Ch/Ab/1 ANDREAS BIANCHO DE VENERIIS ME FECIT

M.CCCC.XXXvj: ATLANTE NAUTICO OF ANDREAS BIANCHO EXPLAINED

ABSTRACT

Now comprising 10 sheets; the '*Raxon de Marteloio'*, 'seven charts', a 'circular World map' and a 'Ptolemaic world map', they have now been removed from a binding which stitched through their centre fold and presented in a boxed edition folio. It was produced in 1993 as a special publication of 1500 exemplars, (this authors is number 1148), and has a text by Professor Piero Falchetta of the Biblioteca Marciana,Venice, which holds the 'Atlante Nautico' and he describes the content (in Italian) but does not attempt to analyze the diagrams or charts cartographically. It is a historian's narrow view of the 'Atlante Nautico'.

This paper delves into the construction and draughtsmanship required for the charts, their geometry and trigonometry as well as explaining the '*Raxon de Marteloio*' principles as set down by Andreas Biancho which have hitherto been basically mis-represented and not forensically examined to exhibit the simple facts. There is also a discussion apropos the supposed Ptolemaic map of possibly indifferent authorship and the problems there-of.

There are 14 A4 pages and 29 A4 diagrams.

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INTRODUCTION Diagrams Ch/Ab/1/D01 to D08 inc.

In 1436 Andreas Biancho prepared seven charts or diagrams for his 'Atlante Nautico'. There are now in fact 10 sheets within the folio held by 'Biblioteca Nazionale Marciana di Venezia', with the first being the '*Raxon de Marteloio'*, and then the last two being a circular World map and the Ptolemaic world map, which is possibly a later addition to the original folio of 1436. That is a not proven and is possibly a contentious fact. The probity of the maps will be questioned later in the paper.

The text is divided into sections each explaining the obvious different forms within the folio. The first section discusses Diagram Ch/Ab/1/D01, the '*Raxon de Marteloio'*, its form, construction and usage. The second section describes 6 of the charts, their scale, how it was conceived and the actual charts form. The third section describes the overall European or 7th chart, Diagram Ch/Ab/1/D08, its form and how the original seven charts interlink to form the whole (Diagram Ch/Ab/1/D29 and later text). The world maps both Circular and Ptolemaic are discussed individually.

SECTION 1; RAXON DE MARTELOIO Diagrams Ch/Ab/1/D09 to D14 inc.

As diagram Ch/Ab/1/D01 illustrates, this first sheet within 'Atlante Nautico' contains a descriptive text, three tables for calculations, the '*Toleta de Marteloio*' which includes that

which Andreas Biancho names the *"Tondo e Quadro*"; a semicircle with 16 winds; a circle with 16 winds plus alternates from the East and NbE nodes and a wonderfully drawn wind rose with the eight major winds noted, namely, Ostro (south), Libeccio (sw), Ponente (w), Maestro (nw), Tramontana (n), Greco (ne), Levante (e) and Scirocco, south east. The north point, Tramontana, is emphasized although it is drawn (perhaps) upside down.

The text there-on explains in somewhat strange and idiosyncratic medieval terms the ideology of the '*Raxon de Marteloio'*, and is as follows, with a translation following:

"questo si xe lo amaistramento de navegar per la raxon de Marteloio como apar / per questo tondo e quadro e per la toleta per la qual podema saver chose chomo xe / la toleta a mente e daver andar per ogna parte del mondo senca mexura / e senca sesto choncosia che alguna per son ache vora far questa raxon eli a luogo / a saver ben moltiplichar chen partir Amaistramento del mar sie per saver / ben navegar e si se vuol saver la suma de marteloio per questo muodo quanto / se avanca per una quarta de vento e quanto se alarga chosi per una quarta e per / do e per tre e per quarto e se algun te domandase per queste sume se pol far tute raxon de navegar con cosia che nui non podemo saver la raxon chosi a ponto / ma nui se achosteremo ben a la veritade Anchor ate voio mostrar per cotal / muodo foxe una nave che vol andar per ponente e non de puol andar e si va / una quarta una de soto in ver el garbin mia cento a alargase mia vinti dal po / nente e avanca nonanta oto e per do quarte se alarga mia trena oto e avan / ca mia nonanta do per tre quarte se alarga mia cinquanta cinque e avanca / mia otantatre per quarto quarte se alarga mia setantaun e avanca mia / setantaun per cinque quarte alargo mia otantatre e avanco mia cinquanta / cinque per sie quarte se alarga mia nonantado e avanco mia trenta otto / per sete quarte alargo mia nonan ta oto e avanco mia vinti per oto quarte alargo mia cento e avanco mia nesun impero se lo retorno lo qual xe schroto in la toleta de Marteloio chomo apar per le suo chaxelle a le ssuo righe."

That translates as follows;

"*This is the way to learn how to sail, through the system of 'martelojo', made of this circle, this square and this table, which helps to know things that we can easily remember by heart, so that we can go around the world without ruler and dividers. From the sea you will learn how to sail properly. A person wanting to use this system needs only to be able to multiply and divide. And one can know the sum of 'martelojo' in this way, how much you go forward with a quarter of wind, and how much you go offshore: and similarly for one quarter, two quarters, three quarters and four quarters.*

And, if one wants to know, through this system you can understand all courses for sailing. Although we cannot know perfectly the course, we will be very close to the truth."

