfoundland, Canada). It was introduced to the world by the British Museum and Yale University in the year 1965, but discovered previously in 1957. Since then controversy followed the Vinland map.

The Vinland map is drew in the 15^{th} century, but it represents a map from the 11^{th} century. It shows Europa, Asia and Africa (as they knew it at the time), but the main features are that it shows Greenland and mostly Vinland (where it took the name from). We know from the Viking Norse settlement of L'Anse aux Meadows that Leif Erikson's crew colonized America on the region of Vinland, so that make plausible the hypothesis of a map of America before Columbus arrived there. Though there is no notice of the Vikings exploring Africa or Asia, the fact that the map was not made by Viking, only using the information that they collected while they were in America, make also possible for another one on the 15th century to use such information. But the detonator of the controversy around the Vinland map is that some subsequent analysis of the map reveals that a chemical component found in the 20th century was mixed with the ink used to paint the map. So it is not clear that the Vinland map was the first map to contain part of America, though it is considered of a precious scientific value.

Figure 3.1 Vinland Map

http://upload.wikimedia.org/wikipedia/commons/d/dd/Vinland_Map_HiRes.jpg

3.2 Portolan Charts

The Portolan Charts are an old kind of charts that fulfil just one purpose, to navigate safely from one port to another. For many years this will be the way to see the world, so the Portolan Charts fill the need of directions for the increasing sea trade and the future Age of Discovery. They started in Italy (Sometimes referred as Italian Portolan charts) and quickly spread to Spain and Portugal, the great naval countries at the time, and finally all over Europe. They will be later a beg asset on the Dutch Merchants and the English and Spanish armadas. Portolan charts were usually drawn in animal skin and the pigments used to paint them differ depending on the client. Over two thousand Portolan charts are counted on today’s archives, and we find from a simple chart used to navigate for a long time to the ornate chats that decorate the libraries and the wealthy families’ houses.

As said, the Portolan charts were made to obtain directions and safely navigate from one port to another. To do so, Portolan charts used a sophisticated web of courses that join in the middle of circles. Those courses were meant to join ports and to leave as much open sea as possible free, for example, if we are commanding a ship and depart from Barcelona and want to go to Valencia we just keep a safe distance off the coast (there’s no soundings of the deeps on the charts nor any device that shows the depth of the ship) and then steer the course that cross Barcelona and Valencia. Another characteristic of the Portolan chart was the abundance of landmarks. Charts were very simple to understand and they serve the purpose well enough.

It’s been difficult to know the origins of the Portolan charts. We find text like the one of Tony Campbell that says “Even among what might be termed the "ancient" rather than the "medievalist" school, there has been great divergence of opinion. Most extreme, in terms of both age and plausibility, is Hapgood's contention that the inception of the Portolan charts should be traced back to Neolithic times. Less controversial, but still little supported, have been Cortesao's further suggestions that the Phoenicians or Egyptians were responsible for developing the charts, notwithstanding the conflict with his support for a medieval origin. It is, however, to the worlds of ancient Greece and Rome that we have most often been directed in the search for a solution to this mystery." It is also difficult to track the origins of this kind of charts because normally we find them alone and in poor condition. Greeks used to digitalize all the information on the charts, and explain from where they took the information they are using. The Portolan charts just present the map, sometime along with few information (like in the Catalan Atlas), but information is not displayed in long volumes of books like Ptolemy or Strabo.

The projection of the Portolan charts is also of controversy. Those who claim that the Portolan charts come from the Greeks say that the web of courses joining on a big central circle is just a simplification of the latitude and longitude that Greeks used. Others say that the absence of latitude and longitude lines is evidence enough to prove that they lack of any projection. This last theory may not be true, so it is true that they lack of explicit latitude and longitude lines, but some of the cities and landmarks that have to be on the same latitude or longitude lines were displayed so.

Now we will proceed to see the most representative or somehow interesting Portolan charts. Those charts were:

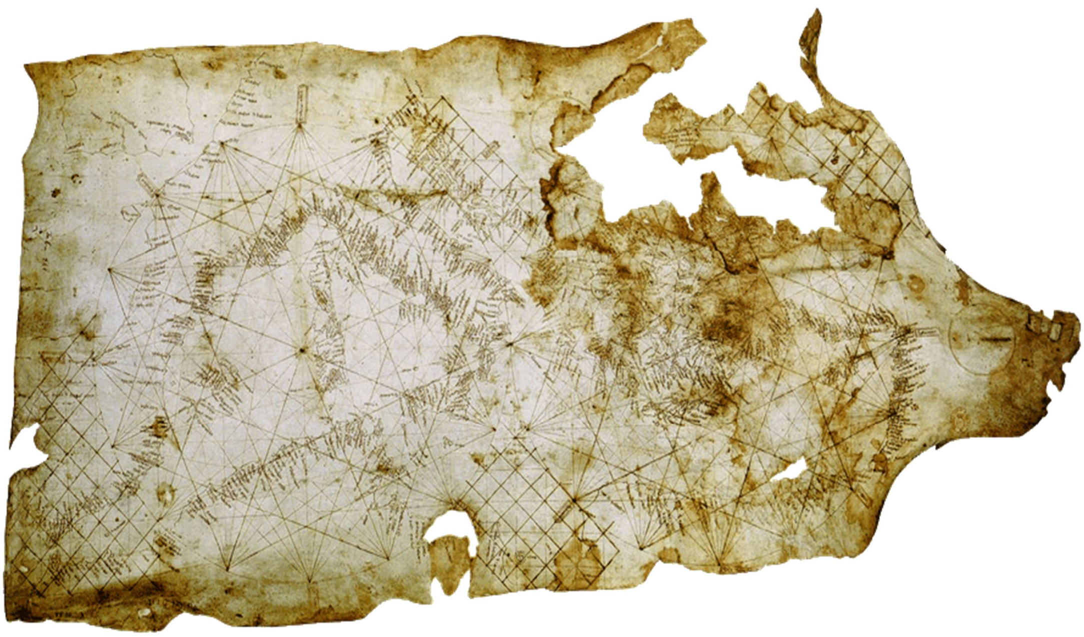
- Carta Pisana
- Catalan Atlas
- Pizzigano Map
- Map of Juan de la Cosa
- Cantino World Map (Portolan Chart with latitudes)

