Cp2 The Mediterranean Sea of Marinus of Tyre and Claudius Ptolemy

An investigation of the methodology and distance measures utilised

Synopsis

The text of '*Claudius Ptolemy's Geography' (Stevenson 1932)*[1] clearly states that he is using the research of '*Marinus of Tyre'* (Book 1, chapter 6) as the basis for his work, but, revising it to suit his own ideas or pre-conceptions. Even with those revisions, the Mediterranean Sea was still distorted in both Latitudinal and Longitudinal measure. But, by direct comparison of scale plots it can be shown how they actually achieved their map of the Mediterranean Sea, and provide circumstantial evidence for Mappae Mundi and world measures.

Caution. The basic text used is the *Stevenson* translation of *Ptolemy*. It has serious faults; some easily rectified others harder to spot. Therefore a second set of data has been used to provide a balanced text, **Codex Lat V F 32**. Do not utilise the one without the other. There are perhaps ten major editions of *Ptolemy* and the variations in each, normally due to copyist error, are very evident.

The Mediterranean Sea; Historical

Diagram Cp2D01

From the first migrations of ancient peoples, c8500 to c4500 BCE, the Mediterranean littoral has been a haven for many. The principal sea faring nation of the ancient world, following the *Egyptians, Hittites, Hyksos and Peloponnesian Greeks* were the *Phoenicians* who peopled the eastern littoral around 1000 BCE. They sailed not only this sea but also adjoining seas and oceans. All afore named used the Mediterranean Sea as a major highway for trade and warfare. Thus there is upwards of 5,000 years of knowledge handed down to, and possibly collated by the ancient historians and geographers. This information probably coalesced firstly within the work of *Eratosthenes* and then into the now lost work of *Marinus of Tyre.* It was then incorporated into the work of *Claudius Ptolemy*. Indeed, it is solely the work of Marinus as he makes clear in Book 1, chapter 6, '*Concerning the geographical narrations of Marinus'*, in which *Ptolem*y states: *'Marinus the Tyrian, the latest of the geographers of our time, seems to us to have thrown himself with the utmost zeal into this matter.// He is known to have found out many things that were not known before. He has searched most diligently the works of almost all the historians who preceded him. He has not only corrected those parts of the work which he himself had done badly in the earlier editions of his geographical maps. If we examine closely his last work we find few defects. It would seem to be enough for us to describe the earth on which we dwell from his commentaries alone, without other investigations*.'

These investigations may well have included the following texts and data such as the text *"March of the Ten Thousand"* as described by '*Xenophon'* in '*The Persian Expedition*[2]**.** The tale dates from the beginning of the 4th century BCE, and the whole text describes the route from *Sardis(Turkey)* to the gates of *Cunaxa,* (north of Babylon, near Baghdad) and thence northwards to *Trapezus* [Trabzon] on the Black Sea, and finally to the Bosphorus and *Byzantium,* now Istanbul.

In chapter 4, the march is described from the *Gates of Cilicia and Syria* (now known as Belen, south east of *Iskenderun)* to the Euphrates, which is said to be eight hundred yards wide. Further east is the *'great and prosperous city of Thapsacus*.' Within this story are marching distances, geographical descriptions and information which any geographer would surely seize upon. From such texts ***MT/CP*** must have gleaned information enabling a geographical picture of the Turkish and Mesopotamian lands to be drawn.

It should also be noted that *Strabo*[3] wrote the seventeen books of his '*Geographia'* in Alexandria, and these contain a compendium of geographical data taken from the texts of *Eratosthenes'* and *Hipparchus*. Include the details within the text of *Quintus Curtius Rufus*[4] [AD40/50] and possibly *Arrian*[5] [AD90/175], regarding the history and campaign of *Alexander the Great*, and the geographical data mounts inexorably. *Arrian* also wrote [c136/137], '*The circumnavigation of the Black Sea [Periplus Ponti Euxion]'*. The publication would have coincided with the period *Claudius Ptolemy* was resident at the Great Library of Alexandria, cAD146/170.

Thus, we are entitled to ask the simplest of questions, "If the sailing and littoral distances were well known, and with those distances the sailing directions, i.e. angular bearing of a littoral as set against

the Pole Star, how did land masses such as the Italian Peninsula and the Phoenician littoral become so distorted, as shown by the drawing of maps from the details supplied by *Claudius Ptolemy*?"

The simplest answer has always been that the World circumference was reduced from an accurate 216 000 *stadia* to an inaccurate180 000 *stadia* both of 0.184Km. Thus, to accommodate known distances correctly, an east west expansion of not only the Mediterranean Sea was required, but also the assumed distance to China. This expansion is still required even after the reduction made by *Claudius Ptolemy* of the original *Marinus of Tyre* distance to China, as is fully explained in his text[1].

How it was achieved whilst maintaining a mathematical integrity for the whole is surprising simple.

The Mediterranean Sea; Comparisons

Diagram Cp2D02, Cp2D03 and Cp2D04

It is necessary to compare the geographical plot with the ***MT/CP*** plot to establish the varying distances between major sites as is illustrated on diagram 3, and, thus establish an expansion ratio at any given point within the Mediterranean Sea. This will indicate if the expansion is gradual, along the east-west line, or has been adjusted to suit local plots.

The Mediterranean of ***MT/CP*** is described via the 36N latitude, and in Book 1, Chapter XII of '*Claudius Ptolemy's Geographia*[1]', we read;

"We will now add, from the distances which Marinus gives, the other degrees on the same parallel, and first of all from the meridian passing through the Fortunate Islands, as far as the Sacred promontory of Spain 2^0 30', thence to the mouth of the river Baetis, and from the Baetis to the Strait and to Calpe is likewise 2^0 30', being one and the same distance; from the Strait to Caralis, a city in Sardinia, is 25^0; from Caralis to the promontory of Lilybaeum in Sicily , 4^0 30'; from Lilybaeum to Pachynus is 3^0 00'; from Pachynus to Taenarus in Laconia is 10^0 00'; thence to Rhodes is 8^0 15'; from Rhodes to Issus is 11^0 15'; from Issus to the Euphrates is 2^0 30'; the sum of all those degrees is 72^0 00'. (Diagram 4 refers)

And here it is necessary to question the veracity of the foregoing text. Did ***MT*** really mean that each point is on the 36th parallel? The *Sacred prom* is 38^0 15'N, *Baetis* river is 37N, *Calpe* is 36^0 15'N, *Caralis* is 36N, *Lilybaeum* is 36N, *Pachynus* is 36^0 20'N, *Taernarus* is 34^0 20'N, *Rhodes* is 36N, *Issus* is 36^0 25'N, *Euphrates* is 36N. It would seem as though ***CP*** has amended the original if it was at 36N.

However, a glance at a geographical map indicates a very different plot. The parallel, 36^0 00N passes through the Strait of Gibraltar between the Pillars of Hercules, and then traverses Algeria from Ain Tedeles, crosses into Tunisia, exiting that coast just north of Sousse on the Gulf of Hammamet. Thence it passes Malta/Gozo, north of Crete, and on to the southern part of Rhodes. The closest point on the south Turkish littoral (*Cilician)* is Anamur, and at the most eastern part of the Mediterranean it crosses the coast south of Samondag (*Seleucia)* midway to the Turkish/Syrian border. It actually crosses the Euphrates river where it turns from its north/south course to an easterly course at c38E; 36N

Hence, by comparative maps, an assessment of the accuracy of the ***MT/CP*** plot can be made, and, enable the question that, 'if ***MT/CP*** had chosen a latitudinal scale of 600 *stadia* per degree and not 500 *stadia* per degree, would their picture of the Mediterranean Sea fairly represent its geographical form?, to be answered.

In his paper entitled *"Ancient sources for Greek Coastal Topography*", *Prof. O A W Dilke*[6] sets out the historical record from 1500BCE to *Claudius Ptolemy*. He then discusses the Mediterranean as described by *Claudius Ptolemy* in his *"Geographike Hyphegesis" or 'Manual of Geography*[1]*'* as is now being used, and illustrates the discrepancies, but concludes [p16]; "*But there are a great many Greek coastal co- ordinates, so that even the computer can give a realistic impression of the coastal shape without filling in with verbal descriptions*." Therefore this paper avoids discussing the Greek homeland territories.

But, the Oxford Classical Dictionary has the following comment there-in under the heading of *Ptolemy*, page 1272/1275. Section 3, *The Geography: The main systematic error, the excessive elongation of the Mediterranean in the east-west direction, was due to one of the few astronomical data utilised, the lunar eclipse of 20 September 331BC observed simultaneously at Carthage and Arbela (see Gaugamela): the faulty report from Arbela led Ptolemy to assume a time difference of three (instead of two) hours between the two places, leading to a 50 per cent error in longitude*.