Thus we can readily understand that Andreas Biancho did not mean this system to be in any way complicated, but simplicity for the memory to access quickly. Simple mathematics!

THE THREE TABLES EXPLAINED Diagram Ch/Ab/1/D09

The primary table set out adjacent to this text has within it the measurements from the text but set to a circle of 100 unit radius, which the quarter winds, 11.25; 22.5; 33.75; 45; 56.25; 67.5; 78.15 and 90 degrees in a quadrant would subtend if projected onto a square encompassing the circle. That is the 11.25 degrees wind; "*una quarte*" line at the

circumference is 98 units from the centre and 20 units from the horizontal line. There is a repetition of the units in reverse order after the 45 degree or centre line of the quadrant as is to be expected.

The two larger tables are in fact one and the same with the second correcting scribal errors in the first. These two tables have a single notation which aids the unraveling of the second set of figures in each. That is "*de ritor:10*" and this signifies that the figures set below this heading refer to a distance of 10 units and not the 100 units of the circle.

A question thus arises; if the two tables are one and the same with the second slightly more accurate, (and as it appears to be hurriedly written under the "*Tondo e Quadro*"), is it in fact just a correction for the framed table, the tabulated figures, which were latterly realized as wrongly copied? And, from where was it copied? [See final discussion]

However, the system promulgated by Andreas Biancho becomes curiouser when the third and last table is studied. This table represents the figures obtained from the quarter winds if the "*di ritor*" is only 1 unit and not the 10 units previously noted. Thus we should expect the '*Avancar/Avanco'* to be simply the tenth part of the first (or second) table. This does not happen, but at least the division of 55 by 10, written as 5 1/12th could be explained as a scribal error for 5 ½. However, the tenth part of 92 is 9 1/5th, not 9 1/13th, which although gives wind directions close to 22.5 degrees i.e. 22.716, is less accurate than the 9 1/5th which gives 22.44 degrees. The included tables as diagrams explain these points.

It is as if the tables had been previously written out and now mis-copied.
But, as the calculations upon Diagram Ch/Ab/1/D09 indicate the figures are accurate enough to form triangles with the third side always 10 units long, and thus the return journey to the original East course is always 100 units. They are merely reciprocal calculations.

INTERIM COMMENT 1

It is therefore possible to opine that the whole 'Raxon de Marteloio' is predicated upon the distance to be sailed, "*de ritorno*" being identical to the outward distance and thus all that is actually being stated is "hand" the triangle you have sailed and return to course. In simple terms, sail the opposing quadrant matching quarter wind for the same distance, i.e. sail ESE out, but ENE "*de ritorno*".

THE TOLETA DE MARTELOIO Diagram Ch/Ab/1/D10

Having established from the mathematics of the tabulated distances that the return course is none other than the precise opposite handed course it can be shown by diagrams to be correct using the distances quoted by Andreas Biancho.

ALTERNATIVE DISTANCES Diagram Ch/Ab/1/D11

The tables are simple distance measures based upon 100 miles, but, if the distance sailed is variable, new units should be calculated. (That is not entirely correct as the scale diagrams at 100 miles can just be altered by denoting them as a different length).

Upon the diagram the new distance chosen is 65 miles and it has been tabulated to indicate the change in the '*Avancar'* distances.

ALTERNATIVE SAILING DIRECTIONS Diagram Ch/Ab/1/D12

The example given by Andreas Biancho is based upon an original intended course of

Due East. Thus if a ship is blown off course by any of the quarter winds in the quadrant the return can be simply calculated. But, if the intended course was other than Due East then by diagram the correct return course can be established; i.e. intended was SEbE, actual SEbS and return is therefore EbS.

RAXON DE MARTELOIO Diagram Ch/Ab/1/D13

The "*Tondo e Quadro*" has been reconstructed and the angular disposition of the *'Rayons'* calculated. A quarter wind is 11.25 degrees and thus its half would be 5.625 degrees. To achieve that the spread would be 78.75 degrees and the "*Tondo e Quadro*" would therefore be a *perfect square* in a circle of 100 units and its size thus 2 x 70.71 or 141.42.

By drawing the square less than the circle the '*Rayons*' are compromised. Curiously though the original notation in the circle states, "*Suma de questo quadro m la 160*" or" the sum of the squares is 160 miles". This comes from the text adjacent to the scale bar, "*da una quarta alaltr.a xi mia 20 ----inti*", and would appear to translate as each square represents 20 miles and thus the total is 8 x 20 or 160 miles.

The second section of Diagram Ch/Ab/1/D13 tabulates the possibilities using the "*Tondo e Quadro*" to return to your original course by a shorter sailing distance than the outward course as prescribed by the original tables shown on Diagram Ch/Ab/1/D11.

INTERIM CONCLUSION 1 Diagram Ch/Ab/1/D14

Andreas Biancho in setting down upon the' *Tavola 1*' his diagram, "*Raxon de Marteloio*", has allowed mariners via the "*Tondo e Quadro*" to plot their intended course, and then the actual course sailed and thus calculate and or draw there-on their return to the desired course knowing the distances to be sailed.

