Paper 4. The Exterior

M. J. Cooper

Version 2.0 (October 21, 2019)

Publisher: mikecooper@pyramidpapers.org

4. The Exterior

The average base lengths of five surveys, from Petrie to the Glen Dash Foundation Survey (GDFS), are shown in the table below.

Average of Surveyed Base Lengths of the Great Pyramid from Petrie to GDFS

Side (B″)	Petrie 1881	Cole 1925	Dorner 1979	Lehner/ Goodman 1984	GDFS 2015	Average
North	9069.4	9065.1	9068.0	9070.4	9068.1	9068.2
East	9067.7	9070.5	9069.6	9066.2	9068.3	9068.5
South	9069.5	9073.0	9069.8	9067.3	9070.2	9070.0
West	9068.6	9069.2	9069.8	9068.4	9071.1	9069.4
Average	9068.8	9069.4	9069.3	9068.1	9069.4	9069.0
Mean Difference	0.6	2.3	0.6	1.3	1.3	0.7

The surveyed weighted average is 9069.017 ± 0.4 B″. For general use, herein, the surveyed average unweighted base length is taken to be 9069 ± 0.7 B″.

The Orientation of the Sides of the Pyramid

Side	Petrie 1881	Cole 1925	Dorner 1979	Lehner/ Goodman 1984	GDFS 2015	Average
North	-3′ 20″	-2′ 28″	-2′ 28″	-2′ 52″	-2′ 30″	-2′ 44″
East	-3′ 57″	-5′ 30″	-3′ 26″	-3′ 24″	-5′ 10″	-4′ 17″
South	-3′ 41″	-1′ 57″	-2′ 31″	-3′ 41″	-2′ 31″	-2′ 52″
West	-3′ 54″	-2′ 30″	-2′ 47″	-4′ 37″	-4′ 21″	-3′ 38″
Average	-3′ 43″	-3′ 06″	-2′ 48″	-3′ 38″	-3′ 38″	-3′ 23″

The Pyramid is aligned -3′ 23″ to the cardinal points, and it appears that the intention was that it should align precisely. The same can be said of the corner angles, as shown in the Tables below.

The Surveyed Angles of the Corners of the Base of the Pyramid

Corner	Petrie 1881	Cole 1925	Dorner 1979	Lehner/ Goodman 1984	GDFS 2015	Average
NW	89° 59′ 26″	89° 59′ 58″	89° 59′ 41″	89° 58′ 15″	89° 58′ 09″	89° 59′ 06″
NE	90° 00′ 37″	90° 03′ 02″	90° 00′ 58″	90° 00′ 32″	90° 02′ 40″	90° 01′ 34″
SE	89° 59′ 44″	89° 56′ 27″	89° 59′ 05″	90° 00′ 17″	89° 57′ 21″	89° 58′ 35″
SW	90° 00′ 13″	90° 00′ 33″	90° 00′ 16″	90° 00′ 56″	90° 01′ 50″	90° 00′ 46″

The corner angles were computed from the orientation of the adjacent sides. For example, the NE corner angle = orientation of north side – orientation of the east side + 90°. A check was made for each survey that the four corners summed to 360°.

Some analysts consider that the variation in the base lengths and corner angles is intentional and therefore has meaning. The tables are structured, by the addition of the average column, to aid in determining if there are any patterns in those variations. The individual surveys, such as Petrie′s, show that the lengths of some sides are similar, e.g., North and South, but the five survey average in the final column shows the north and east to be similar and also the south and west, so there is no pattern across all five surveys. Since there appears to be no discernible pattern for the lengths of the sides, then this is true for the angles of the corners.

It is concluded that the finished base of the Pyramid was intended to be a perfect square, aligned with the cardinal points, with corner angles of precisely 90°. The average side length, by five surveys, is 9069 ± 0.7 B″

As shown in the Pyramidology section, Davidson′s 12 sided Pyramid is not a viable description of the Pyramid as surveyed.