Thus *Ptolemy* is using information from before the era of *Eratosthenes* and we may expect to find from the investigation that the Mediterranean Sea is $50^0/_0$ longer.

Comparing the Two Mediterranean Sea plots in detail **Diagrams Cp2D05 & Cp2D06**

To understand the Mediterranean littoral of ***MT/CP***, a careful reading of the words used is necessary, viz., land and sea measurement. The text of *Claudius Ptolemy* is quite specific, as expressed in Book 1 chapter VIII, entitled, *"They are also corrected by measuring journeys on land*" and chapter IX, *"They are also corrected by measuring journeys by water,*" where he sets out the methodology. Chapters XII and XIII tell of the correction of longitude by the same journeys.

Sailing in the Mediterranean Sea in the centuries prior to ***MT/CP*** was basically a coastal cruise, not proceeding far off shore and using islands, major and minor as landfalls when traversing major open waters[7]. The distances should be well known.

From ***MT/CP*** text, the *Fortunate Isles** to the *Sacred promontory* is 2^0 30' and thence 5^0 00' to Calpe/Gibraltar. From Gibraltar to Alexandria in Issus is then 62^0 00'. The geographical equivalent is, Gibraltar 5^0 22'West and Alexandria in Issus 36^0 10'East, giving a total length of 41^0 32'. A calculation of the ***MT/CP*** length gives 62^0 x 404.5 *stadia* = 25079 *stadia*, which is a geographical 51^0 19', a c10 degree difference. However, from the Canary Islands* at c17^0 00'West to Alexandria in Issus, 36^0 10'East is c53 degrees, and a good comparison for the ***MT/CP*** length.

Now comparing the distance from the Canaries* to the Heel of Italy, at 18^0 30'E, a total of 35^0 30' geographical or 17,200 *stadia,* which equates to 43^0 00' by ***MT/CP*** and fairly reflects the actual point; [i.e. Otranto/*Hydruntum* is 43^0 00'E and 39^0 05'N ***MT/CP,*** and geographically 18^0 30'E, 40^0 09'N]. Other reasonably correct positions are the Toe of Italy, *Leucopetra prom*. 39^0 50'E, 38^0 00'N, now named Capo dell'Armi at 15^0 40'E and 37^0 57'N. The calculations given by ***MT/CP*** are 39^0 50' = 15933 *stadia* and, actually, $17^0 + 15^0$40' = 32^0 40'or 15843 *stadia.*

Note**, the Canary Islands have been chosen as concurrent with the norms for the base line of ***MT/CP. The fact that this is incorrect and should be the Cape Verde Islands does not alter this text, as points outside of the Detroit of Gibraltar are generally ignored. A paper by this author is available for this fact (see end notes).

The mid Longitude of the Mediterranean Sea **Diagram Cp2D06**

In constructing their map, ***MT/CP*** required to align as closely as possible geographical features which even persons with scant knowledge of the whole Mediterranean Sea would know were aligned. Hence one check of the expansion co- efficient for their Mediterranean Sea from its geographical length would be the position of the nominal longitudinal central meridian. The nominal Latitudinal centre parallel having been established as 36^0 00N. Comparing the two lengths from Gibraltar to Alexandria in Issus on the 36^0 00N parallel their methodology becomes quite obvious.

Gibraltar/Calpe -------Alexandria in Issus

Geog. 5^0 22'W 36^0 10'E $= 41^0$ 32': 41^0 32/2 = 20^0 46'- $5^0$22' =
15^0 24'E *centre longitude*.

MT/CP 7^0 30'E 69^0 30'E $= 62^0$ 00': 62^0/2 = 31^0 00' + 7^0 30' =
38^0 30'E *centre longitude*.

These calculations are based upon the following length of a degree;

36N geog. = 488. 65 *stadia* 36N ***MT/CP*** = 404. 5 *stadia*

Geog.; 41.533 degrees x 488.65 *stadia* = 20295 *stadia.* [Use 20300 for ease]

MT/CP; 62 00 degrees x 404.5 *stadia* = 25079 *stadia.* [Use 25100 for ease]

This is an expansion of 1.2357 units per geographical unit.

The 15^0 24'E geographical longitude is the western coast of the Gulf of Sirte, Libya which then passes north through the eastern cape of Sicily, Nizza di Sicillia to Rometta Marea, just west of the Strait of Messina; thence to the mainland of Italy at Punta degli Infreschi, just west of *Buxentum*, exiting the Italian Adriatic coast at Lago di Lesina, west of the Gargano peninsula.

The 38^0 30E ***MT/CP*** longitude starts in *Africa minor* at the *Brachoda prom*, *Usilla* and *Taphrura* as well as in *Syrtis Minor, Theaenae and Macomada* with the *Triton river* at 38^0 40E. Proceeding north it passes directly through the centre of Sicily commencing in the south with the *Hypsa River* and then *Agrigentum,*

Cenuripa and Imachara before finishing in the north at *Tyndarium*. The coast of Italy is crossed at *Sinuessa* and exited at *Castrum* on the Adriatic bay, and it is a reasonable match.

A similar comparison of the centre longitude commencing with the ***MT/CP*** 0^0 00E, *Fortunate Isles**, gives a geographical centre longitude at 9^0 35'E, *Jehkeul* on the Tunisian coast west of *Bizerte and Carthage*; whereas the equivalent ***MT/CP*** centre would be 34^0 45'E and this is *Carthage and the Catadas River*.

These are both surprising and intriguing, but show attention to detail.
Whilst calculating the centre longitude, the expansion co efficient was shown to be 1: 1.2357 and as such exposes another surprising feature of the ***MT/CP*** map composition. For clarity the calculation is repeated;

Gibraltar to Alexandria in Issus
5^0 22E to 36^0 10E = 41^0 32' x 488.65 = 20288 *stadia.* Geographical
7^0 30E to 69^0 30E = 62^0 00' x 404.51 = 25079 *stadia*. ***MT/CP*** plot

But, 25079 stadia is actually 41.52 or 41^0 31' at 604 stadia per degree, the geographical length or equatorial equivalent of the Mediterranean Sea!

Simply put, the length of the Mediterranean Sea as calculated by *Marinus of Tyre and Claudius Ptolemy* is equivalent to the geographical length of the Mediterranean Sea when measured at the Equator. There is no 50 percent expansion of the geographical length as previously referred to in the O C D.

The mathematics is staggeringly simple: the Cosine of 36 degrees is either 0.809017, or the ***MT/CP*** equivalent of **93/115**. Thus we have a very simple multiplication to perform; **20288 x 115/93 = 25088 stadia**, and thus the ***MT/CP*** length of the Mediterranean Sea is actually produced **by using the reciprocal of the cosine of the latitude**, which is its equatorial equivalent, and that is the latitude upon which the ancient measures have been calculated. ***Cosine 36 = 93/115 and the expansion of the Mediterranean Sea length is 115/93.***

Thus we can assume that *Marinus of Tyre* [or a predecessor] required to establish a longitudinal length for the Mediterranean Sea and upon compilation found that the effective length of the coastline when subjected to a latitudinal length of 500 *stadia* per degree was the inverse ratio of cosine 36 degrees. This was most probably found via a comparative chart as follows, indicating they thought 58 x 115/93 = 72;

0° longitude	2.5°	5.0°	7.5°	69.5°	72. 00°
stadia,	1011	1011	1011	25079	1011
Stadia,	1000	1000	1000	24800	1000
0° latitude	2.0°	4.0°	6.0°	56.00°	58.00°

There are 360 degrees to the Equator and ***MT/CP*** text states in Book 1, chapter XX; *"It being given that there are 115 parts into which we divide the Equator*". Thus with an extrapolation as follows; 360 to 115 are as 72 to 23, the divisor being 5, and thus the Mediterranean Sea is accorded one fifth of the world circumference from the zero point of the calculations the *Fortunate Isles**. But, did *Ptolemy* actually mean a quadrant was represented by 115 parts, thus giving an easy set of ratios for the cosine of the latitudes?

Determining the Alignment points from *MT/CP* to the Geographical plot

The first named geographical point for establishing distances is *Sacrum Promontory*, now known as Cape St. Vincent on the south west corner of the Iberian Peninsula.

It is not practical to align latitudes or longitudinal markers when comparing the ***MT/CP*** and Geographical plots. Scale is the only determinant for alignment when the maps are drawn to the same simple projection. A map of the Mediterranean Sea drawn at the scale utilised here and based upon a *Mercator* or preferably a Meridional Points projection will enable a direct overlay and therefore a direct comparison of coastal profiles.