But, in so doing, from the example chosen of a Due East course and deviations there-of, he has inadvertently produced a table which if plotted out describes no more than a simple written answer would give;" incident course out, reflected course back, with equal sailing distances". That is, one quarter wind south requires a return of one quarter wind north with the same distance to be sailed and the *'Alargar'* or distance from the original course is an unnecessary unit of measure.

It is only when the return leg to the original course is not to be the precise opposite, which is a total of double the distance to be sailed, that the tables become of great use.

Hence a simple "*Tondo e Quadro*" with the squares being denoted by whatever distance measure the mariner required would have sufficed, as diagram Ch/Ab/1/D14 illustrates.

If the "*Tondo e Quadro*" had not been drawn in the circle then its usage for the four quadrants would have been quite perfect as it could be turned as necessary.

But it is an example of new knowledge, mathematics being of use to ordinary persons, but the implications of the mathematics in this instance are not realized by the author or originator of the system we have just discussed.

The *Toleta de Marteloio* was first described in 1286 by "*Ramon Lull of Majorca*" in his book "*Arbor Scientiae*", where he asks the question," *How do sailors know how to*

measure their mileage at sea? He continues" *mariners must consider the four principal winds, that is to say the east, west, south and north winds; likewise they must consider the four winds which fall between these, that is to say, 'grecum, exallochum, lebeig and maestre'. And look carefully at the centre of the circle in which the winds meet at angles; when a ship travels by the east wind 100 miles from the centre, how many miles would it make on the southeast wind? And for 200 miles, they double the number by multiplying and then they know how many miles there are from the end of each 100 miles in an easterly direction to the corresponding point in a southeasterly direction. And besides this 'instrument' they have a map, a Portolan, compass and the polestar*. [Note; wind names are Catalan and the 'instrument' is a table as per Andreas Biancho's work.]

Thus it is quite clear that Andreas Biancho has merely taken the description there-in and reworked the '*Raxon de Marteloio*,' and this probably accounts for the two tables and the differing units of measurement on his Tavola 1 sheet. But is he the actual author?

SECTION 2: THE CHARTS, SCALE AND CONTENT Diagrams Ch/Ab/1/D15 to D18

The most striking fact regarding the six (+1) charts is that they are all identical in size, use the same diameter Windrose circle and hence the graticule for that Windrose. But, although the scale bars overall sizes are identical in length, they portray different units of scale by number. The variation is 50/45/35 units within an identical frame length.

Thus we have Tavola 2, the Black Sea with a scale of 35 units which is 1 ^{3}/7ths larger than the 50 unit scale, and, Tavola's 5, 6 & 7 with 45 units, 1 ^{1}/9th larger than the 50 unit scale of Tavola's 3 & 4.

This is quite extraordinary for an atlas of so few sheets, particularly as the difference between the 45 and 50 unit scales is really so small as to be irrelevant. And, thus we must question if the scales actually have any relevance to the charts.

Diagram Ch/Ab/1/D15 indicates the scales as set out on each chart with the centre line of the Windrose aligned. There are two scales per chart and each is drawn accordingly. The distortion of the vellum or parchment is quite apparent, but it is still possible to retro fit the chart to the correct size of parchment as follows.

PARCHMENT SIZE Diagram Ch/Ab/1/D16

The Windrose circle is the key to the original parchment size as from the measurement of the circle and the graticule there-of it can be assessed. Diagram Ch/Ab/1/D16 has the calculated graticule sizes appended which confirms the circle as a 120/240mm unit and is thus 11 uncia. There are 12 uncia in a Palmo of 262mm and thus the size of the original parchment can be positively identified as 1 x 1 ½ Palmo, 12 x 18 uncia or 262 x 393mm. Parchment sizes varied slightly by manufacturer and edges were cut for shape.

Diagram Ch/Ab/1/D17 sets down the complete research for the scale bars to the 12 uncia divisions of the parchment and indicates that the scale bar overall length is in fact determined by a 30 degree 'wind' line across the circle and is not actually part of the measurement system. This is pure geometrical action which indicates knowledge, but of course also indicates the scale bars may be a design element and not reality.

MAP SCALES Diagram Ch/Ab/1/D18

Thus the map scale lengths are actually determined by the 22 ½ degree wind lines

forming a 45 degree segment which is then subdivided into 35/45/50 units as required. This was achieved from the quarter wind angles as diagram Ch/Ab/1/D18 indicates. The 45 degree wind is the Black sea scale of 35 units formed from a 1/1/√2 triangle of 50/50/70 units.

The 33 ¾ degree wind is for Tavola 5, 6 & 7, with a 45 unit scale.

The zero degree line is for Tavola 3 & 4 and the 50 unit scale.

This though must not be taken as a sign of measurement as is now explained.

When the charts are analysed for geographical content, which is the latitudinal and longitudinal extent of the 240mm wind rose circle the variation cannot be resolved in most of them.

Tavola 2, the Black Sea has a variation of 40/48 latitude and 26/39 longitude which appear to be consistent with the geographical actuality in that 18Cos44 = 13 degrees.

Tavola 3, East Med Sea is 28/41 latitude and 20/36 longitude, an inverse proportion.

Tavola 4, Central Med Sea is 32/47 latitude and 1/20 longitude, an inverse proportion

Tavola 5, West Med Sea is 28/43 latitude and 18W/3W longitude, a square plot.

