Appendix

MARS AND D&M PYRAMID PARAMETERS

The known values and relations for Mars and D&M pyramid are taken from the specified sources.
The author's notes and considerations are given in the rubric under the heading "Comment".
Some non-conventional denotations are changed for the purpose of clarity and uniformity of designations.

A1. The Solar Cycle Constant

The ***average duration of the 11-year Solar activity cycle*** [14] makes

$T_0 = 11.07$ years with a relative error of about $\delta_* = 1\%$.

The great importance of this value results from that influence these cycles exert onto planetary processes; they so to say modulate the processes so that the planetary periods follow a Golden section structure of periods (ATS – Auric Time Scale) being centred by T_0, as well as the basic periods in nature and society on this planet – at least in the interval of seconds to hundreds of millennia [15]; besides, the actual Solar cycle periods themselves follow the ATS as well [16]. For this reason this ***Solar Cycle Constant*** may be called a ***Solar year.***

A2. Martian units of time

A2.1. Average length of ***Martian sidereal day*** ***24h 37m 22.663s*** (in Earth time units) [17]

Average length of ***Martian solar day (sol)*** T_S ***= 24h 39m 35.224s*** (in Earth time units) [17]

A2.2. ***Sidereal period (year)*** [6] ***1.8809*** Julian years (686.98 Earth solar days)
N_S ***= 668.5991*** sols

Average ***tropical year*** [17] ***668.5921*** sols

Comment A1. Due to a small difference in Sidereal and tropical years, for the purpose of this study we consider an average of these two as a Mars year (myr, for short).

$(\frac{T_S}{24h} \times N_S) / 365.24 = 1.8809$ – the Sidereal period of Mars in Earth years

A2.3. ***Precession cycle*** [17] T_P ***= 175 000*** (yr)

A2.4. ***Obliquity cycle*** [18] T_{Ob} ***= 124 000*** (yr)

During this period the obliquity varies from 15° to 35° (in millions of years the swing may be 0° to 60°)

A2.5. ***Perihelion cycle*** [18] T_{Ph} ***= 43 000*** (yr)

Table A1. The basic Martian cycles in units of Martian and Solar years

No.	Unit	In Martian years (*myr*) (1.8809 Julian years)	In Solar years (*syr*) (11.07 Julian years)
1	**No. of days in a year (sols)**	***668.6***	***0.16991***
2	**Precession cycle**	***93 000***	***15 800***
3	**Obliquity cycle**	***66 000***	***11 200***
4	**Perihelion cycle**	***22 900***	***3 900***

A3. Mars radii and intrinsic units of measure

The basic linear measures of Mars are as follows [6]

Equatorial radius $R_E = \mathbf{3402.5}$ km;
Polar radius $R_P = \mathbf{3377.4}$ km.

Comment A2. Find the intrinsic units of linear measure for Mars by analogy with the geographical mile.

A3.1. The lengths of 1° and 1' of Equator

$$\Lambda_E = \frac{2\pi R_E}{360^\circ} = \mathbf{59.38483} \text{ (km /degree);}$$

$$\lambda_E = \frac{\Lambda_E}{60} \times 10^3 = \mathbf{989.7471} \text{ (m/arc min).}$$

A3.2. Find the length of 1° of the latitudinal circle for the latitude of the D&M.

Consider a cross-section of Mars as ellipse with **semi-axes** $a = R_E$ and b = R_P (Fig. A1).

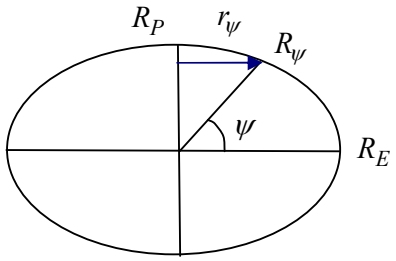


Fig. A1. Radius r_ψ of the latitudinal circle for the D&M pyramid

The radius-vector R_ψ for D&M makes $R_\psi^2 = (R_E \cos\psi)^2 + (R_P \sin\psi)^2 = 3391.871^2$, where $\psi = 40.65^\circ$ is its latitude (See A4). Then, the radius r_ψ of its latitudinal circle is equal to $r_\psi = R_\psi \cos(\psi) = 3391.871 \times \cos 40.65 = 2573.423$ (km) and **the lengths of 1°** and **1'** of **D&M latitudinal circle** make

$$\Lambda_D = \frac{2\pi r_\psi}{360^\circ} = \mathbf{44.9147} \text{ (km /degree);}$$

$$\lambda_D = \frac{\Lambda_D}{60} \times 10^3 = \mathbf{748.578} \text{ (m/arc min).}$$

A3.3. Find the average length of 1° of meridian.