3.2.1 Carta Pisana

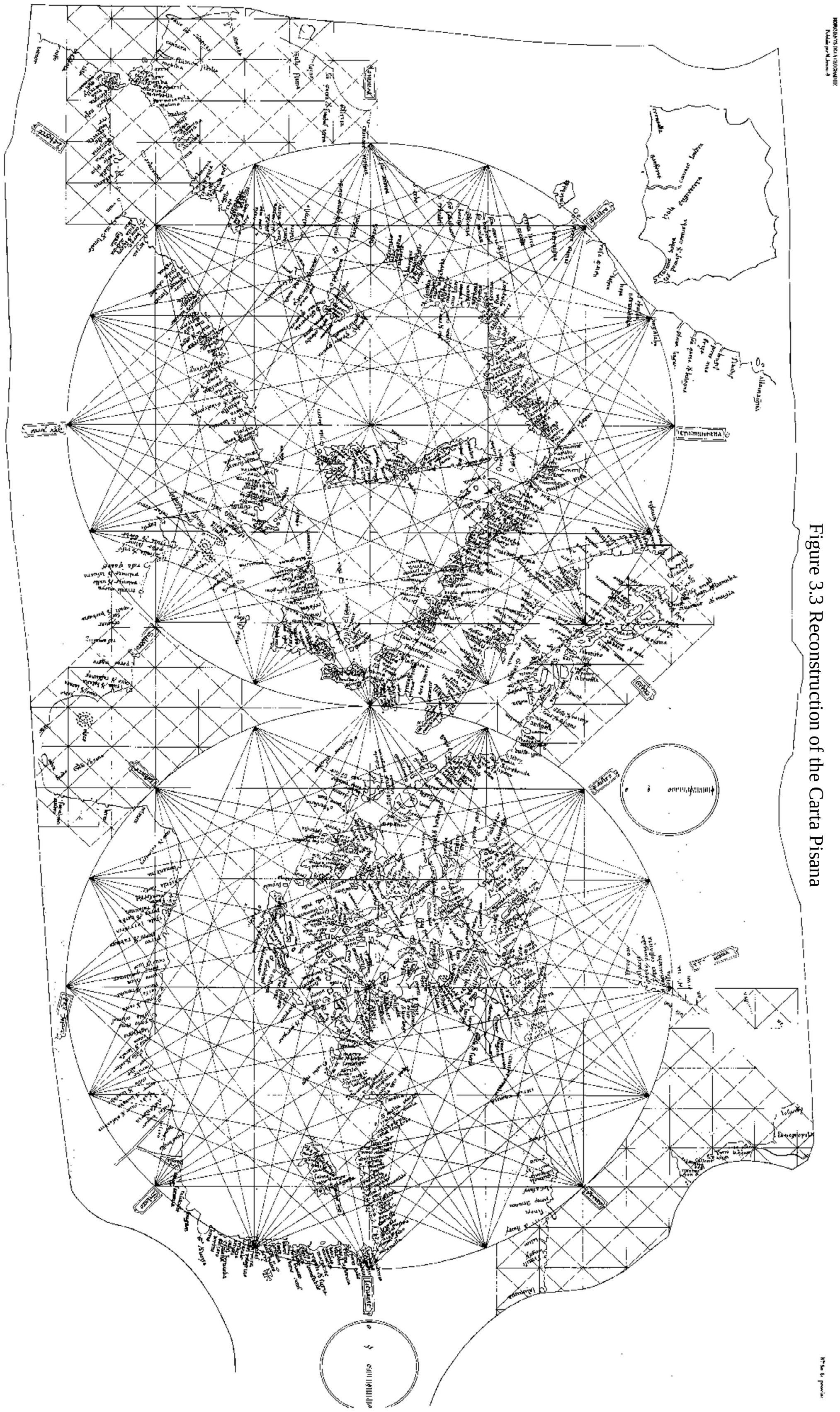
The Carta Pisana (Figure 3.2 and 3.3) is the oldest of the known Portolan charts, so it is fair to say that the Carta Pisana was the first navigation chart that expressly serve this purpose. We know that it was made in Italy, probably in Pisa, where it was found, or Genoa but his author remains unknown. The chart dates of the 13th century and shows from the north of Morocco to Netherlands and from the Iberia peninsula to the Black Sea, but it focus mostly on the Mediterranean.

We can see on the Carta Pisana chart the characteristics of a Portolan Chart. We find two great circles that work as a network or web of courses. The chart was also made on animal skin (sheep probably). It is very precise on the Mediterranean (as we said before it focus on the Mediterranean) but not so good to navigate rear the British islands or the Black Sea. We know few things about its origins, probably the author used a compilation of different sources as the fact that names are written in different dialects may suggest.

Figure 3.2 Original Carta Pisana



http://upload.wikimedia.org/wikipedia/commons/0/0f/Carta_Pisana.png



http://www.sfakia-crete-forum.com/read.php?7,169,173

Figure 3.3 Reconstruction of the Carta Pisana

3.2.2 Catalan Charts and Catalan Atlas

The Catalan charts are a subtype of Portolan Charts that will be drawn during the 14th and 15th centuries coinciding with the period of maximum extension of the kingdom of Aragon till in 1469 Aragon will join the kingdom of Castilla to become part of Spain. During this period the Catalan was set as the language of common use for the wealthy people and the studiers (some say old Catalan was considered more close to Latin than the other Romanic languages). Also during this period the kingdom of Aragon had the biggest navy in the world, so Scientifics had access to information from the ships. With all this ingredients a group of cartographers and map makers excels in Majorca in the Balearic Islands and write his books and maps in Catalan language (here the name). In this group we find Cresques Abraham the author of the most representative of the Catalan charts, the Catalan Atlas (Figure 3.4).

The Catalan subtype of Portolan charts is characterized to display a larger part of the world (not only the Mediterranean). They also show more inland information, the name of the different seas and the compass directions are shown in numbers for the first time. That information makes them look closer to future charts and the fact that there was a Majorcan cartography school suggests that Catalan subtype of Portolan chart was set as the main way to make Portolan charts.

Figure 3.4 Catalan Atlas

http://mallorcaphotoblog.com/2009/02/12/the-catalan-atlas-of-1375/

The Catalan Atlas (1375) was a present from Pedro IV king of Aragon to his cousin and king of France Charles VI in 1381 and since then it remains in the French royal library (still available to the public). The Catalan Atlas is a collection of 12 sheets 4 containing information about cosmography, astronomy and astrology, and the 8 remaining sheets contain the map. It is one of the first Portolan charts to have this vision of the whole world from the Canary Islands to the Eastern Asia and from India to the Scandinavia peninsula. It is of great importance because the Asian part of the maps shows for the first time information of the travels of Marco Polo along Asia.

3.2.3 Pizzigano Map

Pizzigano Map (1424) (Figure 3.5) is a Portolan chart showing the phantom islands of the Antillia group. Antillia Islands are a group of island believed to be the eastern most part of the American continent, but despite de fact that they appear in some maps and text before and right after Pizzigano Map was delivered, there is no evidence that they exist, because after 1492 (Columbus' discovery of America) the traffic on the north Atlantic Ocean start to increase and no one else reported to see them again.