Tavola 6, UK etc is 43/58 latitude and 1E to centre line of 9W produces a longitudinal spread of 20 degrees, and is another inverse proportion plot.

Tavola 7, Scandinavia is difficult to assess but appears to be 53/63 latitude and 7/19 longitude, and is another inverse plot.

Tavola 8, Europe is discussed fully later in the paper.

INTERIM CONCLUSION 2

Andreas Biancho has used geometry and trigonometry much the same as he has on the 'Raxon de Marteloio' to designate the scales of the charts, whilst allowing the base measurements to vary from the graticule. This permitted a simple regime to be established but it would appear that the charts are just a haphazard mixture of draughtsmanship.

THE CHARTS, A BASIC DESCRIPTION Diagrams Ch/Ab/1/D02 to D08

The text accompanying the charts was written by Professor Piero Falchetta and is a full description by a historian with notes upon the charts annotations. They illustrate the knowledge of the early 15th century in and of Europe and thus this papers notes are merely a general guide.

TAVOLA 2; THE BLACK SEA Diagram Ch/Ab/1/D02

This area had been settled by the Greeks and then the Romans before our common era and latterly by the Genoese and Venetians, as well as Pisans and other city states of the second millennia. The chart commencing in the SW at Constantinople, as we move clockwise we arrive at the Danube Delta illustrated as being populated by numerous islands. Then the Dneister and Dneiper rivers are shown prior to the Crimea Peninsula, with the Sea of Azov to its north, with the River Tanais or Don flowing northwards from it. The residue of the eastern section and southern coastline is reasonably accurate geographically with the major ports well noted in the red colouration of the text.

TAVOLA 3: THE EASTERN MEDITERRANEAN Diagram Ch/Ab/1/D03

This chart is set at a magnetic angle or deviation from geographic north as indicated by the wind line from Crete to Cyprus. The coastal names are so closely written and the script so minute as to require a magnifying glass to be read. The quill pen used to write the names

must have been extra-ordinarily finely cut. The two river systems noted are the Nile and Jordan, which has a branch extending to Jerusalem! This city has been accentuated as no doubt on many other charts, but it is not a Biblical enhancement, the chart is geographical.

TAVOLA 4; ITALY AND CENTRAL MEDITERRANEAN Diagram Ch/Ab/1/D04

This is a 'tour de force' chart, with Italy and the major islands of the surrounding seas plotted in minute detail. The chart is set at the magnetic angle, and the only river of consequence indicated is the Danube.

TAVOLA 5; NORTH AND SOUTH OF THE PILLARS Diagram Ch/Ab/1/D05

This chart is surprising in its content. The eastern half is the Iberian Peninsula and the North West African coastline including the "Fortunate Islands" or Canary Isles, but in the west is the rather large island of Antillia, deliberately shaped and coloured red and set opposite the Pillars of Hercules at 36N, but only a few degrees west of the Canary Isles.

In such a position it must have been known to countless mariners!

TAVOLA 6; FRANCE, GREAT BRITAIN & HIBERNIA Diagram Ch/Ab/1/D06

Commencing in the south with the northern coastline of the Iberian Peninsula, nominally the 43N latitude, the coastline of France facing the Bay of Biscay leads to the European coastline and the Netherlands. The Islands of Britannia and Hibernia are drawn in a style adopted by many cartographers of the age. Perhaps Andreas Biancho should have followed the example of Claudius Ptolemy, sans Scotland, for his pattern?

TAVOLA 7; SCANDINAVIA Diagram Ch/Ab/1/D07

The knowledge of the Scandinavian Peninsula, 'Danemark', is clearly indicated as is the Baltic Sea, although in a very schematic form. However it does indicate that Andreas Biancho was so very aware of the latest developments in geographical detail.

SECTION 3; OVERALL CHART OF EUROPE, TAVOLA 8 Diagram Ch/Ab/1/D08

The chart is a Portolan with standard magnetic deviation for the eastern portion. The Iberian Peninsula has been drawn NSEW and the charts central position is delineated by the 43N/15E co-ordinates. There is a full description of this chart in the text following.

BASIC DESCRIPTION OF CHARTS CONSTRUCTION Diagram Ch/Ab/1/D19

The basic chart appears to emulate the previous six in its graticular sub-divisions, but, there is an anomaly with the measurements. The latitudinal measure is as the six charts, 240mm or 11 uncia, but the longitudinal measurement is 252mm (probably meant to be 251mm and thus 11.5 uncia). The paper size is again 262mm or 12 uncia as the other sheets.

The measurements obviously indicate that a circle could not have been drawn to locate the basic winds and the graticule there-of. But an examination of the chart does indicate that it is two semicircles with the wind positions precise in each half. This is shown by a radius of 120mm being used which locates the two sectional winds.

The scale bars set at the east and west sides of the chart use the four central squares as the distance measure, 170mm, representing 210 divisions.

THE SCALE EXPLAINED Diagram Ch/Ab/1/D20

As has already been explained and shown by Diagram Ch/Ab/1/D18, the six charts have three separate scales all derived from the basic sub-division of a circle into 11.25 degrees or quarter winds. They are 35, 45 and 50 units long. The scale bar of Diagram Ch/Ab/1/D08 is part of the same system and is subtended by a 45 degree wind alignment. Thus the base scale of 50 units has morphed into the 35, 45 and 210 units as is shown. But the scale has had to be manipulated such that it is applicable to both the latitudinal and longitudinal measurements of the chart.