Pyramid Height and Base Angle

As regards to the height of the Pyramid, this can be calculated from the base angle of the faces. Both Smyth and Petrie measured these angles. Smyth measured the base angle between each face and the base. He also measured the arris angle, which is the angle between the face and the base of the diagonal cross-section. The individual and average values are shown in the Table below and are from pages 164 to 172 of Vol. 2 of his ″Life and Work at the Great Pyramid….″:

Smyth′s Measured External Angles of Pyramid

Side	Face Angle	Corner	Diagonal or Arris Angle
North	51° 39′	NE	42° 1′
East	51° 46′	SE	42° 1′
South	51° 42′	SW	41° 59′
West	51° 54′	NW	41° 58′
Average	51° 45′		41° 59′ 45″

Smyth′s theoretical angles are 51° 51′ 14″ and 41° 59′ 50″. The differences are 0.2% and 0.003% respectively.

Petrie′s measure of the face to base angle in P24 varies from 51° 44′ 11″ to 51° 57′ 30″. He provides a mean angle of 51° 52′ ± 2′.

Petrie (P25) calculates the height as 5776.0 ± 7.0 B″ with a base length of 9068.8 ± 0.5 B″.

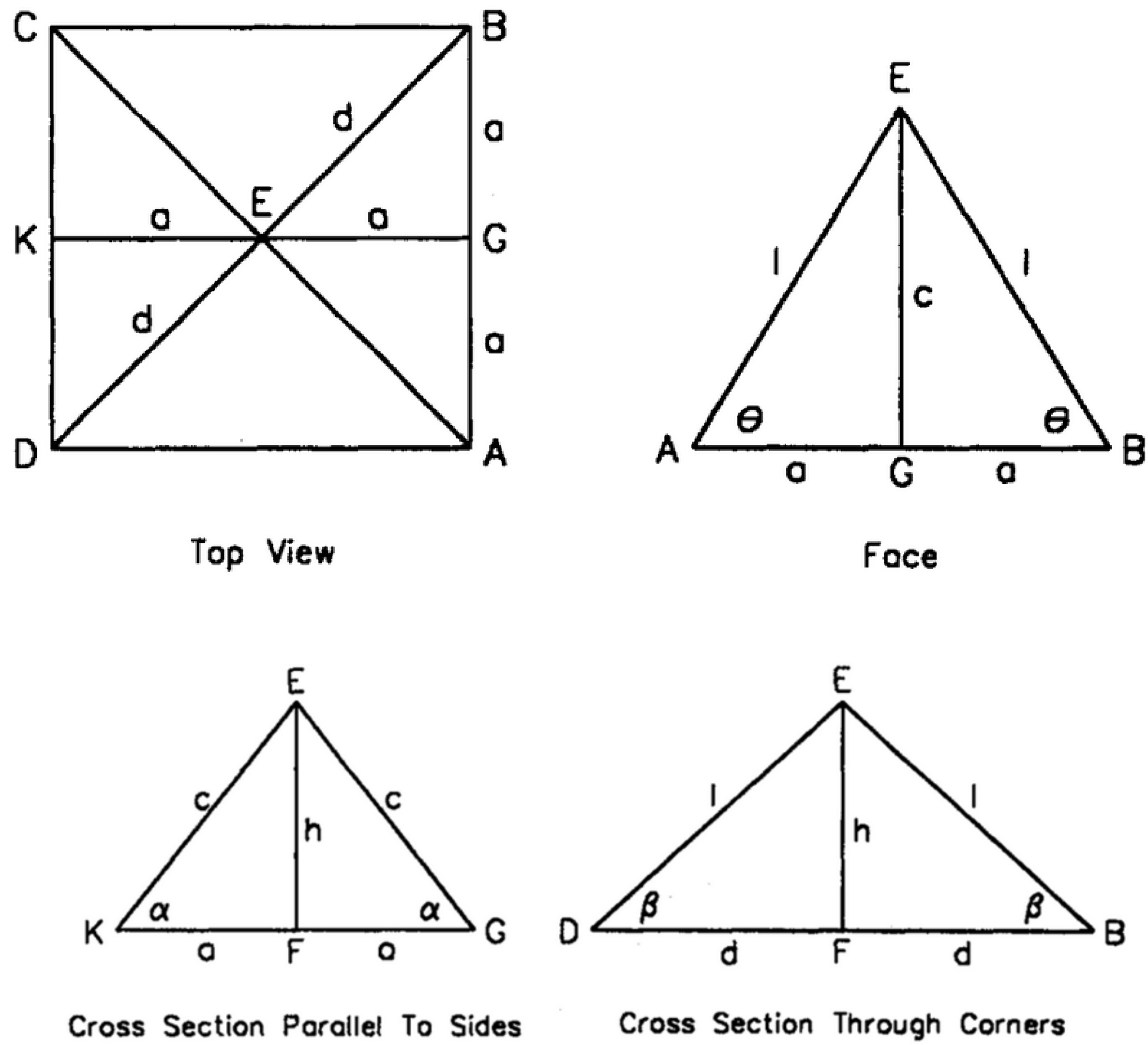
At this point in the study, the intended base angle needs to be known, but the problem is that there are many theories. In his book ″The Shape of the Great Pyramid″ Roger Herz-Fischler identifies 12 theoretical angles that apply to the shape of the Pyramid. These are shown in the Table below, and the diagrams following the Table aid in its understanding.