3.5 Pizzigano Map

http://upload.wikimedia.org/wikipedia/commons/4/44/Pizzigano.jpg

Chapter 4: Age of Discovery

Introduction

The Age of Discovery is one of the most influential periods on the cartography. During this period European explorers, navigators and traders start to navigate everywhere from America to China. It is without a doubt a golden age for the maritime navigation, being the main choice of transport for the expeditions that will discover the world, like Columbus discovering America, Dom Vasco da Gama discovering the maritime route to India and the circumvallation around the world of Ferdinand Magellan finished by Elcano. In addition of the discoveries during this period more navigation instruments start to be available in all ships, instruments like the compass, quadrant, and astrolabe that helped the cartographers bringing home from the expeditions more accurate log books.

During the Age of Discovery the whole world will be discovered, the Pacific Ocean (never visited by Europeans) will start to appear in the maps and the islands on it until eventually we find the map of the whole world.

Also during this period after the discoveries we find the colonialism and the wars between territories for the control of colonies, wars against natives, civil wars against the colonists by the people living in the colonies, etc. All this events will set the new map of the world and lead to the Modern era.

4.1 Map of Juan de la Cosa

The Map of Juan de la Cosa (1500) is yet a Portolan chart, but it also is the first representation of the American continent on a European chart.

Juan de la Cosa (1450 – 1510) was a cartographer and a navigator. He was the owner of the Santa María (one of the Columbus expedition ships) and during Columbus' first and second voyages to America he was Santa María's captain. He was an important person for the crown and often carried official duties, but he mostly spends his life navigating. After the discovery of America he went back there several times until he finally died in Colombia during a battle against the natives. Before he delivered his map in 1500 he had already been in America 3 or 4 times, including the Antilles and South America.

The map of Juan de la Cosa (Figure 4.1) was made for someone on the court or for someone wealthy as the materials used on it suggest. In addition to the new discoveries of America it also shows the entire known world at the time and we see Africa on a pretty accurate shape. The reason of these knowledge of Africa is that by the time the map was done, Bartolomeu Dias had already reach the southernmost point of the African continent by sea, and India had already been reached by Dom Vasco da Gama two years before the map was delivered, and new trading routes were established between Europe and Asia

Figure 4.1 Map of Juan de la Cosa (Rotated 90º to fit the modern view)

http://upload.wikimedia.org/wikipedia/commons/4/4a/1500_map_by_Juan_de_la_Cosa_rotated.jpg

4.2 Cantino World Map

Cantino world map (1502) is a Portuguese map of the world showing unique information about the discoveries of Portugal during the colonization of America. This map was smuggled from Portugal to Italy by Cantino an agent working for the Duke of Ferrara. During the period of the colonization of America by the Spanish and the Portuguese it was quite common for agents from other countries to try to smuggle precious information to make money on the process.

Cantino world map (Figure 4.2) is of special importance to the history because it's the first map to depict the newly discovered regions of Brazil, Florida and Newfoundland (many claim its discovery), and regions of east Africa and India that had never been pictured on a map. It is not completely verified that the Portuguese were on Florida before Ponce de Leon (official discoverer) was in 1513, but if that be true, it would mean that Portuguese discovered Florida about 12 years before Ponce de Leon.

The Cantino world map has also another characteristic that makes it unique, and this characteristic is the use of latitudes. Cantino's map is a mixture of Portland chart and the latitude charts that seemed to be lost over the years since they were used in the Greco – Roman period of history.

Figure 4.2 Cantino World Map

http://hallnjean.files.wordpress.com/2010/01/cantino.gif

4.3 Universalis Cosmographia

Universalis Cosmographia (1507) by Waldseemuller (1470 – 1520) is the first map to separate America from Asia. At that point of history there were different opinions regarding America. No one really knew if it was part of Asia or a new continent (Columbus died believing that Cuba was part of Asia and not even an island) but Waldseemuller probably based on information from Vespucci, describing part of America and the people that lived there, believed that these lands couldn't be Asia so they had to be something new.

Waldseemuller was from Germany and in his early life had studied in the university in Germany. After that he moved to France where he joined the Gymnasium Vosagense at Saint Diey where he had information about Columbus and Amerigo Vespucci. With that information he formulate the theory stating that the new discovered land could not be Asia, and named these land America (after Amerigo Vespucci). After that based on other maps, probably Cantino's map of the world, he depict his version of the world map including the Pacific Ocean (he called Occeanus Occidentalis).

Figure 4.3 Universalis Cosmographia

http://upload.wikimedia.org/wikipedia/commons/thumb/c/c0/Waldseemuller_map_2.jpg

Universalis Cosmographia (Figure 4.3) is a very interesting peace of cartography as the way that it is represented. As we see on the picture, the map is represented on a grid of longitudes and latitudes like the late Greek cartography. It also shares with the Greek cartography the projection, so it is believed to be a variation of Ptolemy's projection (nowadays called equirectangular projection).

4.4 Padrón Real or Padrón General and the Casa de Contratación

Along with the supremacy of Spain on the top of new discovered land and conquests a strict organization was needed and that is why in 1503 the Casa de Contratación was born. The Casa de Contratación (officially La Casa y Audiencia de Indias) was the link between the government and the voyages to discover the new world or to trade with India or the colonies. The Casa controlled everything related to the voyages by sea, collected all colonial taxes and duties, approved all voyages of exploration and trade, maintained secret information on trade routes and new discoveries, licensed captains, and administered commercial law, but the most important is that by 1507 the Padrón Real was created.

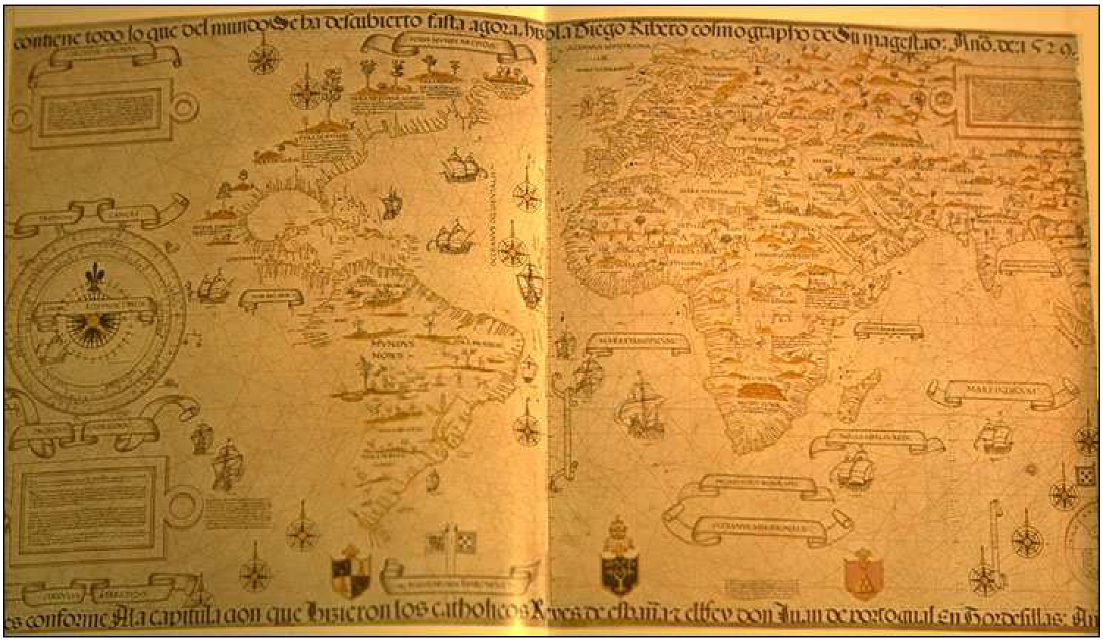
The Padrón Real was one big map that was constantly updated by cartographers (called cosmographers) with the information provided by the voyages overseas. To provide such information Spain had started to train its own officers and navigators. During that time with the control of the Casa de Contratación Spain made compulsory for everyone sailing under the Spanish flag to carry accurate navigation instruments, trained personal and maps from the Padrón Real under the penalty of a fine. After a ship came back from a voyage, they had to report everything to the Casa de Contratación, including a detailed log book and the coordinates, latitude and longitude, of all places they had been along with new information of discovered land if so. Thanks to all that information brought from everywhere of the world the Padrón Real was improving rapidly. That led to the supremacy and control of the seas by the Spanish Armada during the 16th century.