It is totally unacceptable to align the 36N latitude to afford a comparison of the maps, as the plots are based upon differing spheres.

Thus it is necessary to evaluate each individual map or series of maps by *Claudius Ptolemy* to establish which point was chosen as the zero point for the actual drafting. Unless the individual parts are understood the whole cannot be drawn. This zero point will normally be a feature which is coincident with the geographical plot as well as the ***MT/CP*** plot. (**Diagram Cp2D06)**

The alignment points chosen for the descriptive texts which follow are; *Sacrum Prom*., Iberia: *Albingaunum*, [Albenga] and Neapolis (Naples) Italy, and *Alexandria*, Egypt. Others which are local points are mentioned in the text.

Alexandria has been chosen as the third co-joint location for the overlaid maps for a simple reason, the accuracy with which its latitude compares to the Sacrum Promontory. Alexandria is both geographically and by ***MT/CP*** located at 31^0 N, the Sacrum Promontory is geographically 37^0N or by ***MT/CP*** located at 38^0 15'N. **Thus 6 degrees geographical equals, 6 x 604 stadia or 3624 stadia, and 7.25 degrees *MT/CP* equals, 7.25 x 500 or 3625 stadia**. This accuracy enables the map plots to be aligned even though the Mediterranean Sea of ***MT/CP*** has been expanded by a 115/93 ratio.

However, the most important alignment point, and the one evaluated as defining the whole Mediterranean Sea, as well as both Hispania/Iberia and Gallia is *Sacrum Promontory*, Cape St. Vincent. From the picture provided by the overall map of the Mediterranean Sea, based upon this single coincident point, it is obvious that there are many examples of correct distances being contorted to fit the longer slimmer profile of the ***MT/CP*** plot, and that coastlines, map to map on the overlay, actually align. But it is in the detailed comparisons of individual maps that both the accuracy and information regarding the obvious distortions made by ***MT/CP*** are indicated.

SPAIN AND FRANCE----IBERIA AND GALLIA **Diagrams Cp2D07 & Cp2D08**

When ***MT/CP*** describe "*Our Sea*", the Mediterranean Sea, the first definitive land point is the *Sacred Promontory of Lusitania Hispania*, 2^0 30' east of the *Fortunate Isles**. The second definitive point is the mouth of the *River Baetis*, a further 2^0 30' east and the third point the Strait and *Calpe* a further 2^0 30'. The African coast line is not mentioned upon this 36N descriptive alignment, but three points on the southern littoral of *Hispania/Iberia* are. The corresponding geographical locations are, Cape St. Vincent, the mouth of the Guadalquivir River and of course Gibraltar, the northern part of the *Pillars of Hercules*.

Commencing at Cape St. Vincent the coastline indicated by ***MT/CP*** in both the northerly and easterly directions bears little or no resemblance to the geographical plot. The geographical south coast is an easterly route towards the Guadalquivir River mouth, and then south south east to the *Detroit*. Where-as the ***MT/CP*** plot is distinctly an E30S line with their *Detroit* a pure fiction when compared to reality. But, further east from Gibraltar past Malaga to Almeira and thence to Cartagena, the ***MT/CP*** profile can be said to reflect the reality. Proceeding north easterly towards Barcelona and thence to Marseille (*Massilia City*), although the coastline is extended easterly to suit the ***MT/CP*** extended length of the Mediterranean Sea and its reduced latitudinal spread, it is a recognisable coast line viz., the geographical plot.

However once an attempt is made to reconcile the west coast of the Iberian Peninsula, Portugal and N W Spain, the ***MT/CP*** plot contains one rather strange feature. From the *Sacred Promontory* at $2^0$30' East, 38^0 15'N the next location is the mouth of the *Calipodis river* at 5^0 00'E and 39^0 00'N, followed by a series of latitudes on a c5^0 0'E longitude, from 39^0 00'N to 45^0 30'N, and the *Sesti Altars* promontory at 5^0 40' East.

There has been a sudden shift of the west coast by 2^0 30', or 800 *stadia* east on a coastline which is to all intents and purposes a north alignment.

Regardless of the historical facts concerning the *Phoenicians* jealously guarding the sailing rights past the *Detroit*, it is inconceivable that any sailor rounding Cape St Vincent could change a sailing direction from due north to N20E.

But, if this 2^0 30' shift were to be corrected then the ***MT/CP*** coastline is a very acceptable representation of geographical fact. The ***MT/CP*** distance by latitude from the *Sacred Prom* to the *Sesti Prom* is 7^0 15' or 3625 *stadia*. The geographical distance is 6^0 45' or 4077 *stadia.*

When the two same scale plots are overlaid the correspondence of the land form is quite remarkable. This includes, of course, the good alignment of the northern littoral, the coast line of the Bay

of Biscay. Thus it can be shown that by aligning same scale and same projection ***MT/CP*** plots to geographical plots, definitive information can be obtained concerning the original details available. However, it should be noted that there is still a very large contortion within the coastline to accommodate the actual length of coast. This produces a large bay, which if it were true would have been a haven for boats and no doubt filled with harbours.

But first it is necessary to determine the reason for the 2^0 30' shift east, of the peninsula's west coast.

It would appear that in the ***MT/CP*** *Book 2 Chapter III, 'Location of Baetica Hispania'*, the southern coast has been faithfully copied by a scribe, although strangely one of the determinants of the length of the Mediterranean Sea, the mouth of the *Baetis River* [western] at 5^0 00 East has been omitted. The description of the western coast actually commences on the southern coast as follows;

After the mouth of the *Anas River the Turditani*

Baba	3^0 40E, 37^0 45N	
Ossonoba	3^0 00E,37^0 50N	
Sacrum prom	2^0 30E,38^0 15N	
Calipodis river	5^0 00E,39^0 00N	*It must be obvious to any researcher that*
Salacia	5^0 05E,39^0 25N	*the sudden jump is an error of copying.*

A CHANGE OF GREEK SCRIPT IN THE FIRST MILLENIA BC Cp2T01

In the first millennium BCE the *Attic* system of numbers used by the *Athenians* and other Greek cities, assigns a specific letter to each of their numbers and is based on an addative principal. These are *acrophonic*[8] numbers as the initial letters of the Greek names correspond to the number, and are fully described by Ifrah[8] (1994). Thus, in **Cp2T01,** tables 1 and 2 are indicated the original and later forms of numbers in the Attic script.

It is by a probable transliteration of the figure **11(2) to ∏ or PI**, i.e.5, (5 now written as ∏evte [pente]) that confusion arose in the reading of numerals. Thus the sudden movement of the west coast of the Iberian Peninsula from **11 to II (**or 2^0 to 5^0**)** may be quite simply resolved. Is this an original mistake upon which the remainder of the *Iberian Peninsula* and then Gallia [France] is drawn as an ***MT/CP*** map, or is it a later copyist mistake? The north coast figures appear to follow quite naturally and thus it must be original. But, by *Marinus or Ptolemy*, or earlier is indeterminate.

When the west coast is realigned by the removal of the '**5**' and returned to a '**2**',which means a basic three degree shift west for the coastline, the *Iberian Peninsula* and the west coast of *Gallia*/France become acceptably close to the geographical plot, and of course France regains much of its lost land area.

Having finally corrected the map of Iberia, the distortion of the ***MT/CP*** map can be rectified and at the same time it can be shown that the basic distances on the ***MT/CP*** map, are, in many instances, a reasonable match for the actual geographic distances. But each example, such as those above, only serves to illustrate the fact that *Marinus of Tyre and Claudius Ptolemy* must have ignored the sailing directions known to the Sea Captains and Pilots who sailed the Mediterranean Sea. Surely they realised there was a great discrepancy between the facts and their maps?

Gallia/France **Diagrams Cp2D08 and Cp2D09**

From Bayonne to Bretagne, the west coast, first it is the Landes Departement and this is a nearly due north alignment. The profile which comes from the details given by ***MT/CP*** can only have occurred to accommodate the correct geographical length of the coast between those two points. They are both c3100 *stadia*. But if the distances between the ***MT/CP*** co-ordinates are compared to geographical distances the accuracy is indicated. From the *Garumna River* to the *Liger River* it is 2^0 or 1000 *stadia.* It is 1^0 40' geog and thus also 1000 *stadia*. From the *Garumna* River to the *Gabaeum Promontory* is 3^0 25' or 1625 *stadia,* and geog distance is 1710 *stadia.* In other words, align the two plots at the western cape of France, *Gabaeum Prom*, the Bretagne peninsula, whilst keeping the nearly correct north coast of Iberia aligned, and observe that their west coast will generally agree with the main error south of the *Garumna River* to the Pyrenees promontory instead of the inner bay at *Oeasso Town*. It also aligns the north coast of Gallia correctly at the Cotentin Peninsula. Carry out the same exercise on the south coast of *Iberia and Gallia*, and the distances begin to equate to the geographical map. It is therefore quite apparent that both *Marinus of Tyre* and *Claudius Ptolemy* were provided with accurate distance or survey plots!