The Table is aimed at assisting in the selection of the intended base angle of the Pyramid. It is adapted from Herz-Fischler′s; Petrie′s minimum, mean, and maximum base angle values have been inserted, which identify the base angles that are more likely to express the intent of the designer rather than Herz′ Observed row. Theoretically, the closer they are to Petrie′s mean the more likely they are to reflect the intended angle. The Table has been sorted from lowest to highest angle α so that the relationship between the theories and the limits of Petrie′s observed angles can be easily seen. The ***e*** constant theory is a new theory for the dimensions of the Pyramid, which was found on the internet.

The first column provides an ID for each entry in the Table, which is mainly used for sorting purposes. The second column names the theory, and the third provides the mathematical relationship. The fourth column identifies the year in which the theory was published. The fifth column provides the angle between the face and base in decimal degrees, and the sixth column provides the value in degrees ° minutes ′ and seconds ″.

Pyramid Base Angle Theories

ID	Theory	Defining Relationship	Year	Angle α °	Angle α ° ′ ″
12	Side:Height = ϕ	Tan(α) = 2/φ	1899	51.027	51° 01′ 36″
7	Side:Apotherm = 5:4	Sec(α) = 8/5	1809	51.318	51° 19′ 04″
8	Side:Height = 8:5	Tan(α) = 5/4	1809	51.340	51° 20′ 25″
10	Heptagon	α = 360/7	1849	51.429	51° 25′ 43″
15	Height:Arris = 2:3	Tan(β) = 2/3	1883	51.671	51° 40′ 16″
11	Kepler′s Triangle	Sec(α) = φ	1855	51.827	51° 49′ 38″
13	Equal Area	Sec(α) = φ	1859	51.827	51° 49′ 38″
18	Petrie Min. (p43)		1883	51.833	51° 50′ 00″
5	Seked	Tan(α) = 28/22	1922	51.843	51° 50′ 34″
2	Observed	-	1883	51.844	51° 50′ 38″
14	Slope of the Arris = 9/10	Tan(β) = 9/10	1867	51.844	51° 50′ 39″
17	e constant	α = e (90e/(2+e))	?	51.851	51° 51′ 02″
9	Pi-theory	Tan(α) = 4/π	1838	51.854	51° 51′ 14″
19	Petrie Mean (p43)		1883	51.867	51° 52′ 00″
20	Petrie Max. (p43)		1883	51.900	51° 54′ 00″
6	Arris = Side	Θ = 60	1781	54.736	54° 44′ 08″