Not before delivering to the world some great quality maps (the world map of Diogo Ribeiro and the master map of Juan López de Velasco), during the 17th century the Casa de Contratación starts losing power and importance until it finally disappears at the end of the 17th century. Nonetheless it sets precedent and other countries that later will try to rule the oceans will have similar organizations setting rules to the ships and seafarers like the Casa da Índia of Portugal or the Admiralty of England (surviving nowadays). In my opinion the idea of an organization that set rules to the ships regarding the ship's equipment and the training of the seafarers working on it for the achievement of a higher purpose is what nowadays we call International Maritime Organization.

4.4.1 Diogo Ribeiro

Diogo Ribeiro (unknown birth – 1533) was a Portuguese cartographer that worked in the Padrón Real and depicted some copies that will be of great importance to history. He started to work at the Padrón Real in 1518 and since then he acquired experience until in the year 1523 was named Royal Cosmographer. After that in 1527 he finished the Padrón Real and made some copies, the best preserved survives at the Vatican Library.

Figure 4.4 Vatican Library copy of the World Map by Diogo Ribeiro



http://upload.wikimedia.org/wikipedia/commons/f/f9/Worldmap_1529-Ribero.jpeg

On Diogo's Map we see the experience of the new discoveries, the East coast of North America and the increasing detail of the East coast of South America, the shape of Africa and the size of the Pacific Ocean, most provably from the Magallanes circumvallation.

4.4.2 Juan López de Velasco

Juan López de Velasco (1530 – 1598) like Diogo Ribeiro was a member of the Padrón Real. He took over the control of the Padrón Real when Alonso de Santa Cruz gave him his map collection. With an express order from the king he had to improve the Padrón Real, and in the 1574 he delivered "Geografía y descripción universal de las Indias". The book contains information and maps, a general map of the Spanish world and twelve maps showing judicial districts of Spain in more detail. Unfortunately the maps had been very deteriorated and improved copies by Antonio Herrera (Figure 4.5) are easier to interpret.

Figure 4.5 Improved copy of Juan López de Velasco Map by Antonio Herrera

http://elgaleon.weebly.com/page-17.html

4.5 Dieppe Maps

The Dieppe Maps (1540 – 1584) are a collection of maps mostly French that show information about the discoveries of the new world, mostly by the Portuguese. It is believed that information somehow was smuggled from Portugal (not the first time in history as we see the precedent of Cantino's Map). Dieppe Maps are supposed to be designed in a large format to fit the houses of the royalty and the more wealthy families, though there is scholars that believe that compasses showing sailing directions may indicate they could be used as navigation charts.

Figure 4.6 Example of Dieppe Map: Piere Desceliers, 1550

http://dawnemapy.com.pl/media/mapy%20XVIw/129.%20dauphin%20map%201550%20Pierre%20Descelie rs%20Carte%20du%20Monde%20Parchemin%201350x2150%20mm%20Londres%20British%20Museum% 20kopia.jpg

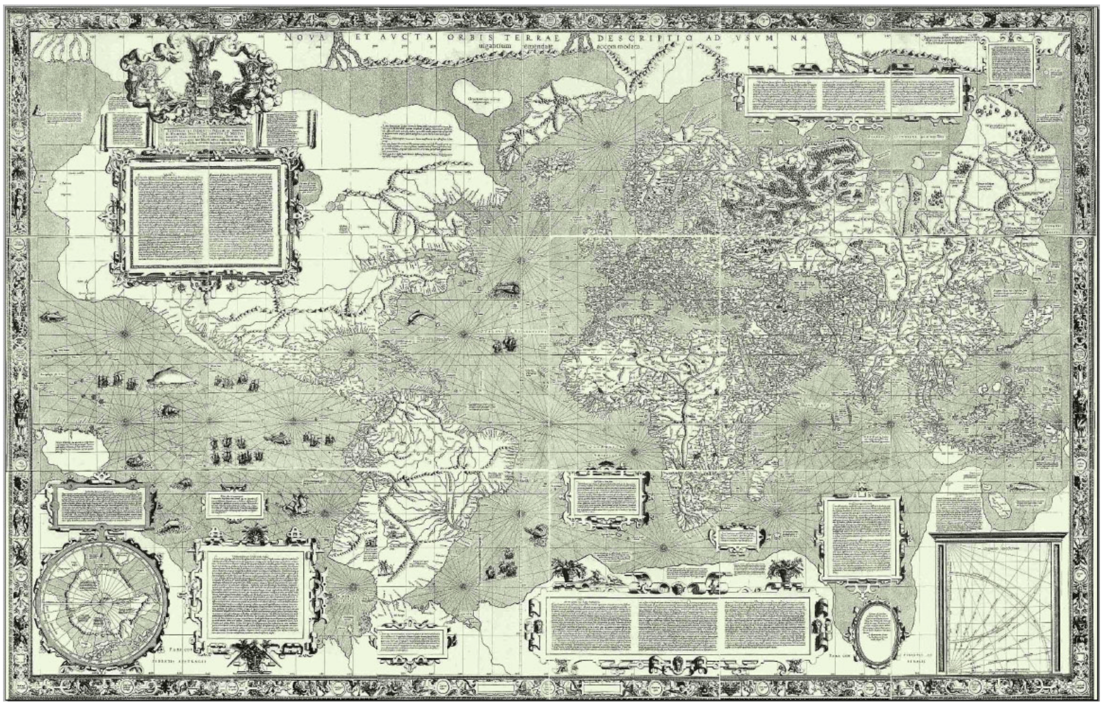
Dieppe Maps were the first evidence of Australia. As we see at the Figure 4.6 on the inferior right corner a land believed to be together with the Antarctica. Those are verified traces of a discovery of Australia many years before Willem Janszoon arrived to Queensland, Australia. We don't know exactly if someone landed in Australia before Mr Janszoon, but we know that Europeans knew that there was land on that part of the world. Along Dieppe Maps we also find the Spiece Islands, every time more accurate as the years passed.