Hence the 240mm diameter circle expands to 252mm and the extra 12mm used to produce the correct measurements.

The Venetian Miglia or Mile of 1000 Passi or 5000 Piedi, is given as 1.7387Km and is the measure used within this text for the following calculations.

CALCULATIONS OF THE CHART MEASUREMENTS

The longitude of 252mm is shown to represent a geographic distance of 41.5 degrees; that is from the Pillars of Hercules at 5.5W to Issus at 36E. But the centre of the circle is at 43N/15E and here a geographical degree of longitude equals 441.74 stadia of c185m, or c81.72Km.

The calculation is; 604 stadia of c185m or 111.74Km multiplied by the cosine of 43N produces 441.74 stadia or 81.72Km and this equals a total of 47 Venetian Miglia per degree.

It is not in the research of this paper to guess it may have been 50 Venetian Miles.

But the charts of Andreas Biancho are square charts; that is latitude and longitudes are the same measure as has been shown to be the system for the Portolan Charts.

Therefore we can calculate what the 210 units represent when set against the 41.5 degree measurement. If 252mm equals 41.5 degrees then a degree is 6.07mm and thus 170mm must represent 28 degrees. Quite simply, 28 x 60 = 1680 minutes which if divided by 210 equals 8 minutes per unit. And, there are 7.5 x 8 minutes in a degree.

We now have the tool to investigate the latitudinal measure of the circle of 240mm, such that; 240÷170 = 1.41176 x 210 units =296.471 units, which again in all probability is 300 units, which at 8 minutes per unit produces a latitudinal spread of 40 degrees.

THE TWO SEMICIRCLES JOINED Diagram Ch/Ab/1/D21

We can now understand just how clever Andreas Biancho has been with his mathematics/geometry/trigonometry as the centre line is set at 43N, which when the 40 degrees calculated is divided will produce a northern limit of 63N, precisely as Claudius Ptolemy set down and a southern limit of 23N, which is the limit of Book 4, Map 3, “Libya embracing all of Marmarica, Libya and Egypt” again as set down by Claudius Ptolemy. This agrees precisely with the chart drawn by Andreas Biancho.

It is obvious therefore that Andreas Biancho had a copy of the Map of Claudius Ptolemy, if not the text of “Geographia”. That map is likely to be the Ptolemaic map enclosed with his ‘Atlante Nautico’, probably either a gift or purchase as it, in all probability, could not have been drawn until after 1407,(well possibly), and the date given by Andreas Biancho is 1436.

GEOGRAPHICAL COMPARISON Diagram Ch/Ab/1/D22

The simplest of geographical lines of longitude and latitude have been appended to the diagram and indicate that although the Iberian Peninsula was drawn NSEW and the longitudes continued eastwards until the 25E centre line, the magnetic variation was then introduced latitudinally from within the Iberian Peninsula. Thus only the south, west and north coasts of the Iberian Peninsula are drawn NSEW.

TAVOLA 9; THE CIRCULAR WORLD MAP Diagram Ch/Ab/1/D23

The map by Andreas Biancho is a curiosity. It has both Ptolemaic, Christian and Portolan overtones. Based upon the same circle as the previous 7 charts, 240mm or 11 uncia diameter, the inner circle is 218mm and thus 10 uncia diameter. But there is a flaw in the draughtsmanship; the east west measurement is certainly 240mm but the north south measurement is 247mm. This is only 3 ½ mm per radius error and could easily be accounted for by a minimal parchment expansion in the length and a slight wobble of the quill in the compass as the circle is scribed. That is a very simple error to make.

But, it is an obvious error and was mostly original as the 45 degree wind lines are slightly off alignment when compared to the NSEW lines.

In his text Professor Piero Falchetta has discussed the textual additions to the world map, but it is worth noting that the overall spherical shape of the world as drawn is based upon a 9 uncia circle set off centre to the east. One surprising feature is that the Red Sea, although correctly coloured, has been drawn as far to the east as the map is off centre. The terminus of the Red Sea should be south of the Eastern Mediterranean Sea.

There are two further peculiarities on the world map; the circular intrusions into the outer framework. That in the south is 3 uncia in diameter, but the two northern curves, which are in fact centered upon the 10 uncia circle have no discernible radius/diameter, other than being 3 1/3 or 10/3 parts of the main 11 uncia circle.

TAVOLA 10; THE PTOLEMAIC MAP Diagram Ch/Ab/1/D24; D25; D26; D27, D28

Included as the last map in ‘Atlante Nautico’ is a Ptolemaic based map of the oikoumene. This would have originally been drawn from the co-ordinates given in “Geographia” by Claudius Ptolemy. That text was written c150AD, translated into Latin from Greek in c1406AD and subsequently copied both by hand and printing and widely distributed in Italy. (see cautionary note at the end of section).

Thus in the intervening years, 1406 to 1436, Andreas Biancho became aware of the text and possibly the maps which can be drawn there from. This text has shown that on Tavola 8, the Ptolemaic world was known to Andreas Biancho.