2a = side, 2d = diagonal, h = height, c = apothem, l = arris

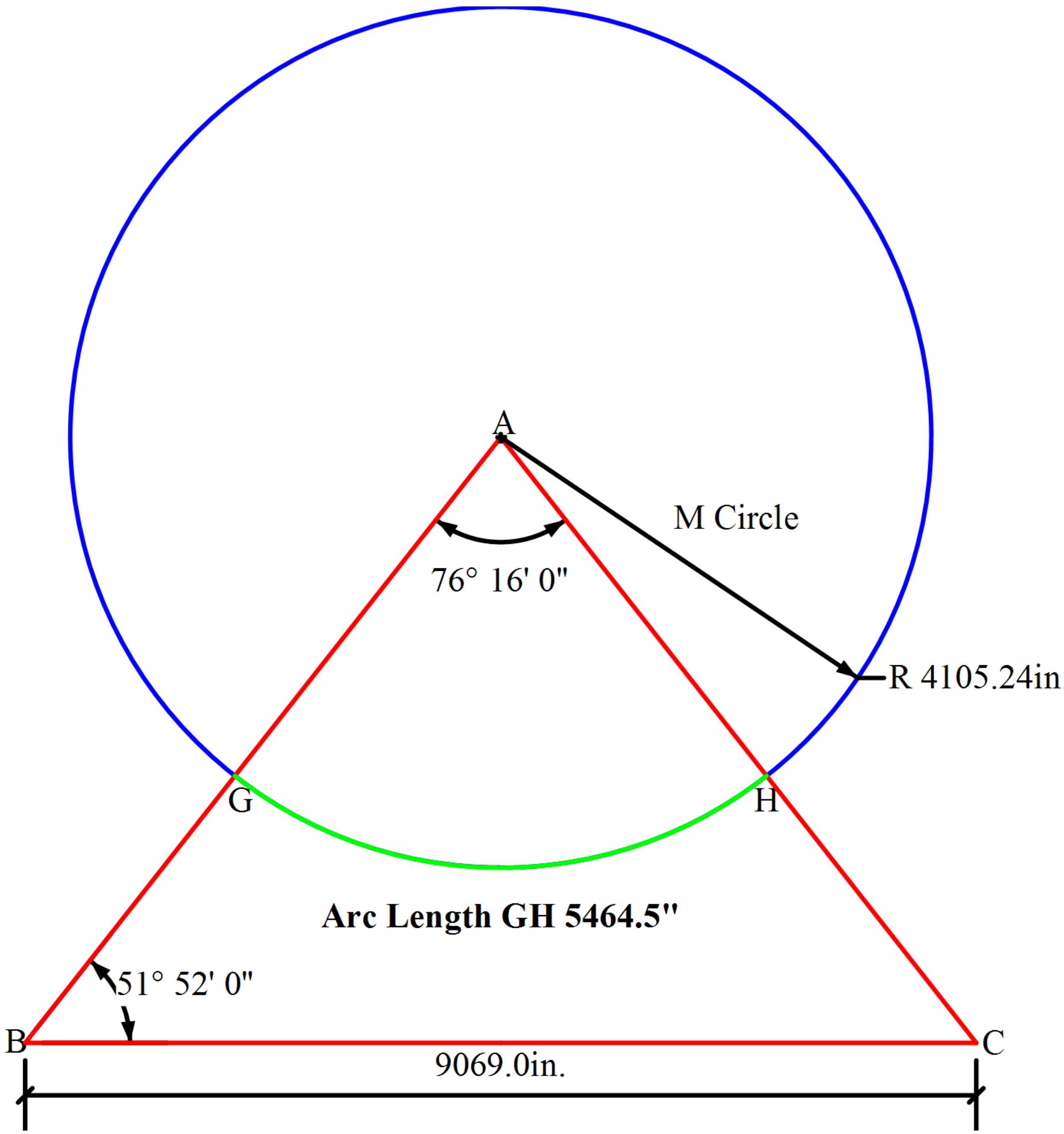
Except, probably, for number 6, ″Arris = Side, θ = 60″, which is an outlier, any of these theories could reflect the intent of the designer. As stated, the more plausible theories are those that lie between Petrie′s minimum and maximum angles. All other theories have a lower probability of being the intent of the designer and the position of the row, relative to Petrie′s mean, and its color code is designed to reflect this. However, this does not exclude the other rows.