Following the tendency of that time, the Dieppe Maps show characteristics of the Portolan charts and include some new characteristics like the latitude lines.

4.6 Gerardus Mercator

Gerardus Mercator (1512 – 1594) was the cartographer that introduced the Mercator projection that we use on the nowadays charts to the world. Mercator was not a cartographer initially, he went to the university and graduated as philosopher and humanist, but he was a well-known mathematician. In 1536 he was involved in the construction of a globe of the world, and after that he started to occasionally depict maps. After years of teaching an improving his skills as cartographer he starts to work for the Duke of Julich-Cleves-Berg in 1564 and end up making his famous map of the world in 1569.

Figure 4.7 Mercator's world map



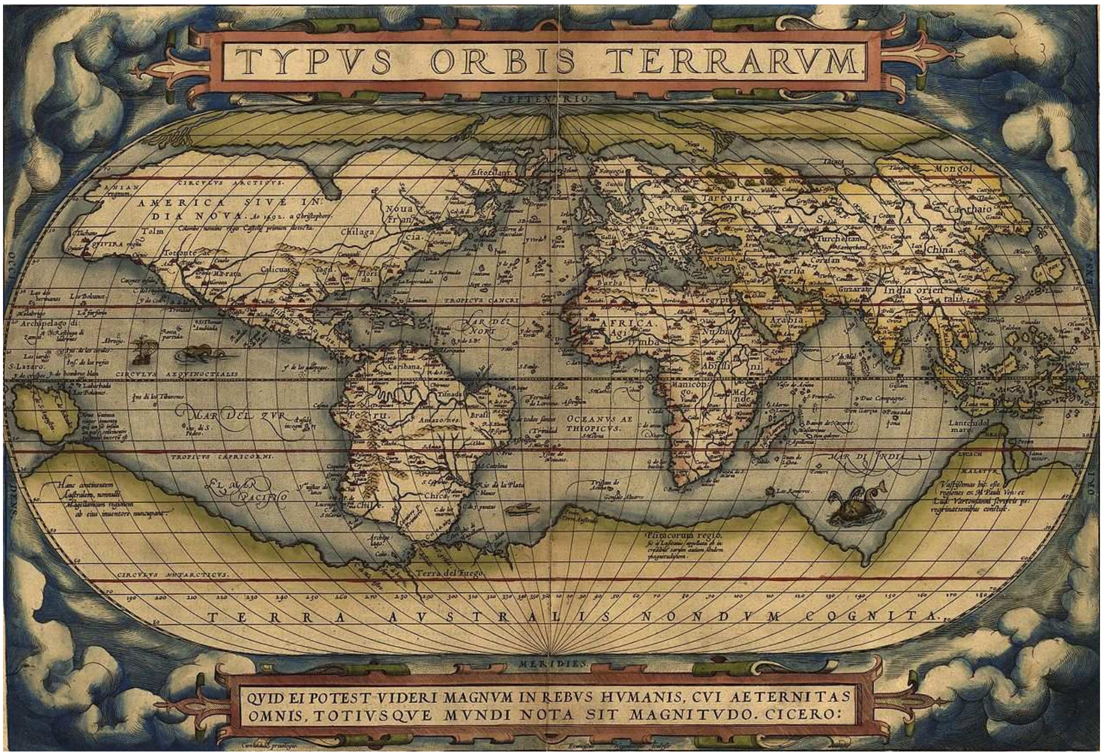
http://upload.wikimedia.org/wikipedia/commons/b/b2/Mercator_1569.png

Mercator's world map (Figure 4.7) establishes what later will be the way to represent every single nautical chart. The map introduces for the first time longitudes (after the Greeks we only found vertical lines on the Universalis Cosmographia by Waldseemuller). Mercator's map is set on the characteristic grid of longitudes and latitudes, but it also shows the sailing directions that characterize the Portolan charts. It takes Australia from the Dieppe Maps and we can also see that areas well explored like Europe, Africa, Asia and Central America are of great detail.

4.7 Theatrum Orbis Terrarum

Theatrum Orbis Terrarum (1570) by Abraham Ortelius is considered the first modern Atlas and sometimes is called "the summary of the 16th century". The first Atlas consists of seventy maps on fifty-three sheets but it kept growing until it reached one hundred sixty-seven maps in 1612. The importance of the Atlas, besides being the first modern Atlas, is that it included a great number of references and that allowed us to know of the existence of many cartographers of the time.

Figure 4.8 Representative Mappa mundi from Theatrum Orbis Terrarum



http://upload.wikimedia.org/wikipedia/commons/thumb/e/e2/OrteliusWorldMap1570.jpg

Part 4: Modern Era

Chapter 5: Discoveries during the 17th and 18th centuries

Introduction

During the 17th century further research was done, but there was not the development and the discoveries we saw back on the 16th century. We find the reasons in a weakened Spanish Armada (the one promoting most of the discoveries) by the English and the world caring more about wars and power than ever before. Despite the poor contribution to science of the 17th century, the 18th century represents a period of recovery from a cartographic point of view.

During the 18th century we find important developments in the field of chart projections and the creation of the Admiralty United Kingdom Hydrographic Office that will later deliver the 70% of the world's charts and be responsible for the charts on the merchant marine ships.

5.1 Chart projections during the 18th century

During the 18th century we find important improvements in the way maps were represented. With almost all the planet already surveyed and information about surveys available it was the logic step to proceed with.

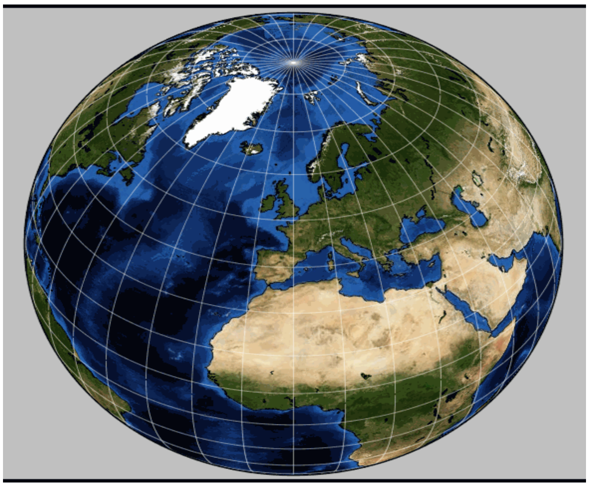
In 1740 Matthias Seutter was a cartographer with his own company of mapmaking. He invented the Vertical Perspective projection, a way to see the Earth as if it was seen form an altitude of about 12.750 km from the Earth.