The following approximation gives the length of ellipse with half-axes *a* and *b*

$$L \approx \pi(a+b)\frac{64 - 3\lambda^4}{64 - 16\lambda^2},\ \lambda = \frac{a-b}{a+b}.$$

Hence, for Mars we obtain $\lambda = 0.003702$, $L \approx \pi(3402.5 + 3377.4)\frac{64 - 3\lambda^4}{64 - 16\lambda^2} = \mathbf{21\ 299.\ 757}$ (km), and the **average length of 1° and 1' of Meridian** make

$$\Lambda_M = \frac{L}{360^\circ} = \mathbf{59.16599} \text{ (km/degree);}$$

$$\lambda_M = \frac{\Lambda_M}{60} \times 10^3 = \mathbf{986} \text{ (m/arc min).}$$

A4. D&M Pyramid Geographical Coordinates

Viking orbiter frames show that the D&M Pyramid is located at 40.65N 9.55W. All three frames were taken close to periapsis and yield a pixel resolution of ~50 m [3]. The later images from MGS MOC and from the Mars Odyssey camera give the same (in round figures) location: "near *40.7*° N, *9.6*° W" [19]. So, we can accept the following geographical coordinates for the D&M pyramid

$$\psi_D = \mathbf{40.65°}\ \text{N (or } 40°\ 39'\ \text{N)},\ l_D = \mathbf{9.55°}\ \text{W (or } 9°\ 33'\ \text{W)}. \quad [3]$$

A5. D&M Pyramid Geometry

A5.1. A synopsis of Erol Torun's reconstruction [3] of the D&M pyramid geometry

In exploring the geometry of the D&M Pyramid, the most conservative approach possible was pursued.

Study of the D&M Pyramid's geometry was therefore restricted to overall observations of location and symmetry, and to some relationships.

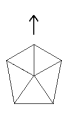
The D&M Pyramid shows signs of being damaged on one side, perhaps by a meteoric impact. Some edge and angle reconstruction was therefore necessary before any accurate measurements could be obtained. This is a speculative reconstruction, due to the eroded state of the object. The reconstructive technique is however the same as that used widely in archaeology when evaluating sites in which geometry is important, as in archaeoastronomy.

An NGF filtered orthographic negative of Viking orbiter frame 70A13 was obtained from the National Space Sciences Data Center. An orthographic projection was necessary to ensure that the geometry of the object under study was accurately represented on the image.

The negative image of the D&M was projected using a photographic enlarger that had first been calibrated with a projection grid. This image was used for the reconstruction, combined with reference to an unrectified image processed by Dr. Mark Carlotto for confirmation of detail that was sometimes less clear in the contrasty original negative.

1. The most distinct edges on the pyramid, those on the sunlit side, were marked by visual averaging. These edges were extended to locate the position of the hypothetical original apex.
2. A straight line was drawn from the apex through the flat protuberance at the front of the pyramid to mark what appears to be an axis of symmetry.
3. A line was extended from the apex to the right front corner, which is sharp and clearly visible on the Carlotto image.
4. The figure was enclosed, based upon the left side of the pyramid and the right front corner.

All visible angles of the D&M Pyramid were measured (***+/- 0.2 deg***) and subjected to the tests mentioned earlier: radian measure, angle ratios, and trig functions.



The reconstructed geometry of the D&M Pyramid shows a five-sided object which has ***bilateral symmetry***, with a ***pair of congruent angles forming the front***, and ***another pair of congruent angles forming the sides***. In this illustration the arrow points along the axis of bilateral symmetry.

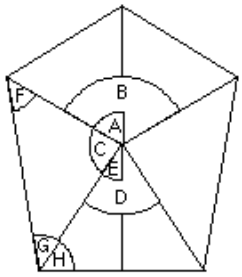
The five-sidedness, bilateral symmetry, and primary alignments were first observed by Richard Hoagland after studying quality digital enlargements prepared in 1984 by SRI International from negatives of images processed by DiPietro and Molenaar.

The angles formed by the D&M Pyramid when viewed from above differ from each other. Consequently, they can form various ratios. These angle ratios were studied to see if the values were significant, or merely random.