Unfortunately, this approach only acts as a guide rather than a witness.

An approach that provides many witnesses for the intended lengths of many features of the exterior and interior is based on Master (M) Circles that are associated with the Pyramid.

M Circles and the Great Pyramid

The M Circle is a clue that defines many of the dimensions and features of the Pyramid. This clue was discovered when studying Davidson′s theory concerning his dating of the Great Step in the Grand Gallery. It is described as follows:



The M Circle Clue with Regard to the Base Angle

One astronomical feature Davidson uses for his dating is the Precession of the Equinox. The earth rotates around its polar axis, which is tilted approximately 23.5° to the plane of the Earth′s orbit around the sun. It is this tilt that causes the seasons. The tilt is not stable but slowly rotates in a small circle with a period of about 25,800 years. If this period were sped up, the Earth would look like a wobbling top. See the Wikipedia Axial Precession article.

In paragraph 236 of Davidson′s ″Great Pyramid Its Divine Message″, he calculates that the Pyramid indicates a Precessional rate of 25794 years as of the year AD 1844. A representation of the Pyramid, as surveyed, is drawn above with a circle of circumference 25794 (Radius 4105.24 B″) at its apex. Under consideration was whether the length of the green arc, GH, defined any part of Pyramid chronology. The length of the arc is defined by the circumference of the circle, 2πR, and the fractional part of the circle represented by the apex angle, which is 76° 16′ ÷ 360°. The result is 5464.5 units, which seemed a familiar number. It turns out that it is close to the total length of the Entrance Passage, Descending Passage and Subterranean Passages as seen in the Table below:

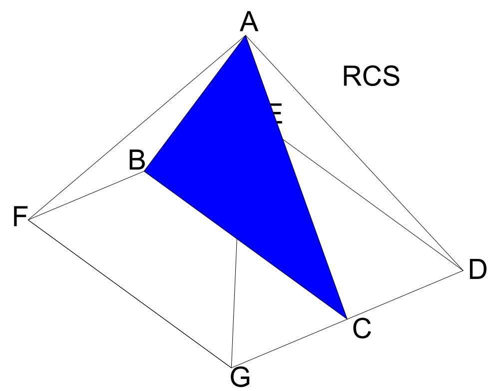
Location	Length B″	Notes
Entrance Passage	1110.6	Petrie
Descending Passage	3037.5	Edgars (More accurate than Petrie)
First Subterranean Passage	346	Petrie
Subterranean Chamber	326	Petrie
Second Subterranean Passage	646	Petrie
Which is a total of	5466.1	Which is close to 5464.5 B″

The arc length of the base angle, shown in the Figure above as Petrie′s mean angle 51° 52′, was calculated as 3716.2 B″ to see if this concept held for other angles. Alas, at this stage, any similarity to a Pyramid dimension was not immediately seen.