The Positioning of the Pyrenees

The north coast of *Tarraconensis Hispania* commences at *Nerium Prom*., but on that coastline in the *Stevenson* text we can detect errors when a comparison is made with the maps in Codex Lat V F. 32. At *Flaviobriga* and the *Deva river* we read transposed northings, thus *Flaviobriga* should read 44^0 25'N and *Deva* 44^0 15'N, instead of the opposite in the text. Next comes perhaps the greatest copy error in that the northings are increased by one degree, with *Menosca* 45N instead of 44N, *Oeasso* at 45^0 05'N instead of 44^0 05'N and *Oeasso Prom* 45^0 50'N, instead of 44^0 50'N. These last figures of course affect the coastline of *Aquitania Gallia*.

However it is the factors governing these northings which are of importance, and thus indicate the error of the copyist. Having placed the north coast of Iberia at 45^0 45'N, it was necessary to relate it to *Gallia Narbonensis* and its Mediterranean coastline. It commences at the *Temple of Venus*, 20^0 20'E; 42^0 20'N. This is a correct geographical northing for the Pyrenees and the Franco/Spanish border area, and would thus provide for a correctly drawn Pyrenees, east/west.

However, it is actually because *Massilia City* (Marseille) has been placed at 43^0 05'N (its geographical position is 43^0 15'N) and the north coast of Iberia is in general 43^0 30'N.

MT/CP knowing the correct latitude for *Massilia City,(and also Narbon Colonia)* had to bring the coastline of north Iberia, *Tarraconensis Hispania*, to its correct relative position apropos *Massilia City* and this required a reduction in the latitude to 44N compared to the geographical 43^0 30'N. These were fixed latitudes known to the ancient cartographers and they had to be upheld.

Hence, we can state that ***MT/CP*** were aware of the contortions they created.

The Italian Peninsula and its environs

Diagrams Cp2D010 to Cp2D013

Note: the Stevenson text is seriously mis-copied from Naples to Brindisi. The text and map in Codex Lat V F. 32 should take precedence.

The geographical peninsula of Italy can be described as encompassed by a near rectangle based upon the coastlines. The Adriatic or eastern coast alignment is simply a line from Ravenna via the Gargano Peninsula to Otranto, whence a perpendicular is drawn to the south west passing through Capo S M di Leuca and Capo Spartivento. **[Diagram Cp2D010]**

From Albenga on the Ligurian Sea and the Gulf of Genoa, a line which is actually 2^0 30' out of parallel to the Ravenna line, can be drawn along the western or Tyrrhenian Sea coast, where it then passes through the Calabrian province, the 'Foot of Italy'. This rectangle is by proportion 1: 4.59.

The ***MT/CP*** peninsula of Italy is also fairly described by the same lines. Thus we may utilize these lines to compare same scale plots of the map of Italy. These indicate that the ***MT/CP*** map has a considerable degree of accuracy, but the final profile is distorted to accommodate that accuracy and remain within the confines of the modified Mediterranean Sea. **[Diagram Cp2D011]** That accuracy is indicated by the near correct latitudes for, Naples, Leucopetra Prom and Rome.

The first alignment to be tested for compatibility is the eastern/southern right angle at the 'heel' or Apulian province of Italy. Once both maps are aligned at this point, the similarity between the two, particularly the 'Toe' position becomes very apparent. It also indicates that the ***MT/CP*** map was pivoted at the "*Naples Poleis*", and that this pivot point, when corrected, has the immediate effect of shortening the over length of the eastern or Adriatic coastline. By pivoting the ***MT/CP*** plot at the "*Naples Poleis*" to an alignment parallel to the original geographical Albenga 87.5^0 alignment, we find that there is an immediate coincidence point at *Populonius,* now the Piombino headland. The ***MT/CP*** plot position for Albenga then aligns to the same geographical alignment. Thus the ***MT/CP*** plot of Italy is surprisingly accurate.

The eastern/Adriatic coast can then be re-aligned from the ***MT/CP*** plot to the geographical plot by utilizing the Ravenna alignment. The result indicates the closeness of the two plots by the near correct positioning of Ravenna on both aligned diagrams. **[Diagram Cp2D012]**

Corsica and Sardinia

Diagram Cp2D013

The islands of Corsica and Sardinia are geographically due south of Genoa and its Gulf. The 9^0 00E geographical longitude is reasonably represented on the ***MT/CP*** plot by the 30^0 00E longitude.

However, by re-orientating the Italian peninsula of ***MT/CP*** to the geographical alignment, these two islands wander in the Tyrrhenian Sea with a 20 degree differential. The ***MT/CP*** plot is reasonably correct, but obviously one degree too far east. Visually on the comparative plots one can immediately see the difference, however in terms of distance, a mere 300 *stadia* or 56Km east; hardly a discussion point. But when the Islands are drawn as overlays on the same base plot it is obvious that the Bouches de Bonifacia or Boche di Bonifacio, geographically 42^0 20N and ***MT/CP*** 39^0 10N, maintains a geographical position.

Sicily

Diagram Cp2D013

The Isle of Sicily is a very different problem. The geographical shape and the ***MT/CP*** form are rather at odds. Certainly they are triangles, but the geographical plot is perhaps best described as a slim truncated isosceles triangle, which when fully extended is actually 193/386/386Km or 1050/2100/2100 *stadia*. The island is actually 270Km or 1470 *stadia* east/west, as diagram 13 illustrates.

The ***MT/CP*** plot is a longitude/latitude square of three degrees with the northern coast sliced at a 1:3 ratio angle.

If however we concentrate on the text of ***MT/CP*** it is possible to evaluate the problem. The text in Book 3, chapter iv commences with;" *The maritime shore of this island is thus described: the central part of the north side, which, terminating in a point, and more toward the north is called Pelorus promontory, 39^0 40E, 38^0 35N*. The text continues: "*A description of the west side, a description of the southern side and a description of the eastern shore*". Thus there is no north side which geographically extends from Cape Pelero to Trápani (Drepanum), along the 38th parallel. That the text is corrupt regarding the north side and whatever the reference to the 'central part' means is no surprise. It is in fact a copy of the text in the description of Corsica and is thus probably a copyist error in the distant past. However it is the fact that ***MT/CP*** chose to use Lilybaeum Promontory as one of their determinants for the length of the oikoumene, positioned on the 36th parallel that has caused the errors. By locating Syracuse at its proper latitude c37N, and having Lilybaeum at 36N, instead of a geographical 37^0 45'N, the north side distortion was inevitable This is somewhat at odds with the accuracy seen on the plot of Iberia and the Italian mainland, and the visual comparisons of Corsica and Sardinia. The longitudes and latitudes given by ***MT/CP*** appear to be a cohesive set of figures, but only the east coast has a form which approximates to the geographical shape, although the length of the south coast is nearly correct. It is hard to imagine a sailor recognising this island.

Detroit, the Strait of Gibraltar

Diagram Cp2D014

In Greek history the *Pillars of Hercules* form a barrier to the western end of Mediterranean Sea. This barrier as stated was also economic, but, by the time of our geographers *Marinus of Tyre and Claudius Ptolemy*, the whole *Detroit*[7] and littorals of Europe and Africa were under Roman control, and had been for over a century.

Hence it is quite surprising not to find these *'Pillars of the Inner Sea'* itemized as a geographical feature by ***MT/CP***. Book 1 of the *'Geography'* mentions *Calpe* [Gibraltar] and in Book 2, *"prologue of the particular descriptions*", it is mentioned as follows; "*First of all, therefore, let us set down Europe which we separate from Libya by the Straits of Hercules*", and in Book 2, Chapter III*; Location of Baetica Hispania,* we have, "*The southern side of Baetica is terminated by the Outer Sea and the Hercules Strait, and by the Inner or Iberian Sea*". Then; "*Calpe Mountain and Pillars of the Inner Sea, 7^0 30E, 36^0 15N etc*.. Book 4, Chapter 1*; Location of Mauritania Tingitana*, states, "*The western side of Mauritania Tingitana is bounded by a part of the Outer Sea, which we call the western ocean, it extends from the Hercules strait to the Greater Atlas Mountains*", and "*The northern side is terminated by the strait, on which, after the [Cotes] promontory are the following; Tingis Caesarea, 6^0 30E; 35^0 55N---mouth of Valon River 7^0 00E; 35^0 50N----Exilissa city 7^0 30E; 35^0 55N----Septum Fratres mountains 7^0 40E; 35^0 50N, and by the Ibericum sea coast on which are the following, Abila Columna 7^0 50E; 35^0 40N ,etc, etc".*

Thus the two parts of the *Pillars of Hercules, Calpe* and *Abila Columna* are, according to ***MT/CP,*** some 0^0 20'E and 0^0 35'N, or 135 *stadia*/292 *stadia* apart, with a direct distance of 320 *stadia*. Hardly two imposingly close pillars or columns!