A table has been prepared displaying a list of the measured angles, and the results of the analysis. The square roots of three and five, and the values of e and pi predominate. The identity of these values is strengthened by the numerous combinations in which they occur.

Table A2. The Torun's Angular Model of the D&M Pyramid (Basic Model)

Angles (Degrees; Radians)	Ratios	Trig. Functions
A = 60.0; π/3	C/A = √2	Tan A = √3
B =120.0; 2π/3	B/D = √3	Sin A = √3/2
C = 85.3	A/D = e/π	Cos E = √5/e
D = 69.4; e/√5	C/D = e/√5	Sin G = √5/π
E = 34.7	A/F = e/√5	
F = 49.6; e/π	H/G = e/√5	
G = 45.1	B/C = π/√5	
H = 55.3	D/F = π/√5	



Note that the radian measure and trigonometric functions of some angles yield the same values produced by the angle ratios. The geometry thus has a common contextual thread.

As mentioned earlier in the section on criteria, all of this geometry is "dimensionless", i.e. it is not dependent on such cultural conventions as counting by tens, or measuring angles in the 360 system. This geometry will "work" in any number system.

A5.2. A synopsis of the D&M pyramid linear dimensions

A5.2.1. D&M Pyramid dimensions (as indicated by the remnant outline of its base): ***Length of five radii*** at angles of pyramid in clockwise direction starting with radius to buttressed angle: ***1.17 miles, 1.15 miles, 1.28 miles, 1.28 miles, and 1.15 miles. Maximum length*** along axis containing buttressed is ***2.23 miles***. [20]

A5.2.2. The 'D&M Pyramid' is aligned virtually north south towards the spin axis of the planet. Its ***shortest side*** is a ***mile***, its ***long axis*** extends to ***almost two miles*** and it is ***half a mile high*** [12].

A5.3. Recent correction of the D&M pyramid geometry (southerly pointing pentagon, SPP Model)

A5.3.1. A synopsis of Mark Carlotto's correction [7]

The Thermal Emission Imaging System [http://themis.la.asu.edu/] (THEMIS) aboard the Mars Odyssey spacecraft acquired a 19 meter/pixel visible image over a 53.4 by 22.5 km portion of Cydonia containing the D&M pyramid. In the 1976 Viking images, the D&M was illuminated from the northwest with the sun low in sky so that the east side of the object was shadowed. The higher solar elevation angle in the 2002 THEMIS image reveals the first fully illuminated image of this object.

Although signs of erosion are present, a ***high degree of bilateral symmetry*** in the D&M still exists. We note the difference between the left and right "arms" of the formation. The end of the left arm appears to have collapsed.

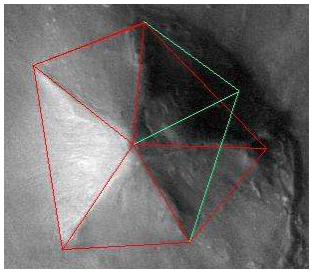
A simple and elegant geometry may be responsible for the symmetry of the D&M Pyramid. Torun identified a number of relationships in its internal geometry. As shown, the presence of ***angles approximately*** at ***30***, ***60***, and ***90 degrees*** suggests that the faces of the D&M can be described by isosceles and right triangular facets. However, more ***precise angular measurements may*** also ***confirm Torun's original model***.

The new THEMIS image also confirms that the ***south facet*** of the D&M Pyramid ***faces almost exactly due south*** as previously thought.

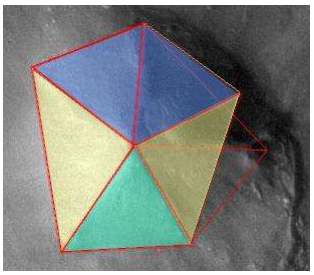
A5.3.2. D&M New Geometry in the 2002 Mars Odyssey Image (analysis of the new geometry that was discovered in the D&M Pyramid by the *Mars Odyssey* spacecraft in early 2002.) [21]

The *Mars Odyssey* imagery revealed that the D&M floor plan was primarily based on a southerly pointing pentagon rather than the northerly pointing pentagonal pattern seen in *Viking* imagery. Although this southerly pointing pentagon is not regular, it is extremely bi-symmetrical, with the two sides of the D&M closely mirroring the other. A second surprise in the *Mars Odyssey* images is the remains of a triangular platform jutting out from the D&M and following the same pattern of mirror symmetry.