In his short description of the Tavola, Professor Piero Falchetta makes the following points;

1) the handwriting differs from the preceding Tavola’s

2) the way the text is written and the correct use of abbreviations (i.e. Latin abbs.) would suggest another scribe at work.

3) it is not inconceivable that it can be determined as drawn after the atlas was completed, but could also be coeva.

Thus before commencing it is perhaps necessary to include all of the text by Professor Falchetta (in my translation), not only to ensure the questionable provenance but also to illustrate the lack of academic research apropos the Ptolemaic projection as drawn. I loosely translate;

"The hand (or hands) that composed this Ptolemaic mappa mundi using his first and conical projection does not appear to be the same hand as previous writings in the other tables in the atlas. The use of capital letters, 'ductus' and the letter forms; correct use of abbreviations; the Latin is not 'crippled' etc, are all elements that will lead us to surmise that Andreas Biancho could have participated in the design of the map, as we will see later, but that the allocation of the whole map's authorship on the other hand cannot be totally his.

It would be scientifically prudent for a comparison by paleographic means with surviving Latin manuscripts of Ptolemy, perhaps the first recorded belonging to Palla Strozzi and now the text, Vatican Graeco 82, (Ch/Ab/1/D27) or 5698. A certain resemblance between the mappa mundi of the manuscript and the mappa mundi of the Codex Marciana can possibly detect some elements, such as the shape of letters for the names of the African area which are also in red ink as the codex Marciana; the trend of the Nile and other rivers in the western part of Africa and, in general, the description of the different countries of Asia.

The codex Marciana seems less prone to distortion and is a more accurate map of the world than the mappa mundi in the Vatican codex for the Mediterranean. Since also the world map in the tavalo above shows in that part that there is a lesser degree of distortion to the rest of the design, you can probably assume that by the representation of this region on the Ptolemaic World Map, Andreas Biancho may have directly contributed to it with his experience as a nautical cartographer. The European continent in particular, conforms to the model of a more nautical chart than that of Ptolemy, also in the form of the Iberian Peninsula and Greece and especially in that of Italy, which does not show here the excessive tilt of orientation West-East and the sudden inclination to the south of the southern part of the Italian Peninsula, which are distinctive features of the Ptolemaic map.

Scholars have generally paid little attention to this representation, and have considered, perhaps wrongly, it is less interesting than the 'medieval' world map that precedes it. Actually this map appears today, when you are evaluating the contribution of Ptolemy to geographical knowledge that will develop later in the course of the Renaissance, to be of great historical importance. In fact, it is probably derived from the most ancient of manuscripts received in the west. The 'earliness' with which it began to circulate, the fact that the atlas has a geo-mapping element are all parts that have to be evaluated with due care. The Ptolemaic map of the world, although much damaged in its central part, has some structure and the same 'readability' as the other tavalo's in this codex, and cannot not be coeval with those. It is not inconceivable that it could have been executed after the atlas was bound in its original form, that is, 'in quarto'.

But, Marica Milanesi in the text, "A Forgotten Ptolemy; Harley Codex 3686 in the British Library," stated this in the abstract to the paper (first and second sentence only);

'*The text of the British library's manuscript Harley 3686 is an undated and anonymous Latin version of Ptolemy's Geographia with an innovative set of eighteen non-*

Ptolemaic maps of Europe, Asia and Africa. Links with Andrea Bianco's nautical atlas (1436) suggest a Venetian provenance for the manuscript and a date of between 1436 and 1450'. (See diagram Ch/Ab/1/D28 for the world map equivalent to those discussed.)

Thus having dealt in a cursory manner with the visual content of the Ptolemaic World Map it is necessary to investigate the actual preparation of the conical projection.

CLAUDIUS PTOLEMY, FIRST PROJECTION, GEOGRAPHIA, BOOK 1, CHAPTERS 23 AND 24 Diagram Ch/Ab/1/D25

The above text is a complete guide to the construction of a conic projection onto which the oikoumene can be drawn. It is carefully proportioned such that the extent of the oikoumene from 16^0 25' south to 63N, and from 0E to 180E is portrayed in a proper manner. Hence latitudinal divisions are set down precisely and longitudinal divisions correctly proportioned. The "Klima" are a separate set of latitudinal bands which have only been used on one section, "Germania" to describe the maps form and thus are not the primary determinant for setting down the maps.

ANDREAS BIANCHO, TAVOLA 10 Diagram Ch/Ab/1/D26

In order to be as accurate as possible in this research, the tavola as presented in the book "Atlante Nautico 1436" has been used for the research and the downloaded copy available on the 'Geoweb Site' of the 'Biblioteca Marciana' as the exemplar.

Firstly on visual inspection it was immediately apparent there were draughtsmanship errors, such as the longitudinal lines below the Equator were vertical and not tapered. This is contrary to the instructions given. The next obvious error or deviation from the original design is the latitudinal spacing northwards from the equatorial line; the first 7 lines appear to be the same distance apart, the next 6 a variation and the final 4 + 1 vary yet again.

These are obviously as noted the "Klima" bands which are not actually useful when drawing the maps or the World Map of the oikoumene, as the co-ordinates are normal degrees and the "Klima" bands vary.