Geographically they are virtually on the same longitude and only $0^0$15' N or 150 *stadia* apart. That is 27.6Km or 17.15 miles for a very credible and visible myth. But why would ***MT/CP*** not align

these two Pillars or Columns. Or is this a miscopy of 7^0 50'E for 7^0 30'E, quite possibly? If the *Abila Columna* had any import for ***MT/CP*** then the following location in their table would have been due south to emphasize a promontory, it is not! After *Abila Columna* at 7^0 50'E / 34^0 40'N we have the *Phoebi Promontory* at 8^0 00'E / $35^0$30'N, which, when compared to the point preceding *Abila,* we find is an unremarkable littoral with no 'pinching pillar'.

It is however quite possible that by the second century CE the myth of the *Pillars* may have passed into history: or, ***MT/CP,*** both resident at Alexandria Egypt, and under Roman rule, may have been fully aware of the ancient Egyptian veneration of Pillars and known that the likely originator of the *Hercules Myth* was actually the *Egyptian myth* of the Sun setting in the west between two pillars or the mountain of sunset, *Manu!*

However, when the whole map is aligned from the *Sacred Promontory*, the peninsula of *Cabo Tres Forcas* and *Melilla* on both plots align quite reasonably, thus allowing the North African littoral to be fully examined.

The North African coastline

Diagram Cp2D015

The comparison of the two coastlines, ***MT/CP*** and the geographical plot is to be made as before, with the alignment of the single coincident point, *Sacred Promontory*/Cape St Vincent. From this point the *Detroit,* or Strait of Gibraltar is fairly positioned, but the African Littoral is rather distorted due to the choice by ***MT/CP*** of the 500 *stadia* degree. The Mediterranean Sea has several 'pinch points' which can be used to evaluate the two plots. The first is the Sicilian channel between Cape Bon, Tunisia, and Marsala, Sicily. This is an E30N bearing of c150Km or c800 *stadia.* But ***MT/CP*** have set down, Cape Bon 35^0 00'E/ 33^0 30'N to Marsala [*Lilybaeum prom*] at 37^0 00'E/ 36^0 00'N, and thus a distance of 1920 *stadia*. This is vastly over distance because of the over-exaggerated slope towards the north of the Italian peninsula. This slope could therefore have been lowered, and the *"Foot*" of Italy properly aligned. If Italy could have been drawn to its geographical form, the ***MT/CP*** data is wrong.

Cape Bon is itself some 3600 *stadia* east and 2250 *stadia* south of its geographical position on the comparative plot. The ***MT/CP*** littoral of North Africa, east from the *Detroit* is a steady E15S slope, whereas the geographical coast line as far as Cape Bon is an easterly drift northwards, at an average of E5N. After Cape Bon the geographical features of the North African coast are quite dramatic with a 4000 *stadia* southerly alignment from the Sicilian and Malta Channels towards Tripoli, Libya and then into the Gulf of Sirte (Surt), east of *Leptis Magna*.

The map of ***MT/CP*** endeavours to reflect this gulf with the change from '*Africa' to* '*Cyrenaica',* and the positioning of the *Tower of Euphranta*, 44^0 10'E/ 29^0 40'N, then via the border position at 46^0 45'E/ 29^0 00'N, to *Hyphali Naval Station* at 47^0 20'E/ 29^0 40'N.

Surprisingly, after this Gulf and a two degree north westerly coastline from 29^0 10'N, to *Boreum Prom* at 31^0 10'N, the North African coast of ***MT/CP,*** which is set generally or near 31^0 00'N, is coincident with the geographical coast line from *Alexandria,* Egypt to *Rhinocorum*/El Areesh, Egypt.

To accommodate the northern Mediterranean littoral, basically Greece, with its many peninsulas', the African littoral has been stretched and sacrificed in terms of accuracy until the south east corner of the Mediterranean is reached, that is the coast of Egypt. It has already been stated in this paper that the Sailing Masters of ancient ships in the Mediterranean Sea could not have described the North African littoral as portrayed by ***MT/CP***. Even allowing for the many sand bar obstacles littering the coast line, the journey from *Carthage to Leptis Magna,* and thence finally to *Cyrene,* cannot but have been described and noted as a set of north/south and east/west or south east/north west sailing directions.

But, why does the ***MT/CP*** plot suddenly revert to a direct comparison with the geographical plot at *Alexandria?* It can be expected that the draughtsmen of the maps had sufficient knowledge of this area to exclude the obvious contortions of the rest.

The Eastern Mediterranean Sea

Diagram Cp2D016

The geographical profile of the Egyptian coast east of *Alexandria* will have altered by the continual discharge of the River Nile silt into the delta plain. Thus from Alexandria to Port Said and the

mouth of the Suez Canal, direct comparisons are not possible, but, given the closeness of the overlaid plots, probably unnecessary.

However, after Port Said (and the ***MT/CP*** *'mouths of the Nile')* we have five places noted, *Pelusium, Casium, Sirbonis, Ostracine and Rhinocoura*. Thence the ancient names of well known sites are given northwards along the eastern Mediterranean coast. What is immediately apparent, as with the distortions elsewhere in the Mediterranean is the alteration of the coastal bearing, by ***MT/CP,*** to N40E, from a geographical plot of N20E? But if the calculated distances are compared, from Alexandria to Gaza, and thence to Alexandria in Issus, they are reasonably compatible;
Alexandria to Gaza: ***MT/CP*** = 1836 *stadia* or Geographical 2315 *stadia*
Gaza to Alex in Issus: ***MT/CP*** = 3021 *stadia* or Geographical 3111 *stadia.*

Further comparisons can be made by superimposing the two plots aligned at Alexandria, Egypt. Here, it becomes quite obvious that there is an extra- ordinary coincidence of the coastlines from Alexandria to Istanbul. The simple visual exercise of stretching the ***MT/CP*** coastline along the Geographical coastline produces the match that should perhaps be expected given the thousands of year's navigation in this area of the Sea.

It should also be noted that when the plots are coincident at Alexandria, the Gulf of Suez, Gulf of Aqaba and the Sinai Peninsula correspond particularly well.

Thus we may state quite unequivocally that ***MT/CP,*** *in their deliberation of the size and shape of the Mediterranean Sea, must have known they were distorting the facts, or at least realized that to make the individual elements of the Mediterranean Sea fit, they had to distort the facts. Thus the accurate distances available and sailing directions given are amended to suit their preconceived idea of the size of the world.*

For two such eminent and learned persons, this author cannot but ask why they did not endeavour to test the 500 *stadia* latitude measure? Or prove, or test, the more correct 600 *stadia* measure? Thus they would have produced a spectacular map.

Who provided MT/CP with quite accurate survey data?

There are two texts dating from the late fourth century CE which inform of the original Roman World Survey. First, a geographical treatise by "*Julius Honorius*" and second a Cosmography by an unknown author, now conventionally known as *'Aethicus'*. We read in *Wiseman* (1992)[9]:

In the consulship of Julius Caesar and M Antonius [44 BC], the whole world was traversed by four wise and chosen men: the east by Nicodoxus, the west by Didymus, the north by Theodotus, the south by Polyclitus. The east was measured in 21 years 5 months and 9 days, from the above consulship to that of Augustus [for the fourth time] and Crassus [30 BC]. The western part was measured in 26 years 3 months and 17 days, from the above consulship to that of Augustus [for the seventh time] and Agrippa [27 BC]. The northern part was measured in 29 years 8 months, from the above consulship to the tenth consulship of Augustus [24 BC]. The southern part was measured in 32 years 1 month and 20 days, from the above consulship to that of Saturninus and Cinna [garbled form of 19 BC].