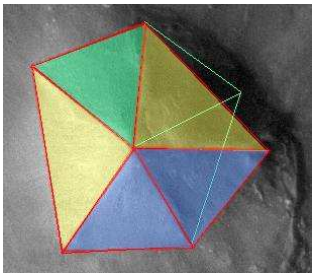
This better understanding of the actual shape of the D&M "Pyramid" would at first glance appear to undermine Torun's geometrical study based on the Viking image. However, when the geometry of the new shape of the D&M is traced ***out it appears to be relatively identical to the old geometry*** - only the orientation is towards the South and not the North. In the diagram below (D&M Pyramid) the red lines show the floor plan of the D&M as revealed in the Mars Odyssey image. The green lines show the floor plan based on Torun's observations using the Isolated Buttress. The other two diagrams colour in the D&M "Pyramid" facets to highlight the degree of bi-symmetry in the D&M in the Viking and Mars Odyssey versions of the D&M geometry. It can be seen that a similar type of geometrical pattern appears to have been encoded into the D&M "Pyramid" twice over. (Emphasize added).



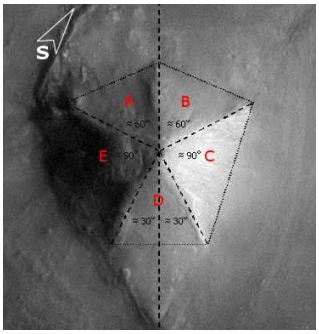
D&M Pyramid



D&M Viking floor plan



D&M Mars Odyssey floor plan



In Dr. Carlotto's suggested floor plan for the D&M (left) the divergence angles from the centre for the five facets is ***two angles of 90 degrees*** and three of **possibly *60 degrees***. Measurements of the Carlotto diagram reveal that the divergence angle for facet "D" is smaller than 60 degrees and those for facets "A" and "B" are greater. In this figure the D&M is oriented pointy side up, with south towards the top of the image.

Comment A3. "If the D&M actually is artificial then it is now heavily damaged by the passage of time. This requires that a "best fit" of its outline and facets has to be estimated from what we can see today" [21]. But what do we see? The Torun's model provides us with quite exact measurements and is still considered to be consistent except of new position of the Eastern edge (with it, another axis of symmetry arises). However, some values which are assigned to central angles of the SPP Model (60° and 90°) diverge significantly (up to 5°, or about 5%) from the actual ones.

Hence, as far as we do not know whether the D&M was built or a mountain was shaped and strengthened, we may only suggest what was the geometrical idea of the original design. Therefore, with the aim to reconstruct the original design of the D&M, if it was, we must use the most exact estimates of the D&M parameters. However, we do not know to what extent the erosion has changed the pyramid faces and edges; from this point of view we should provide definite tolerances to these parameters.

Therefore, with the aim to find a reasonable solution to the problem of reconstruction of the D&M pyramid we propose to consider both the Basic Model, which provides us with quite exact measurements, and the SPP Model with the new symmetric position of the Eastern edge, with the subsequent comparing of the results for both models.

A6. Mathematical Constants

A6.1. The ratio of the circumference of a circle to its diameter $\pi = 3.1415926...$.

This is irrational which cannot be presented with all its decimal orders. It is known from the ancient times and coded in the Bible, Great Pyramid of Giza and other artefacts.

A6.2. The Golden ratio $\Phi = 1.61803399\ ...$,

or its inverse value $\varphi = 0.6180339\ 9...$, since $\varphi = 1/\Phi$ and $\varphi = \Phi - 1$.

This number is also known from the ancient times; it was used in architecture, and, together with π, makes the "geometrical certificate" of the exterior design of the Great Pyramid of Giza [4].
The infinite (to both ends) geometric series with the ratio equal to Φ makes the Auric Time Scale (ATS) which defines the basic periods in nature and society [15], including the timing of the Solar cycles [16], and the evolutional time [22].

A6.3. The number $e = 2.718281829....$

This irrational is commonly known as the base of natural logarithms. It also arises in various mathematical theories. Alongside with the numbers π and Φ it may be considered as a "geometrical certificate" of the exterior design of the Great Pyramid of Giza [4], although it is not clearly seen in other artefacts.