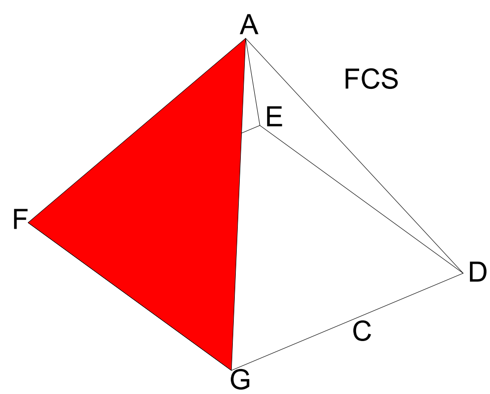
Next, this was tried with the theoretical passage angle, which Pyramidology believes is the angle represented by the inverse sine of the √π divided by 4 ($\sin^{-1}(\sqrt{\pi}/4)$). This is similar to the definition of the base angle, which is defined by arctangent of 4 divided by π or ($\tan^{-1}(4/\pi)$). The result is 1884.6 B″, which is just 1 B″ longer than the measured length of the Grand Gallery, 1883.6 B″ from Petrie.

Now that there were 2 out of 3 potential matches, this was becoming quite exciting, and the concept was tried with the angles created by other cross-sections. The cross-section shown in the Figures so far has been of the Right Cross Section (RCS), but three other cross-sections can be seen from the outside of the Pyramid, as shown below.

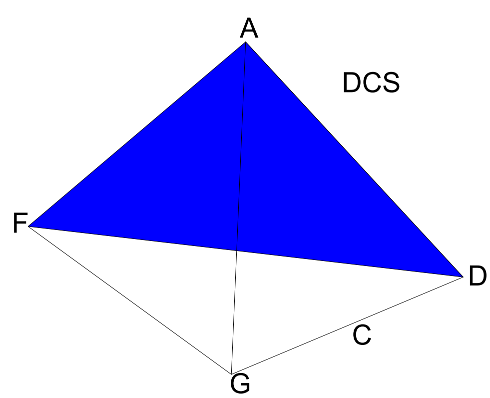
The RCS is defined as the vertical triangle formed by the apex of the Pyramid, A, and the center of opposite sides B and C, usually the south and north sides, i.e., ABC.



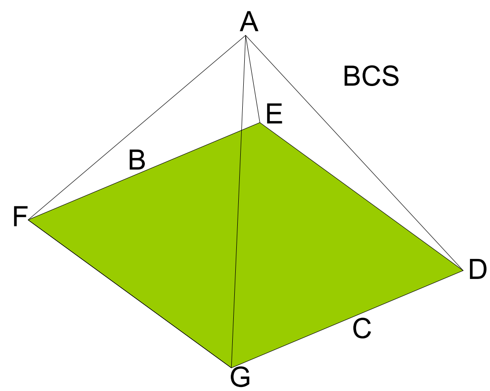
The Face Cross Section (FCS) is defined as the triangle which is bounded by a Base side and the two lines from the Base Corners of that side to the Apex of the Pyramid, e.g., AFG.



The Diagonal Cross Section (DCS) is defined as the vertical triangle formed by the apex of the Pyramid, A, and diagonally opposite corners of the Pyramid, i.e., AFD.



The Base Cross Section (BCS) is defined as the square formed by the horizontal base of the Pyramid, e.g., DEFG.



These four cross-sections account for seven angles, which, along with their possible significance to Pyramid dimensions, are tabulated below. The Passage Angle has been omitted because it was based on the theoretical angle, which has not been determined at this point in the analysis.

M Circle Table – With Preliminary Arc Lengths

Arc Length #	Exterior Angle	Degs °	Arc Length B″	Measured Value B″	Diff B″	Possible Relationship
1	RCS Base Angle	51.867	3716.2	-	-	Level of Subterranean Chamber Roof
2	RCS Apex Angle	76.267	5464.5	5466.1	1.6	The path length of Entrance, Descending, Subterranean Passages, and Subterranean Chamber
3	FCS Base Angle	58.305	4177.5	4175.3	-2.2	The path length of Ascending Passage, Grand Gallery and King's Chamber (See Figures below)
4	FCS Apex Angle	63.39	4541.9	4541.0	-0.9	Path Length of Entrance and Ascending Passages and Grand Gallery
5	DCS Base Angle	42.01	3010.0	-	-	Queen's Chamber Floor Level
6	DCS Apex Angle	95.98	6876.9	1719.1	-0.1	When divided by four this gives a path length from the North wall of the Grand Gallery to the midpoint in the Queen's Chamber (See Figures below)
7	BCS Base Corner Angle	90.00	6448.5	Discuss below	-	Confirms that the Pyramid Base Angle = $\tan^{-1}(4/\pi)$