These two texts were well known in the following centuries and are a feature of the *Ebstorf, Hereford and Cornwall mappaemundi*. Fortunately the question which requires to be posited at this juncture already exists in print, plus three definitive reasons for acceptance of the answer. In the text "*Julius Caesar and the Mappa Mundi*", Timothy Wiseman[9] poses the question," *Can we believe the testimony of Julius Honorius and 'Aethicus' on the world survey of Julius Caesar*?" He then continues," I *think there are three prima facie reasons to answer 'yes.'* " It is worth quoting the first, and paraphrasing the second and third as follows: "*First, the names of the surveyors, Nicodoxus, Didymus, Theodotus and Polyclitus do not sound like late-antique inventions, and learned geographers in the first century BC would naturally be men of Greek origin and culture. [A recently discovered inscription reveals a 'land-measurer', geometres, making a dedication to Augustus at a town in Thessaly: unfortunately, the name is missing.] It is even possible that one of the four can be identified. A Didymus who wrote on measurements in Alexandria, the intellectual capital of the Hellenistic world, has been plausibly dated to the second half of the first century BC".*

Second, the four fold division makes no sense on a modern map and does not fit with the tripartite medieval world. It is Hellenistic. Thirdly, after 32 years work it would have deserved commemoration.

Hence we can assume that *Julius Caesar's* four commissioners report, the latest in 18 BCE, and *Augustus, Caesar's* adopted son, who is now Rome's emperor is expanding the empire and a new world map is proposed. *Marcus Agrippa*[20] was entrusted with the project, but, surely he was only required to update the work of the four commissioners. This task was completed by *Vipsania Polla*, his sister, and actually completed by *Augustus,* as is described by *Pliny the Elder*[10] in his Natural History III 17, VI 139.

Thus, by the beginning of our common era there were available to geographers both road and overall distances, with overall dimensions of provinces and continents.

It is generally accepted that *Marinus of Tyre* [c70-130CE], a geographer and mathematician was the founder of mathematical geography by assigning to each location, latitude and longitude. The second of our pairing, *Claudius Ptolemy* [c90-168 CE] utilized the work of *Marinus* to produce his "*Geography*", probably written around 150CE. Thus there is the possibility that in the first 70 years of our Common Era survey details produced by the four commissioners were copied and transferred to the *Great Library of Alexandria*. It is therefore equally possible that we have both the survey details and the mathematical geographers in the same place, at the same time, to take advantage of this first co-ordinated survey. Unfortunately we do not know what details *Marinus of Tyre* utilized; (we are not even certain who he was), and we cannot even surmise their existence from the text of *Claudius Ptolemy.*

It can however be shown that the information was quite accurate, uncannily so in many areas, indicating measurement, and not just putting travellers' tales into the melting pot and by pro rata adjustment, deducing distances. It is plausible therefore to state that *Claudius Ptolemy* obtained a full copy of the text and maps (old and new) of *Marinus of Tyre,* but, not necessarily the survey notes upon which they were based. It is also plausible to speculate that those survey notes were based upon the commissioners' work, supplemented by the additional information supplied by *Agrippa*[20] and *Augustus Caesar.*

But again it is necessary to ask, why did *Marinus of Tyre and Claudius Ptolemy* continue with a world of 500 *stadia* per degree, when the survey information would have indicated that this was incorrect?

World Measurers

The Egyptians were quite unique in history, in that they created their own units of measure without assimilating units from other cultures. The Egyptian fields were measured with a Line or Knotted Cords, whereas long distances were measured by an itinerary measure named ITRW or ITERU. "Cord-stretchers" is the Egyptian term for a surveyor, who had a specific 100 cubit cord to utilise (52.5 metres).

When *Alexander the Great* set out from Macedonia he utilized the method of 'measure on the march', by '*Bematistai'*. However, the word 'Bematista' is not found in this context. "*The so called Bematistai, Baito and Diogenetus*[11] *had to keep the record of every distance between halting places and describe the geographical features*." Hence, we have the two measures, *Beme-Aploun and Beme-Diploun*[12] *[ampelos]***.** They are now, thousands of years later, considered to be respectively c750mm and c1500mm. These are the near equivalent of the Roman *Passus* of 1479.18mm which is five pedes of 295.835mm or 11.64706 inches.

In antiquity, one Greek foot [pouce] was 308mm (one of many) and thus these two *Bematistai* measures have been corrupted, perhaps by the myriad of measures encountered on *Alexander's* great journey of conquest, to India and back.

The world was also measured by *Eratosthenes*, and the text of his '*Geography*' was available to *Strabo* c20BCE to AD18, and therefore one of the texts available to *Marinus of Tyre*.

The Romans, having learnt a great deal from the Greek mathematicians that they encountered in captured lands, adopted a system of square land measure [exactly as had the Egyptians] and a marching distance of *Mille Passus*, 5000 *Pes* or one thousand double paces. Thus, their land measure and their long distance measure, based upon 120 and 5000 *Pes* respectively, were not easily reconcilable. Their *Stadion* was one eighth of a *Mille Passus* or 625 *Pes* [Greek stade = 600 pouce]. They employed proper surveyors, *Geometres or Agrimensores*[13]. Some were attached to the Legion and others were legal operatives for town development and disputes. That they had the skill to carry out large scale surveys of terrain is illustrated admirably by the road layouts we see in the landscape, direct alignments of over one hundred miles or more. They also had the tools to do the job!

Hence it can be assumed that the Commissioners sent out under the aegis of *Julius Caesar,* around 45BCE, had teams of Geometres/Agrimensors to aid their task in surveying the world.

The Measurement of the World

Regardless of the fact that many reams of paper have been expended on this subject, it is necessary to question the various dimensions attributed to ancient geographers for the great circle of the earth. In 1948, *Aubrey Diller*[14] answered a question posited by *Professor Sarton* regarding, *"a convenient summary of what was known about ancient measurements of the earth*"? The paper duly published by ISIS describes the people involved and the measurements attributed to the great circle.

However, there is one telling paragraph which must be quoted in full;

"The only direct evidence of the length of Eratosthenes' stade is a solitary, but apparently reliable, statement in Pliny XII 53; schoenus patet Eratosthenis' ratione Stadia XL. This transfers the problem from the stade to the schoenus, which was an Egyptian measure of 12,000 cubits. Now Egyptologists, on the basis of measurements of the pyramids and other archaeological evidence, have long maintained that the Egyptian Cubit was about 0.525 of a metre. On this showing the schoenus would be 6300 metres, and Eratosthenes' circumference would be 6300 schoeni or 39690 Kilometres. The result is very near the truth but the stade involved is unknown and irrational [157.5 metres, c9.45 to a Roman mile]. This is at present one of two acceptable conversions of Eratosthenes' measurement of the earth."

There are as *A. Diller* makes it plain, several *schoeni*;

1] 20,000 royal cubits = 1 *schoene* = 6.5245 miles or 10.5Km.
2] 1 *schoene* = 2 *parasang* = 60 Greek Stadia or 6.71 miles/10.8Km.
3] 1 *schoene* = 1 *parasang* = 30 Stadia or 4.0266 miles/6.48Km.
4] 12,000 royal cubits = 1 *schoene* = 3.9148 miles or 6.3Km.

However it is not an irrational unit as he states and this can be explained.

Many author/researchers have commented adversely upon the 157.5 metre *stadion,* but it converts perfectly to 350 *ordinary cubits* of 450mm or 300 *royal cubits* of 525mm, thus maintaining the correct 7:6 ratio of Egyptian measures.

Thus the *schoenus* of 12,000 *royal cubits* is also the *schoenus* of 14,000 ordinary cubits and the *Egyptian Cubit ratio of 24 digits Ordinary to 28 digits Royal.*

Unfortunately the Egyptian system of measurement gradually underwent a fundamental change from the start of *Greek Ptolemy kingdom,* created after the death of *Alexander the Great* in 323BCE, to the period we are now discussing. Thus Egypt would have been gradually subject to the usage of Greek measurements and over those following centuries the ancient Egyptian measures such as the *Kassaba, Theb, Derah, Remen, Amma and Iteru*[13] generally became Hellenized, but the local custom and usage obviously prevailed as the historical record shows.

Thus when found in an Egyptian Tomb[15] is a reference to the measurement of the world being 3814 *Iteru [Egyptian Itrw*], and this is equated to 39,894.48Km, we must look closely at the 157.5 metre Stade. (see end note). The French Archaeologist *Christian Jacq*[15a] used this fact in one of his novels. A calculation will show that this produces a *Royal Cubit* equal to 523mm and hence the *ordinary cubit,* 448.286mm, but, it has been accepted by archaeologists that they are 525 and 450mm respectively. Although the difference is in effect inconsequential for a world measure, the calculation should possibly be, 3814 x 20,000 x 525mm = 40,047Km. This yet again produces a remarkably accurate world circumference.