A7. The Ratios of Mathematical Constants

Cydonia (for more detail see www.enterprisemission.com/)

A7.1. DM-ratio: e/π [1]

Following Hoagland's proposal that a mathematical "relationship model" would be the key to validating the basic reality of Cydonia as an architectural construction, and that "e/pi" might be one significant relationship related to the Complex, Torun (1988) made key mathematical discoveries within a major geometric "Rosetta Stone" located at Cydonia – a unique, five-sided, symmetrical "pyramid": the so-called "D&M." He elegantly "decoded" a series of internal angles found within the pyramid, and discovered the two mathematical constants, "e" and "pi," encoded several times and in several different ways (via angle-ratios, etc.) – to three significant-figure accuracy [3]. But the most intriguing thing presents their ratio, which is considered alongside with its approximation $\sqrt{3}/2 =$ ***0.866025***… being accurate to about 0.1%.

Subsequently, using geodetic data from "The 1982 Control Network of Mars" (Davies and Katayama, 1983), up-dated by Davies for Cydonia (1988), Hoagland discovered that the geodetic Martian latitude

$$L_{DM} = Arc\ tan\ \frac{e}{\pi} = 40.8681938...$$

almost exactly passes through the critical object which Torun had "decoded" – the ***D&M Pyramid***. Indeed, as its ***latitude*** makes [A4] $\psi_D = 40.65°$ N, this correspondence is accurate within the error of 0.5%.

Amazingly, another trigonometrical function – Arc cosine of the same ratio – gives [12] the value

$$L_{GP} = Arc\ cos\ \frac{e}{\pi} = 30.08805...$$

which presents the ***latitude*** of the ***Great Pyramid of Giza*** (*29.98083*°) within the error of 0.3%, the linear equivalent of which makes only 6.4 geographical miles, or about 11 km!

These are negligible deviations if we would take into account how many other relations for each of these pyramids take place simultaneously!

Comment A4. For short, call it the ***DM-ratio*** and denote $g = e/\pi$; So, ***g = 0.8652559794… .***

A7.2. Tetrahedral constant *t = 19.5* [1].

In working out the several possible implications of the tetrahedral geometry, Torun promptly discovered the following: if a ***circumscribed tetrahedron*** is placed inside a globe representing a gridded planetary surface, with one vertex located either on the geographical "North" or "South" polar axis, the resulting latitude TANGENT to the other three vertices will lie at approximately ***19.5 degrees*** N. or S. – 120 degrees of longitude apart.

Later on, this value ***19.5*** was called ***t***, the '***tetrahedral constant'.***

This ***rounded-off value*** of the irrational angle $\alpha = 19.4712...$degrees {SS: it satisfies the equation $\sin\alpha = 1/3$) plays an important part not only in reconstruction of design of the D&M pyramid. It indicates the points of extremely high energy emission throughout the Solar system what is convincingly shown in [2]: many planetary energy phenomena are seen to emerge directly at this critical 19.5-degree latitude on the Sun and a variety of planets.

The Great Pyramid of Giza

(for more detail See [4])

A7.3. The number N_{GP} =*19.5* in the exterior design of the Great Pyramid of Giza

1. Within an accuracy of $\delta = 0.4\,\%$ the number N_{GP}=*19.5* presents a 10-fractal of the ratio γ of two basic mathematical constants – π and Φ – which, as it is known from the ancient times [4], in a verbal form (by correlating the linear dimensions of the GP) define the form of the Great Pyramid of Giza. Namely,

$$N_{GP}/10 = 1.95 \cong \gamma = \frac{\pi}{\Phi} = 1.941611...\ (\delta = 0.4\,\%).$$

2. As a multiple to the ***Solar Cycle Constant*** [A1] T_0, GP's course number and some other intrinsic parameters of the GP this *searched number* N_{GP} defines the duration of a zodiacal age and Platonic year (Procession cycle of 25920 yr) within an error of *0.06 %* (for more detail See [4]).

3. This number also presents the quarter of number ***78*** *(19.5×4=78),* which belongs to a finite subset of Fibonacci-type series $6\times u_k$ ($78 = 6\times 13$) that describes the structure of the Great Pyramid courses.

In other words, this "unusual" non-integer not only presents the ratio of the two principal mathematical constants which uniquely define the form of the GP, but in the terms of duration of Solar cycles and GP's course number (the expansion of which presents a Fibonacci series conforming to the Auric Time Scale (ATS) [15]), gives the exact values of the basic historical ages – the zodiacal periods and the Platonic year.