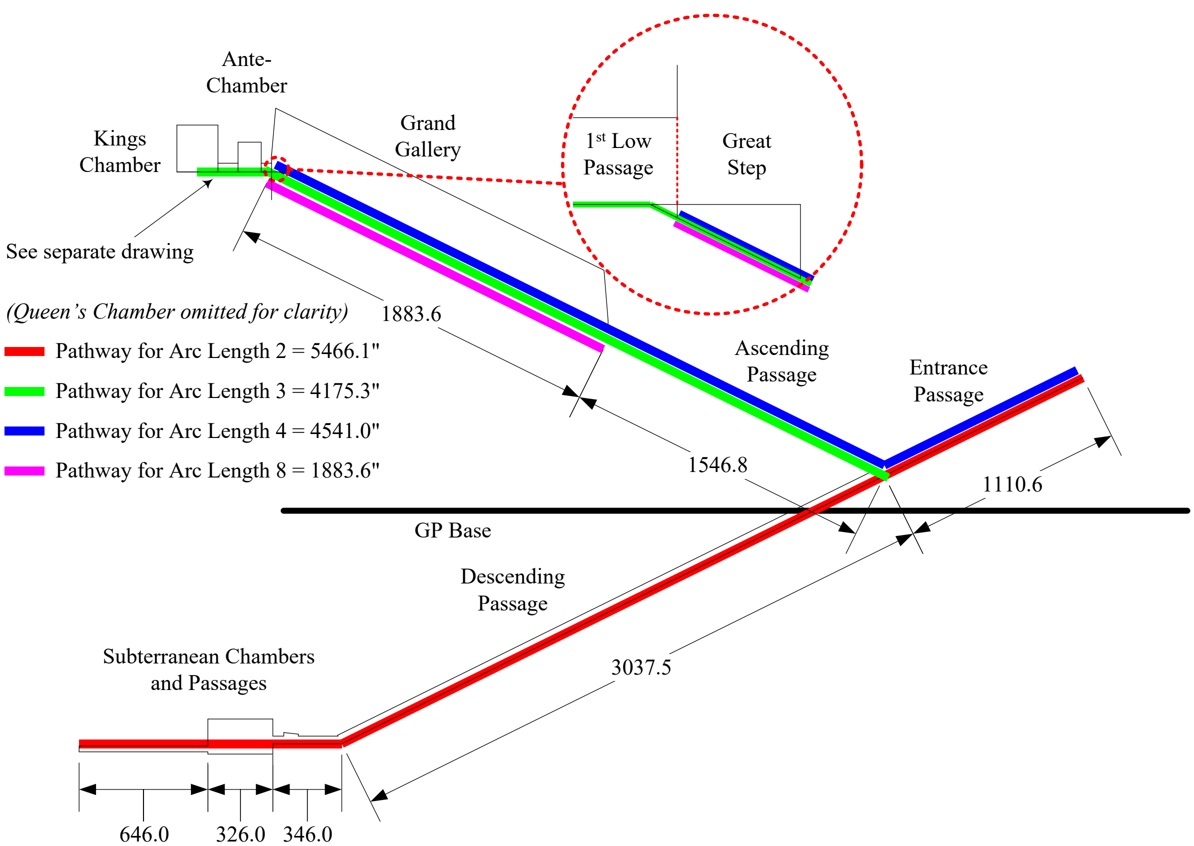
The rows of the Table are color-coded to indicate what appears to be an associative use of the arc lengths derived from the two angles of each cross-section. For example, arc length one and two are derived from the RCS and, as proven later, define the vertical level of the roof of the Subterranean Chamber and the length of passages leading to that chamber.