In 1745 the Equidistant Conic projection was invented by Joseph-Nicolas Delisle a French astronomer. The Equidistant Conic projection is a projection characterized to keep the distances proportionate along the meridians.

Later in 1772 Johann Lambert invented two more projections. The Lambert conformal conic is done by setting an imaginary cone with the centre in a pole (like putting a conic hat on the Earth) and later unrolling that cone and setting the parallel touching the Earth as reference. The Lambert conformal conic is nowadays used in aviation. The second Lambert projection is the Lambert azimuthal equal-area projection that will later be improved by Heinrich Albers in 1805. The Lambert azimuthal equal-area projection is characterized to represent on paper exactly the area of the regions, but it lacks of accuracy when it comes to measure angles.

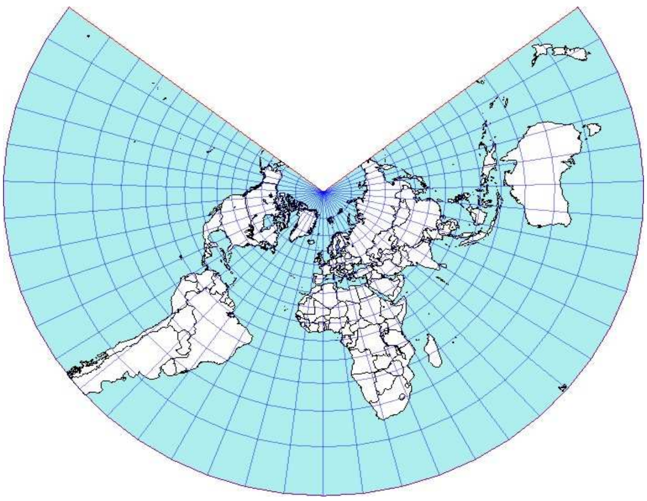
We found nowadays applications of these projections on Google Maps (displaying the Vertical Perspective) or the use of Lambert conformal conic projection in aviation, as said before. After the great advances in the field of chart projections during the 18th century we have to wait over a hundred years to see new advances.

Figure 5.1 Vertical Perspective



http://www.giss.nasa.gov/tools/gprojector/help/projections/verticalperspective.gif

Figure 5.2 Lambert conformal conic



http://www.mgaqua.net/AquaDoc/Projections/img/Lambert%20Conformal%20Conic.jpg

Chapter 6: Admiralty

Introduction

During the 19th century the most relevant accomplishments were by the United Kingdom Hydrographic Office (UKHO), aka. Admiralty. The Admiralty was created in 1400, but it had never been as important as the 18th and 19th centuries. The 18th century previous to the creation of the Hydrographic Office Her of His Majesty's Ships (HMS) were all over the world compiling information, sometimes related to cartography and exploration, sometime in other official matters, but always bringing home new information.

One of the great cartographers that existed before the UKHO was Captain James Cook. Captain Cook was a navigator that enrolled the Royal Navy after spending some years at the merchant navy. He stands out in surveying parts of the Quebec and Newfoundland and then started three Pacific expeditions that will make him famous. Captain Cook was the perfect combination of captain, military leader, cartographer and surveyor. In the Pacific Captain Cook was the first recorded European to arrive to Australia's east coast, he has the first European in the Hawaiian Islands and he holds the first recorded circumvallation of New Zealand. After this he was killed in a battle against some Hawaiian local tribe.

So as the example of Captain Cook tells us, Admiralty had a lot of information of the world and surveys carried out by their own ships. With that information and charts, but no real registry to collect them, King George III appointed Alexander Dalrymple in 1795 to establish the UKHO and start compiling and developing charts for the safe navigation of the British ships.

6.1 19th century: United Kingdom Hydrographic Office

Since its beginning the UKHO has been one of the most important companies that worked with nautical charts along the history. To explain the UKHO's history is to explain the history of the nautical charts from the 19th century until today.

After the UKHO was created it started a job of collection. Up to this point, charts in the United Kingdom belonged to the Admiralty (Naval service of British Armed Forces) and for the first years of the UKHO that will continue being the same way. In 1795 King George III "separate" the cartographers from the Navy and started the UKHO and the first year was about making a register of the existing chart and make the first catalogue. So in 1796 the existing charts were catalogued, and it was time to start making new charts. In 1800 the first nautical chart picturing the Quiberon bay in Brittany by the UKHO was created.

After its starts the UKHO had a change of responsible (called Hydrographer) in favour of Captain Thomas Hurd. Captain Hurd brought some changes to the UKHO, the most important the fact that in 1808 the charts were sold to the public. After that in 1823 the next Hidrographer, Rear Admiral Sir W. Edward Parry, was appointed but Captain Hurd continued supervising the next two big developments of the UKHO. In 1825 the first official catalogue was published with 736 charts and in 1829 the first sailing directions were published to accompany the nautical charts.

One of the greatest Hydrographers in the UHKO was Rear Admiral Sir Francis Beaufort. With Beaufort the UHKO had one of the biggest expansions going from the company that provided charts for the English navy and few merchant ships to be the biggest company in terms of nautical chart of the world. See what Wikipedia says about Beaufort: "Beaufort converted what had been a minor chart repository into the finest surveying and charting institution in the world. Some of the excellent charts the Office produced are still in use today."

During the years Beaufort stayed in front of the UKHO he organized surveys worldwide and encouraged the international cooperation. He is responsible from some improvements that made its way until today, like the Beaufort Scale to measure the wind force, the official introduction of the tide table in the charts in 1833, and the introduction of the Notices to Mariners in 1834. When Beaufort leaves the UKHO in 1855 the catalogue contained 1981 charts, that meant an increment of almost two hundred per cent in the years he has in charge.

After Beaufort in the 1870s the first explicit oceanographic expedition took place by the hand of the UKHO. The expedition was called challenger, after its mother ship the HMS Challenger. The expedition circumvallated the world and obtained 492 deep sea soundings, 133 bottom dredges, 151 open water trawls and 263 serial water temperature observations, and brought home this precious information that helped developing and improving charts.

During the 19th century a last important thing concerning the cartography occurred. In 1884 the International Meridian Conference was held in Washington D.C. and 22 countries voted to establish Greenwich as the prime meridian moving it from the diverse location in the Atlantic that was normally set (Azores, Canary Islands and Cape Verde) to the famous neighbourhood of London.

6.2 20th century: United Kingdom Hydrographic Office

The 20th century is characterized by the new advancements in the technology that allowed to make more precise charts every day. During this century we find further exploration and new technologies that facilitate the work of the cartographers.

The 20th century started with the British Nimrod expedition to the Antarctic. This expedition helped to survey the sea surrounding the Antarctica continent, a sea that was almost inaccessible because of its frozen condition.