This text utilizes an equatorial measure of 40,077Km and a meridional measure of 40,009Km, which is 254,025 Stadia of 157.5 metres.

If *Eratosthenes* considered the world as 252,000 Stadia of 157.5 m, and ***MT/CP*** utilised 180,000 stadia, but, the world is in fact 254,025 stadia of 157.5 metres, there is cause to consider the *Egyptian* measure of the *Royal Cubit* and the *Remen*.

The *Remen* is 20 digits and the *Royal cubit,* 28 digits, but, the one is formed by the other[16]. The *Royal Cubit* is the diagonal of a 20 *Remen* square; in other words the mathematics are 20 x root2 = 28 digits [in fact 28.284].

BUT, the 20/28 ratio produces, 180,000 to 252,000, and thus it would appear that *Eratosthenes'* based his unit on the *Remen* of 375mm [20 digits of 18.75mm], and, ***MT/CP*** based their measure on the *Royal Cubit* of 525mm, using 350 of such to give a stade of c184 metres. It is worth repeating the fact

that the 350 unit is the basis in *ordinary cubits* at 450mm of the 157.5 metre stade; thus, 350 x 525 = 183.75 metres and 350 x 450mm = 157.5 metres.

It would appear that there is nothing more than a complete mix up in the translation of Egyptian measure to Greek measure.

But what was the Roman World Measure? **Diagram Cp2D017**

On the *Britannia map of **MT/CP*** there are Roman Legion fort positions which date from the first century CE [70CE]. For these to have been translated into a latitude and longitude reference, a series of measurements were required which can only have been made by the surveyors of a Roman Legion[17]. One of those measurements concerns the Legion Fort of *Deva*/Chester and its position west and north of *Rutupiae,* the entreport and major terminal for all visitors to *Britannia*. The distances involved are expressed by a perfect triangle of 3:4:5 side ratios with corresponding lengths of 150:200:250 Roman miles. Thus *Deva*/Chester is 200RM west and 150RM north of *Rutupiae*. But the 150 Roman miles is a very credible 2 degrees of latitude (actually the northing is 2.05 degrees geographical) giving the immediate measure of one degree of latitude as 75RM or 600 *Roman Stadia* of 625 *Pes*. This Roman World of 75RM per degree has also been noted through an early Christian alignment across the Italian, French, British and Irish Landscapes which has a very precise 270RM sub-division indicating a Roman World of 27,000RM; or 360 x 75, as described in, '*With Michael from Italy to Ireland',* (FERRAR, 2005)[9].

Is this what the Commissioners found when they reported finally to Augustus?

If we analyze the 27,000/75RM measures, it is 216,000 *Roman Stadia* of 625 *Pes*, each of 11.64706 statute inches. (This measure of the *Pedes/Pes* is normally written as 11.65 inches.) Thus it is 24,818.179 statute miles or 39,935.917Km. This figure is so very close to the Egyptian world figure variously 39,894.48 or 40,047KM. However, *Eratosthenes* figure is given as 39,690Km. These figures are too close to the actual measures of 40,009 /40,077KM that they make little or no difference to basic calculations. Thus if ***MT/CP*** considered that *Eratosthenes'* had used a stade of 0.184Km, then the reduction of his world from 252,000 stadia x 0.184 = 46368Km, was a necessity. *Yes*, they were correct to reduce it, but only by the Cosine 31 degrees, 0.857 and not by the extra-ordinary figure 0.714 or Cosine 44.4 degrees. These two cosines are of course the equivalent of the 6/7 and 5/7 ratios.

There may never have been an actual *Stadion* of 157.5 metres[18,19], it was in all probability a translated Egyptian measure. It is possibly a mis-translation of measures because they are all so effectively related by ratio, i.e. 20:24:28, or 5:6:7, and therefore it is actually very difficult to make a definitive statement concerning the measure used. But, the Roman world survey with its update prior to the world maps of *Marinus of Tyre and Claudius Ptolemy* must be considered the prime contender for the base survey information. These survey details would have enabled *Marinus of Tyre* to evolve the system of Latitude and Longitude and then *Claudius Ptolemy* to produce his *'Geography'.*

CONCLUSION

Having chosen to use 500 *stadia* per degree, without first establishing the veracity of the measure, ***MT/CP*** had to reconcile correct distances upon a distorted graticule of the World.

The contorted littorals, the stretched littorals and the correct littorals are evidence that they probably realised there was an error in their work, but they proceeded anyway.

The choice of 500 *stadia* per degree did not allow the Mediterranean Sea to be accurately drawn using known distances, and it had to be elongated east west. This was achieved by the simple expediency of inverting the Cosine Ratio for 36 degrees, 93/115. Thus the elongating factor is 115/93. This utilisation of a known and simple fraction enabled the calculation of sub-distances to maintain the correct relationships between sites, and ensure that the centre line of the Mediterranean Sea was maintained in its relative position.

The work of *Eratosthenes'* was available in Alexandria, if only within the text of *Strabo.* An analysis of that work indicates some quite accurate measures.[12a]

It is also plausible to argue that the survey carried out by the *Roman State* was the prime information for the ***MT/CP*** plot, but not the only information.

Thus available to ***MT/CP*** was the correct size of the World, and hence, the correct geographical length of a degree of latitude. Their mistake may have been the most simplest, that of a confusion in the *stadion* length, as has also been argued by this author in a paper regarding *Strabo* and *Eratosthenes*.[12a]

A search for more information regarding the Roman World Survey, and a consideration that the map produced by Rome was a proper *Mappaemundi,* is perhaps now necessary. It should not be confused with the diagrammatic examples displayed or produced as road map gazetteers.

We should also look closely at Egyptian measures and their World measurement, consider how it was achieved and confirm the *stadion*[12a]. [End note refers]

Eratosthenes' was probably the recipient of the Egyptian information, and his use of ancient Egyptian measures may prove to be the origin of it all.

M J FERRAR 2009

Note.

There are four papers explaining the Geography of Claudius Ptolemy by this author. The first is entitled: Claudius Ptolemy: Falsification, Regimentation or Symmetry? The map of Britannia examined and the turning of Scotland resolved. The third, (this paper being the second,) is entitled, India intra et extra Gangem + Sinae and Taprobane. The maps of Claudius Ptolemy explained with the resolution of place-names including Cattigara Sina. The fourth is entitled; The Text of Marinus the Tyrian and Claudius Ptolemy, Geographia: Book 4, chapters 1, 6, 7 and 8. The west coast of Libya explored and the zero longitude determined.

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Diller, A. (1934). *Review of above book*. ISIS, vol., 22, pp533/539.

Strang, A. (1998), "*Analysis of Ptolemy's Geography*", Cartographic Journal vol., 35 $N^0$1, pp 27-47

Berggren, JL, and Jones, A. (2000). Ptolemy's Geography. An annotated translation of the theoretical chapters. Princeton and Oxford.

2] '*Xenophon*'; "*The Persian Expedition*", (trans., R Warner,) 1949, Penguin, London.

3] *'Strabo, Geography'*. (trans., H L Jones.) Loeb Classical Library Harvard and London, 1917-1932. The text is also available on-line.

4] 'Quintus Curtius Rufus';" *The History of Alexander*", (trans., J Yardley, 1984,) Penguin Classics, London.

5] 'Arrian'; "*The Campaign of Alexander*", (trans., A De Selincourt, 1958,) Penguin Classics, London.

6] Dilke, O A W. (1990), "*Ancient Sources for Greek Coastal Topography*",
(1986), "*Graeco-Roman Perception of the Mediterranean*"
"*Ancient Cartographic interchanges between Europe and Africa"*
(1985), *"Greek and Roman Maps*", Thames and Hudson
Also in; "Harley, J B. and Woodward. D. (1987), "*The history of Cartography*" volume 1. 'The cartography in pre-historic, ancient and medieval Europe and the Mediterranean'. University of Chicago. Chapters 11 to 16 inclusive.

7] Ifrah, G. (1994-1998) "*The Universal History of Numbers*", The Harvill Press, London. Chapter 16, pp182-185.

8] Ponsich, M. (1974), "*La Navigation Antique dans le Detroit de Gibraltar*", in Melanges offerts a Roger Dion, Editions Picard, Paris, p257-274.

Arnaud, Pascal. (1993), De la durée á la distance: l'évaluation des distances maritimes dans le monde gréco-romain. Histoire & Mesure Vol. 8 no 3, 225- 247

Several conversion scales were in use for high-sea navigation, mainly; 700 stadia per solar day, 1000 stadia per 24 hour day, 500 stadia per solar day. Distances taken along the coast were much

more accurate (down to a one- stadion interval!) and segmented, but seem to belong to a far larger panel of scale-systems. In Section 3, Le probleme de la valeur du stade, is discussed.