4. It is also interesting, that the ***radian measure*** *0.340339…* of N_{GP} or ***tetrahedral constant 19.5°*** gives the ***Fibonacci series***. Thus, if we assign this value to the unit of the Auric Time Scale (ATS [14]) presenting the infinite (to both ends) geometric series of the Golden section powers

$$\ldots\ \varphi^k,\ \varphi^{k-1},\ \ldots,\ \varphi^1,\ \varphi^0 = 1 = \Phi^1,\ \Phi^2,\ \ldots,\ \Phi^k,\ \ldots\ ;\ (\Phi = 1/\varphi,\ \Phi = 1+\varphi = 1.618034\ldots),$$

we obtain a series $0.340339\times\Phi^k,\ (k = -8, -7, \ldots, 0, 1, \ldots),$ with the elements

0.01, 0.01, 0.02, 0.03, 0.05, 0.08, 0.13, 0.21, ***0.34****, 0.55, 0.89, 1.44, 2.33, 3.77, 6.11, 9.88, ...*

the 100-fractals of which (rounded to integers) presents the Fibonacci series

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, ...

where the first deviation (of 0.2 %) appears just at term 610.

A7.4. The number N_{GP}=*19.5* as the duration of the crucial periods of the Platonic year [10]

Four times a Platonic year, viz. every 6500 years, a Great Celestial Conjunction (GCC) takes place when the Cross formed by the Solstice and Equinox axes of the Earth coincide with that of the Solar System being formed by the Galactic Equator and Ecliptic. Each of these four alignments can be likened to exact tuning of an aerial, when the Earth resides in the most sensitive position relative to the Centre of the Galaxy for several decades.

Meanwhile, when the Sun, in its yearly motion, concurrently covers the points of intersection of Ecliptic with the Solstice Meridian and Galactic plane (this event takes place twice a year – on Winter and Summer Solstices), the Galactic influence being transferred to the Earth is highly increased.

Due to the precession of Equinoxes, the Sun stars to concurrently cover these two points ***19.5*** yr before the moment of exact conjunction and continues to do so for the subsequent 19.5 years, whereas the visible disc of the transiting Sun concurrently covers them for at most T_{SG}=***13*** hr, at the moment of exact GCC. At present, this interval of the GCC covers the epoch of ***2012, the end*** of the ***Maya Long Count***.

In particular, this means that:

– ***19.5*** years *(δ =0.04%)* before the exact moment of the GCC the Sun starts to transmit to the Earth those *direct* Galactic influence which was impossible to do during the preceding 6500 yr, and would not be possible till the next GCC;

– ***39*** years make the ***interval*** of the direct manifestation of each GCC; though the "exact" GCC has occurred in 1998, its actual influence is to be distributed over the preceding and subsequent 19.5-year time intervals; this gives the estimate of the ***Era of GCC.***

– ***78*** years make the ***duration*** of the direct manifestation of GCC at Winter and Summer Solstices.

4-multiples of these values give the interval and duration of these events for the Platonic year.

These two principal values – 19.5 and 78 (together with the Fibonacci series and Solar cycle constant) – specify important astronomical constants and structure of courses of the ***Great Pyramid of Giza*** [4]. In particular, if the "altitudinal" structure of the GP shows the development of the Platonic year in cycles of Zodiacal Ages and Solar cycles, the values of these cycles and their accelerating nature (due to the presence of Fibonacci series, ATS and Solar cycle constant), its four "horizontal" faces tell that this year consists of four cycles of equal duration which are separated (as by GP's edges) by the crucial transformations at the epochs of the GCC.

Note also, the number ***13*** (T_{SG}=***13*** hr) fits the Fibonacci series and makes 1/3 of the period of 39 (yr); this number, together with ***20***, makes the base of the ***Mayan Tzolkin.***

Moreover, if we consider the situation (e.g. as in [23]) where the Solar disc is simply *touched* by the Galactic equator, we obtain [10] the value T_{GA} = ***22.5*** yr instead of ***19.5*** yr.

And ***namely these two numbers*** (but in degrees) are obtained in [11] in connection with the ***DM-ratio*** $d = e/\pi$: "With almost ceaseless repetition, pairs of adjoining measurements in ***Cydonia*** would have this same exact ratio [e/pi] between them. The most common of all was the ***angle relationship*** of ***22.5*** degrees to ***19.5*** degrees." (Emphasize added).

Note also that the value ***19.5*** is treated in the analogous way whether it presents angle, or time: Both the latitudes ± ***19.5°,*** and the time bounds around the GCC ± ***19.5*** years.

A7.5. Actually, "**Time** and **Space** are forms of the **One** incognizable Deity"[9]. (Emphasize added).