There are two choices for the latitudinal lines setting out;

1) utilize the actual latitudinal degree spacing of equal divisions, or,

2) utilize the "Klima" degrees spacing of varying divisions south to north and guess the intermediates as best possible..

The major codices produced from the 1460's onwards tend to have the "Klima" sections noted upon the western edge and the latitudinal degrees along the eastern edge for the projection of the arcs.

This diagram uses only the "Klima" divisions in a cursory manner. Thus it is clear this is not a standard Ptolemaic projection, but a local variation by the cartographer involved.

Thus it is possible to opine that the Ptolemaic Map within the 'Atlante Nautico' of Andreas Biancho is probably a poor copy of an extant Ptolemaic Map.

TAVALO 10 ANALYSED Diagram Ch/Ab/1/D26

As stated the Facsimile copy of the map is being used as it is actual scale.
Set on a parallel motion drawing board the maps major features can be aligned; they are the east/west points of the upper arc, the same points for the equatorial arc and then the southern

limit arc. These proved to be parallel and thus would have had the same center for the arcs.

But, the first problem appeared when the two extreme sides were projected towards a notional centre point. They should have subtended an angle of 104/105 degrees as was shown in the correct construction of the conic projection, Diagram Ch/Ab/1/D25. The angle subtended is in fact 90 degrees, and is eminently suitable to use as a subdivision marker for the 180 degrees required, but obviously is out of scale and thus proportion to the design.

This confirmed that the map was not drawn to the correct design, but a variation. The arcs were then tested and as has been shown within the investigation of the Genoese 1457 Chart (cg1457 text) once the centre points are outside of the parchments borders there is the opportunity for a large inaccuracy occurring. If the centre points are in fact on the base board or even the table used for support, the central point necessary can be degraded very quickly. Thus on this map there are at least 4 different radii points all within close proximity to each other but all producing differing arcs and thus problematic map construction.

Thus it is quite evident that the cartographer knew of the first projection method of Claudius Ptolemy but has chosen to invent his own version, or make a poor copy.

DISCUSSION; DRAUGHTSMANSHIP AND HISTORY

To be able to draw the World Map of Claudius Ptolemy upon his first projection, a cartographer must know the shape of each and every part of the map.

Why? Even in the extant codices which have a copy of the medieval rendition of this map it is impossible to draw it accurately with the form of the landmasses correct as the scale is much too small to allow the 8000+ site co-ordinates to be used, or even just the littoral co-ordinates to be accurately drawn.

This map is on a parchment 260 x 380mm and is only 195 x 345mm overall. The average folio from the middle ages is two or three times the size, as listed in HOC, chapter 15, and appendix 15.1., but even so the individual maps would have been drawn first.

Thus this map can only have been drawn by copying a “proper” version of the Ptolemy World Map which itself had been drawn from the amalgamation of all of the individual maps compiled from the data in books 2 to 8 of the Geographia.

If the date of 1436 is upheld then the historical time line is as follows;

1) Byzantine monk Maximus Planudes finds a Greek copy of Geographia in 1295 and since no maps were attached to the text, he drew (or had drawn) those maps based upon the co-ordinates there-in.

2) In 1397 a copy of the text was given to Palla Strozzi in Florence, by Emanuel Chrysoloras. But does this mean there were several copies now in circulation?

3) In c1407, Jacopo Angelus di Scarparia completes the translation into Latin of the Greek text of the ‘Geographia’. This translation had been commenced by Emanuel Chrysoloras.

4) Around 1410 a cartographer or cartographers, possibly two Florentines, Francesco di Lappacino and Domenigo di Beninsigni translated each map, but did this include a redraughting according to the co-ordinates within the text and a completed World map using the first projection. Copies must then have been distributed and one arrives in Venice and others must have circulated freely.

This is confirmed by the Pirrus de Noha chart of 1414 which is simply a Ptolemaic

World Map with Portolan pretentions in the Mediterranean Sea area. But in all probability Pirrus de Noha was working for Cardinal Giordano Orsini in Constance and Rome. The Church Council of Constance was in 1414 and the text of Ptolemy was discussed there.

5) In 1436, Andreas Biancho produces his "Atlante Nautico" which now includes a copy of the World Map drawn to a variation of the first projection as has been proven.

Thus it is quite open for all to assume that the first Latin copies of the 'Geographia of Claudius Ptolemy', circa 1407/1410, had maps appended, or were appended very soon after the original Latin copies were made if the date of 1414 for the Pirrus de Noha map and of other similar maps between then and 1436 for the Andreas Biancho map are upheld.

But a caution must be appended here; in 1154 Al-Idrisi used a copy of "Geographia" by Claudius Ptolemy to carry out his exhaustive study of the oikoumene. The Island of Sicily was a multicultural multi linguistic society and the Benedictine Monks were well established there by King Roger II. They would have had direct access to all of the papers utilized and thus we should also countenance the possibility of earlier text and map availability which enabled the Portolan charts to be visually accurate.

THE TEXTS APPENDED TO TAVOLA 10, WEST AND EAST

The text panels are a mixture of Miliaria and Stadia measurements. The four lines of text in the west indicate that Andreas Biancho established that a degree of latitude or equatorial longitude measured 56.667 miliaria.