Eratosthenes and his predecessors had plenty of nautical measurements: see for example Herodotus on the Black Sea (switching between fathoms, stadia, and time measurements---days' and nights' sailing--- and measurements in stadia.

'*Herodotus, The Histories'*, (trans. A.de Selincourt and revised by A.R.Burns) 1972. Penguin Books Ltd. London.

In Book 4.34, *Herodotus* commences the section with the words, *'I cannot help laughing at the absurdity of all map-makers- there are plenty of them-*', and proceeds to describe the known world. He states later, '*As for Libya, we know that it is washed on all sides by the sea except where it joins Asia, as was first demonstrated, so far as our knowledge goes, by the Egyptian king Neco, who, after calling off the construction of the canal between the Nile and the Arabian gulf, sent out a fleet manned by a Phoenician crew with orders to sail round and return to Egypt by way of the Pillars of Heracles'.*

9] Wiseman, T P. (1992) "*Julius Caesar and the Mappa Mundi*" in "*Talking to Virgil'*, University of Exeter Press, pp22-42.

For a full discussion of the Roman World Survey and its aftermath in and on the landscape of Europe, see,

Ferrar, M J. (2007) 'With Michael from Italy to Ireland', published on www.journalofmaps.com It is available for selection now.

See 6, O A W Dilke, in History of Cartography, Chapter 12, pages 205/206.

10] 'Pliny the Elder'; "*Natural History*: A Selection", Penguin Books 1991

11] Oxford Classical Dictionary, 3rd edition, O U P, 2003. P238,"*Bematists*, the surveyors of Alexander the Great". It should also be noted that this dictionary contains many catalogue references to ancillary subjects in this paper, i.e. Maps, measures, and the people mentioned in this text.

Oxford Dictionary of Classical Myth and Religion; O U P, 2003. This book contains many references to mythical characters such as *Hercules.*

Websters' New Geographical Dictionary; 1988, Merrian-Webster inc. New York. P803-*Jebel Musa* and P955-*Pillars of Hercules*.

12] Doursther, H. (1858) "*Dictionnaire Universel des Poids et Mesures Anciens et Modernes*; Bruxelles.

For a full explanation of the Egyptian measures and world measure, linked to the ITERU, which is not only the name of the River Nile, but their itinerary measure, see, Cartographical Journal;

Ferrar, M J. (2009), 'Eratosthenes, Hipparchus and Strabo: Geographia' and its sister paper, 'Strabo: Declarations of Eratosthenes: Factual or Misquoted' See also End Note Comment.

13] Dilke, O A W.(1971), "*The Roman Land Surveyors*", Newton Abbot.

14] Diller, A.(1948). "*The Ancient Measurement of the Earth*". ISIS, vol XL, p6/9.

15] Zeidler, J.(1997) *"Die Lange der Unterwelt nach agyptischer Vorstellung*", in Gottinger Miszellen 156, 1997, pp101-112.

General notes. The text at the beginning of the Amduat states, 'This god enters the western gate of the horizon. Seth stands along the shore. It is 120 iteru coming to this gate, before the bark reaches the netherworld dwellers. One then continues to Urnes (i.e. once equated with Ouranos).' An early division of the Duat is the Urnes, 309 iteru long. The other divisions are of equal length, and produce an overall length of 12 x 309 = 3708 iteru, to which must be added the distance for Egypt. The length of Egypt is stated as early as the Middle Kingdom as 106 iteru. Thus we have a total of 3814 iteru, or 3814 x 20000 x 0.525m = 40047Km.

The Egyptian ITRW or Iteru is found in inscriptions called a 'river unit': an early source for this unit is the White Chapel of Sensuret 1 at Karnak. It corresponds to 20000 cubits. The Greek term for this measure is *Skhoinus.* The New Kingdom, about 1550 to 1069BCE, has written sources referring to a smaller unit, the 'cord measure' (Egyptian = xt n nwH), corresponding to 100 cubits.

Jacq, C. (2002), The Flaming Sword. (trans., Sue Dyson) Pocket Books, London. Page 131, quote, *'Do you know, for example, why it is stated that the length of the DUAT, the intermediary world*

between the sky and the underground ocean, is 3814 iterus, to use a map-maker's term? Because it corresponds to the perimeter of the earth.' End quote.
16] Berriman, A E.(1953) "*Historical Metrology*", J M Dent and Sons, London
17] Ferrar, M J, and Richardson, A. (2003) "*The Roman Survey of Britain*", BAR 359; 2003. British Archaeological Reports, Oxford
18] Fischer, I. (1975), "*Another look at Eratosthenes' and Posidonius' determinations of the Earth's circumference*", Q. JL. R. Astr. Soc. 16 [1975], pp152-167.
19] Rawlins, D.(1982), "*The Eratosthenes-Strabo Nile Map*. Is it the earliest surviving instance of Spherical Cartography? Did it supply the 5000 stade Arc for Eratosthenes experiment? , in 'Archive for History of Exact Science', 1982, vol., 26 pp211-219.
20] Tierney, J J. (1963), "*The Map of Agrippa*", R Irish Ac. Vol. 63, Section C, 4.

END NOTE
As most readers will be computer literate, I offer this information for further study.
Go to, http://en wikipedia.org/wiki/pseudoscientific_metrology
Contents items 2 and 3. Quote,
"2. *The circumference of the Earth*: From the 18th century, inspired by the statement of Aristotle that the circumference of the Earth was calculated as 400,000 Stadia, it became a belief among members of the French Academie des Sciences that ancient linear measures were all derived directly from the circumference of the Earth. Archaeologist *Jean Antoine Letronne*, in 1822, tried to show the connection to a supposed pre-Greek measure of the Earth.
3. *The Grand Scheme*: By the time measurements of Mesopotamia were discovered, by doing various exercises of mathematics on definitions of the major ancient measurement systems, various people (*Jean-Adolphe Decourdemanche* in 1909, *August Oxe* in 1942) came to the conclusion that the relationship between them was well planned.

Livio C Stecchini claims in his, "A History of Measures",

"The relation among the units of length can be explained by the ratio 15:16:17:18 among the four fundamental feet and cubits. Before I arrived at this discovery, *Decourdemanche and Oxe* discovered that the cubes of those units are related according to the conventional specific gravities of oil, water, wheat and barley. [2] (http://www.metrum.org/measures/length.htm)"

Stecchini makes claims that implies [stet] that the Egyptian measures of Length, originating from at least the 3rd millennium BC, were directly derived from the circumference of the earth with amazing accuracy. According to "Secrets of the Great Pyramid" (p.346 [3] (http://www.csus.edu/indiv/v/vonmeierk/3-03INC.html)), his claim is that the Egyptian measurement was equal to 40,075,000 meters, which compared to the International Spheroid of 40,076,596 meters gives an error of 0.004%. No consideration seems to be made to the question of, on purely technical and procedural grounds, how the early Egyptians, in defining their cubit, could have achieved a degree of accuracy that our current knowledge can only be achieved with very sophisticated equipment and techniques." End quote.

COMMENT

The above text is written in terms which not only show scepticism but also a great ignorance of comparative fact. The criticism is also self defeating with regard to the Egyptian measurement of the world which has now been recorded, and can be fairly expressed as 40,047,000 meters. *Livio C Stecchini* may have been over enthusiastic with a comparison to the International Spheroid, but the rest of the comments are balderdash. The complexity of ancient Egyptian measure and the undoubted accuracy of their achievements, before us in the landscape, indicate a capability that in certain spheres today we cannot emulate without recourse to machinery and possibly a GPS system.

They had a measure equal to 12,000 cubits, now the *Parasang,* but formerly the *Iteru or Itrw*, and that is an itinerary measure, not one for fields and general usage. It was probably designed as a measure to calculate the length of the River Nile, from which it gains its title.

Their knowledge and capabilities should never be underestimated!
But, we must question the later usage of the Egyptian world measure. Is it a case of non recognizance of texts in the pantheon of Egyptian writings or a non acceptance that such a phenomenon was possible? If the data was available to the Greek scholars when the *Ptolemaic Kingdom* was formed, would they have used or ignored it?

We must also consider the possibility that the survey details *Eratosthenes'* utilised were Egyptian and that the original method of measurement we find attributed, the distance between the Well at Syene and Alexandria, is an Egyptian original.

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Thus, Egypt probably provided the Geographers with their base data.

Michael J Ferrar 2009