After that the World War I started and the UKHO kept producing charts only available to the Royal navy. But after World War I, a discovery made some years ago become available to the UKHO, the sonar, and the survey of the ocean bed became easier and quicker.

Also after the war, and with a collaboration attitude between countries, the International Hydrographic Organization (IHO) was created in 1921. The IHO is a United Nations organization that promotes the cooperation and works for the world's seas, oceans and national waters to be properly surveyed and charted. Its standards are normally used in nautical charts.

After the World War II and a change of headquarters, the first surveying vessel was launched in 1953, the HMS Vidal. Vidal was equipped with the latest electronic equipment of the time and helped increasing the information on the charts. After the HMS Vidal more surveying vessels were launched. With modern technics like the multibeam survey and later the Side-scan Sonar the Bulldog-class of surveying vessels was launched in the 1960s. Finally the Echo-class is the most modern fleet of ships surveying the world. It was launched between 2000 and 2003 and the equipment on the ships, as said by Wikipedia, includes:

- Multi beam echo sounder
- Single beam echo sounder
- Survey Planning and Processing Systems
- Side-scan sonar
- Oceanographic Probe and sensors
- Undulating Oceanographic Profiler
- Doppler Current Log
- Sub-bottom Profiler
- Bottom Sampling Equipment
- Survey motor boat fitted with multi-beam sonar and sidescan sonar

Nowadays UKHO charts provide over 3.000 charts covering the entire world. Its paper charts are compulsory in the merchant marine ships subject to SOLAS chapter V and give all information needed for the save navigation of the ships.

Chapter 7: From Paper Charts to Electronic Charts

Introduction

The Electronic Charts were the result of the idea of adding charts on the radar display to make the information more accurate and visualize in the same screen all the information available in a chart. The two early systems were the Norcontrol Databridge and the Mitsubishi TONAC. These two radar systems had the capability of displaying some of the information of the charts on the radar screen. At the beginning was not a big success, there was a very little number of systems sold, and it was not user-friendly or easy to understand. Despite the fact that almost no one liked it for the navigation, companies saw a great potential on it and continued developing. The challenge was to simplify the interface including as much useful information as possible.

Thanks to the new developments of the Electronic Charts the IMO started taking it as a serious navigation tool. The Electronic Charts started making the navigation safer and new regulations regarding these new systems were required.

7.1 Regulations concerning the Electronic Charts

In 1988 the International Hydrographic Organization set for the first time a working team to regulate the Electronic Charts and set some standards for the companies developing these systems to follow. In 1992 the standards were set during the 14th International Hydrographic Conference, and these standards were known as S-57. The S-57 consists of:

- A data model
- List of objects
- Description of the attributes
- Description of the data exchange format (DX 90)

After that the IMO published its resolution A.817(19) in November 1995 about the Electronic charts defining for the first time the Electronic Chart Display and Information System (ECDIS) were defined as “a navigation information system which, with adequate back-up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/20 of the 1974 SOLAS Convention, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and by displaying additional navigation-related information if required.”. By defining ECDIS, IMO also defined what will later accept in the merchant marine ships, separating it from the other Electronic Charts systems that are not safe to operate, taking into consideration that the first point of the resolution is “The primary function of the ECDIS is to contribute to safe navigation.”.

In December 2000 the Maritime Safety Committee adopted a SOLAS revised Chapter V as following:

“IMO SOLAS V/19

2.1 All ships irrespective of size shall have:

(…)

2.1.4 nautical charts and nautical publications to plan and display the ship’s route for the intended voyage and to plot and monitor positions throughout the voyage; an Electronic Chart Display and Information System (ECDIS) may be accepted as meeting the chart carriage requirements of this subparagraph;

2.1.5 back-up arrangements to meet the functional requirements of subparagraph 2.1.4, if this function is partly or fully fulfilled by electronic means;”

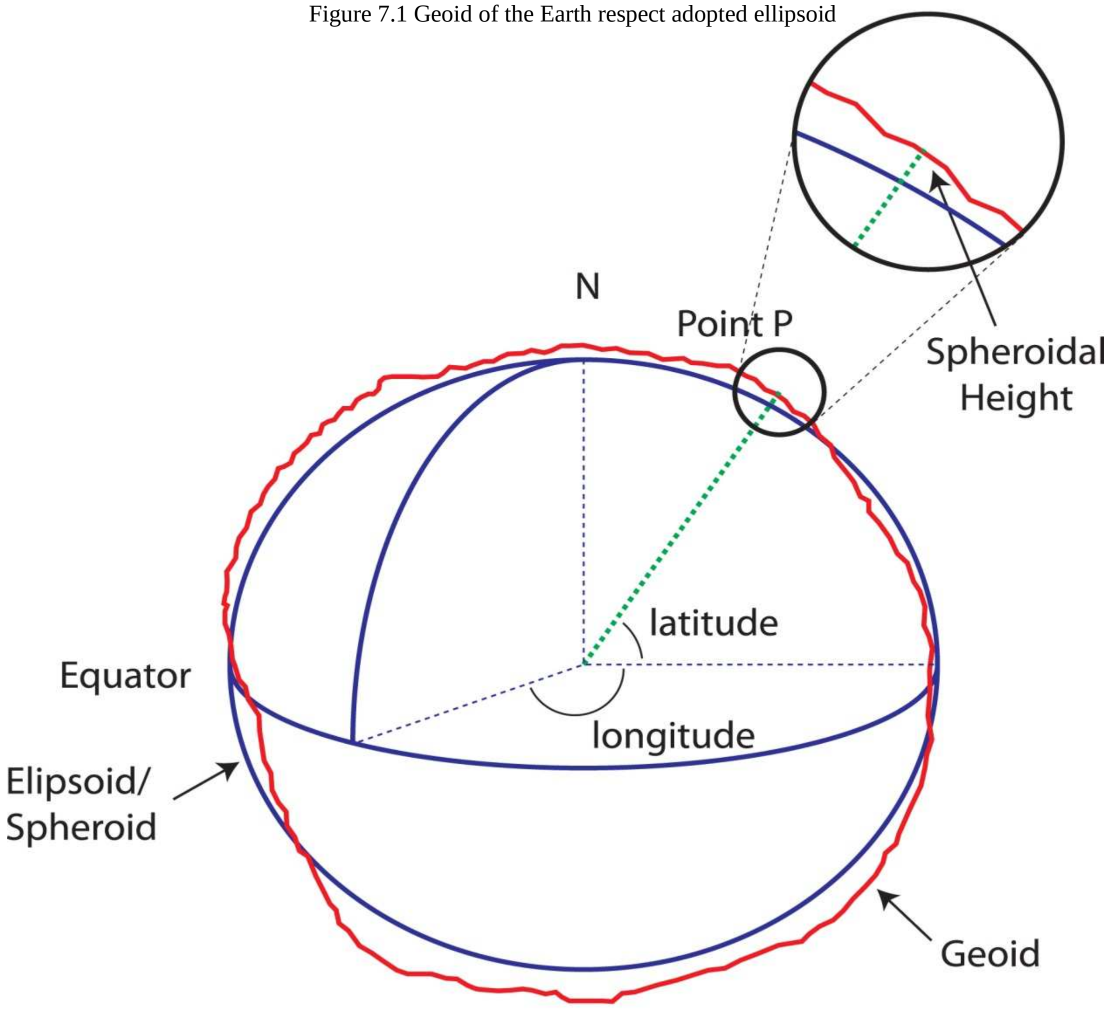
With this amendment to the SOLAS the ECDIS have an established function during the navigation, facilitating the work of the Officers, so it improves the safety during the navigation.