Thus there is an immediate quandary to be resolved. The 56.667m figure for a single degree of latitude was measured by al-Farghani in northern Iraq in two areas, on the plain of Sinjar and near Kufah. He states, *"In that way we find that the value of a degree on the celestial sphere, taken on the circumference of the earth is 56.667 miles, each mile being equal to 4000 black cubits, as was ascertained during the time of al-Ma'mun- may God's grace be upon him! And, on this point a large number of learned are in agreement."*

The task was carried out between 820 and 833AD, and itself inserts a frisson of doubt into the research as to the precise length of the black cubit. Its length could be from 540.8 to 498 to 482.5mm. But quite frankly each gives an answer so close to the geographical world circle and thus the length of a degree at 111.74Km that the difference is irrelevant. We have either 109 or 113Km per degree from the cubits.

But of course, in the West the length measurement was merely thought to be the standard local mile measurement, and instead of the 56.667 miles being c112km it became c84Km, a smaller world which created problems for Christopher Columbus.

But, Andreas Biancho is some 50 years prior to Columbus but could well have known from the works of Sacrobosco (d 1256) or Pierre d'Ailly (d 1410) that the figure of 56.667 miles was given as the single degree measure.

Thus we read in the texts appended that a degree is 56.667 miliaria, 180 equals 10200 miliaria and 90 equal 5100 miliaria, all from 56.667 x 360 equaling 20400 miliaria.

However, a dichotomy exists from a study of the two texts. The eastern text is in fact an approximate copy of Book 7, Chapter 5, 'Geographia' by Claudius Ptolemy.

The tables are as follows;

Claudius Ptolemy	Andreas Biancho
Equator// 90000 stadia	90000 stadia or 11250 miliaria
South // 86350 stadia	86392 stadia or 10791.625 miliaria
North // 40854 stadia (note error)	80858(sic) stadia or 5106.57 miliaria
Rhodes // 72000 stadia	72000 stadia or 9000 miliaria
Syene // 82336 stadia	82336 stadia or 10292 miliaria

The differences are marginal and the conversion of Stadia to Miliaria is 8:1 as standard.

But now we have two world circles: the western text is 56.667 miliaria per degree and thus produces a world circle of 20400 miliaria; the eastern text is 11250 miliaria for 180 degrees and thus 22500 for the world circle. This latter circle is of course 62 ½ miliaria per degree and thus the two are 1.1029 or over 10% different.

Did Andreas Biancho, having shown his expertise (unless of course he copied it all) with the mathematics of the 'Raxon de Marteloio' not recognize that he had written differing measurements for the world circle, 20400 and 22500 miliaria, or is it the result of two separate scribes? In fact is the script on the actual map a third person's work?

TAVOLA 8, REPRISE; LINKING THE INDIVIDUAL CHARTS, Diagram Ch/Ab/1/D29

The overall chart, Tavola 8, has as Diagram Ch/Ab/1/D29 illustrates on the overlay sheet the individual wind roses used on each appended as they are drawn with the scale changes applied. From this diagram it can be established that the background graticule which has been used on each individual chart is part of an overall strategy and thus in all probability indicates that the overall chart was the first drawn. The alignments of the wind rose section from on to another, across differing size squares and rectangles is also a reason for the small change in scale between the charts (excluding the Black Sea chart). The main chart divisions are 55 and 50 units as part of the 210 overall scale bar, which is 11 to 10 ratio, but the individual scale bars are 50 to 45 or 10 to 9 ratio. The difference is negligible at these scales.

We can therefore postulate that a great deal of planning and mathematical work was carried out prior to these charts being produced. This is of course amply illustrated in the "Raxon de Marteloio" sheet, which is nothing but simple mathematics, geometry and of course trigonometry.

CONCLUSIONS

The 10 Tavola's within 'Atlante Nautico' are an eclectic mix reflecting the knowledge of Andreas Biancho.

Within Tavola 1, 'Raxon de Marteloio' we read a short homily reflecting the work of 'Ramon Lull' and then a full explanation of sailing before the winds. However, it is evident from the Tavola that Andreas Biancho was copying the mathematical tables and not cross referencing the data. Hence there is disagreement within them and the one tenth distance table, which should have been a simple mathematical division has been compromised. It is also obvious that it is a work in progress as no notes have been appended to the semi-circular wind chart or the second 'Quadro' setting out. The Windrose however is a work of art.

The charts, Tavola's 2-7 appear to be drawn from Tavola 8, the chart of Europe. Thus from an original the 6 individual charts are drawn upon the same size Windrose circle and have thus required to be re-scaled to suit. Hence we see scales of 35. 45 and 50 units derived from the same measurement.

Tavola 9, the circular World map is in all probability drawn after Andreas Biancho became aware of the genre and wished to show he was capable of producing not only functional charts but 'ethereal' maps having religious overtones; Probably a homage map.

Tavola 10, which is the subject of a separate text –Ch/Ab/2- is mimicking the first or conic projection as set out by Claudius Ptolemy. The fact that it is not correctly drawn indicates it is probably a copy of one of the original maps drawn shortly after the text was translated into Latin in 1407. The Pirrus de Noha map of 1414 uses the Ptolemaic data.

Atlante Nautico 1436, is a wonderful collection of charts and maps illustrating the knowledge of Venetian mapmakers at the beginning of the 15th century and we are lucky it survived so well.

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