7.2 Differences of going from Paper Charts to Electronic Charts

Paper Charts use the skills in navigation of the officers to plot the position (taking bearing, distances, using landmarks or stars, etc.) and the Electronic Charts use the GPS, and the GPS plot the position based on the World Geodetic System 84 (WGS84).

The WGS84 is a system adopted by the GPS because the surface of the Earth is irregular, and it would be practically impossible to design a positioning system that takes into account every irregularity of the earth. The surface of the Earth adopted by the WGS84 is an ellipsoid with a flattening of 1/300 respect the surface of a sphere.

Figure 7.1 Geoid of the Earth respect adopted ellipsoid



http://www.icsm.gov.au/mapping/datums2.html

On the other hand we have the Mercator projection of the Nautical Charts. The Mercator projection keeps the angles between points as they are in the real world (making easier to take bearing or setting courses), but distances are not correct (worst as we approach the poles). In addition, the sources used to make the Nautical Charts can be various like OSGB36, ED50 or the same WGS84, making it even more difficult to determine if we are in the same position the GPS shows us.

The differences between the reference systems make difficult to go from one to the other, and we are exposed to mistakes up to miles in the worst case scenario (normally the error is few meters). As the time goes by, more and more charts are referenced to the WGS84, but even doing that we will have always a small mistake.

7.3 Electronic Charts: Raster vs. Vector

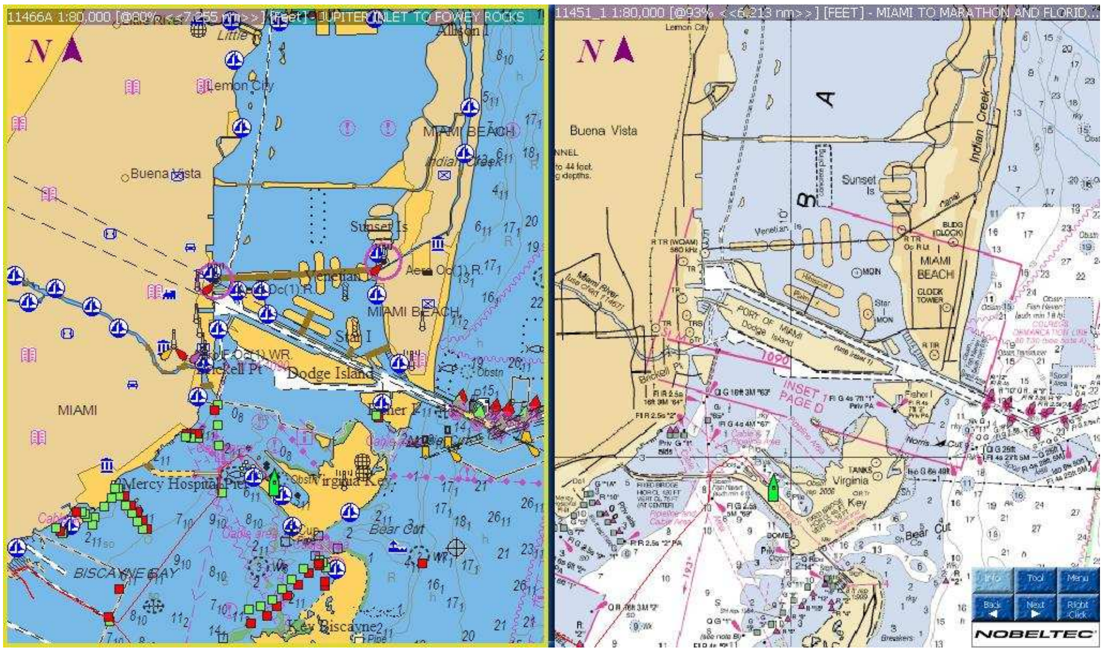
When using Electronic Charts we have two main types of data, Raster and Vector. Raster charts are scanned Paper Charts and Vector charts are the result of digitalizing every point of a chart.

Raster charts are as accurate as the Paper Charts that represent. A conversion between the GPS coordinates (WGS84) and the finally plotted position on the Raster chart may change. Depending on the kind of data used to plot the original chart, the Raster chart may have more or less corrections.

Vector charts are more sophisticated than the Raster charts. The fact that every point on the chart is digitalized allows the user to “ask” about everything on the chart. All information about a lighthouse or any other object on the chart, even a spot in the middle of the sea, is given by just click on it.

Apparently Vector charts and Raster charts look very similar (Figure 7.2), but the functionality is very different. Because of the fact that not the entire surface of the Earth is represented in Vector charts, is very usual to see Electronic Chart systems that work with both Vector and Raster Charts.

Figure 7.2 Vector and Raster charts



http://www.leascotia.com/wp-content/uploads/2010/05/MiamiVectorRaster.jpg

Conclusions

Cartography and the way that the world is represented has been an important part of each important civilization along the ages. Through Cartography nations and empires had the opportunity to trade and communicate among them.

Along this work we saw the evolution in the way civilization saw the world, and we can see that normally the most important nation in the world at the time had the best Cartography. When a nation had the control of the knowledge in the Cartography, the other nations tried to steel this knowledge. Along the history of Cartography we saw the history of the world, because Cartography had been, is and will be one of the most important sciences in the world.

In one hand the human species had always feared the unknown, and we have evidences of it along the history, like the Greeks that never wanted to go north or south, or the European medieval civilization, until one day an explorer dares to go further the known limits. The day that information become available, the day that the first chart of a unknown region of the world appears, that day is the day that the humans dare to explore further looking for a profit in that place. We saw a clear example in the Age of Discoveries, after Cristobal Columbus discovered America, and the fists maps and charts of the new regions appeared, the most powerful nations started to see opportunities and wanted a peace of that land. They saw opportunities of new discoveries, of gold, new lands and power. So in some way, the cartography is always the first step to open the Pandora’s Box.

On the other hand Cartography is the most important tool for us, the navigators. Officers and Captains used charts for a long time to guide themselves and to make navigation safer. The more recent the chart is, the more accurate and safer for the navigation will be. In that way Cartography made a good improvement, making the navigation safer until nowadays navigation accidents are never related to the lack of information depicted in the chart.

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