Arc lengths three and four are derived from the FCS and, as proven later, define the length of the Entrance Passage, Ascending Passage, Grand Gallery, and the King′s Chamber System.

Arc lengths five and six are associated with the DCS and, as proven later, define the floor level of the Queen′s Chamber and the length of the passages leading to it.

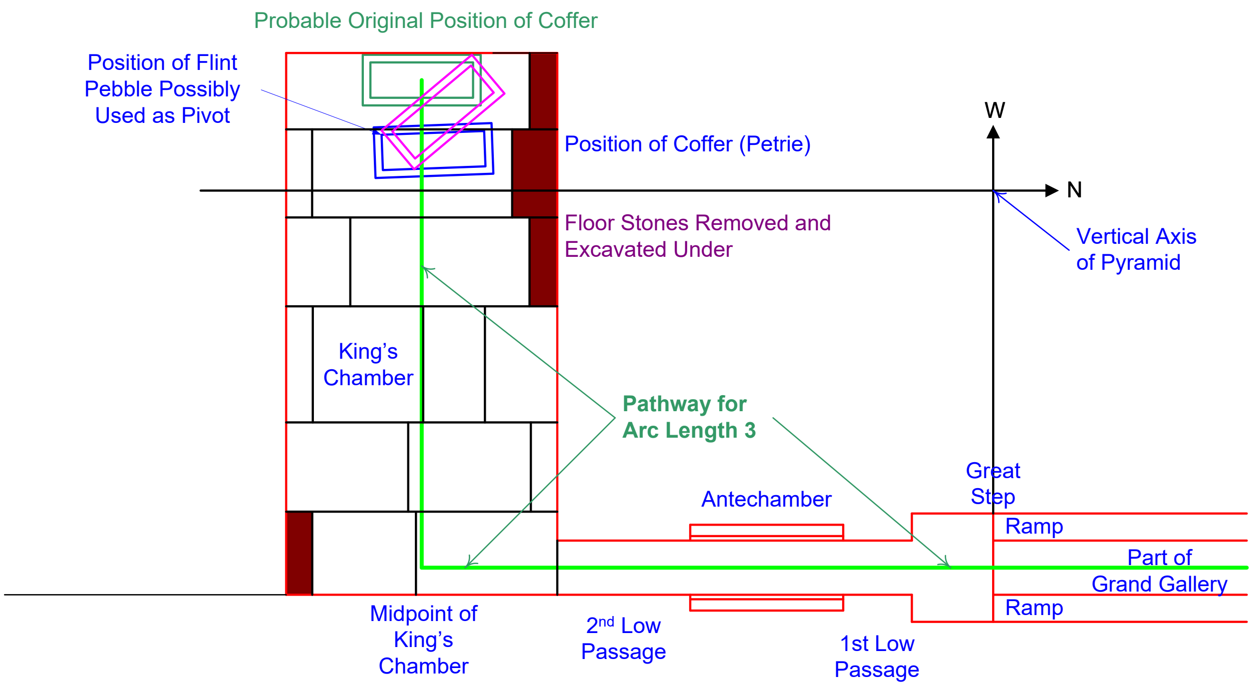
Arc length seven is not related to any other arc length, and it serves the single purpose of confirming that the Base Angle of the Pyramid is intended to be the π angle. The 90° angles of the Base are horizontal, whereas all other angles in the Table, and those which will be added to the Table, are vertical. In addition to the associative rules above, it is concluded that vertical angles define internal features while horizontal angles define external features.

Therefore, the arc lengths are functionally grouped in more than just a random manner, which in turn shows that the design was carried out by more than just an ordinary architect. Proof will be provided that the use of arc lengths is an intentional part of the design.

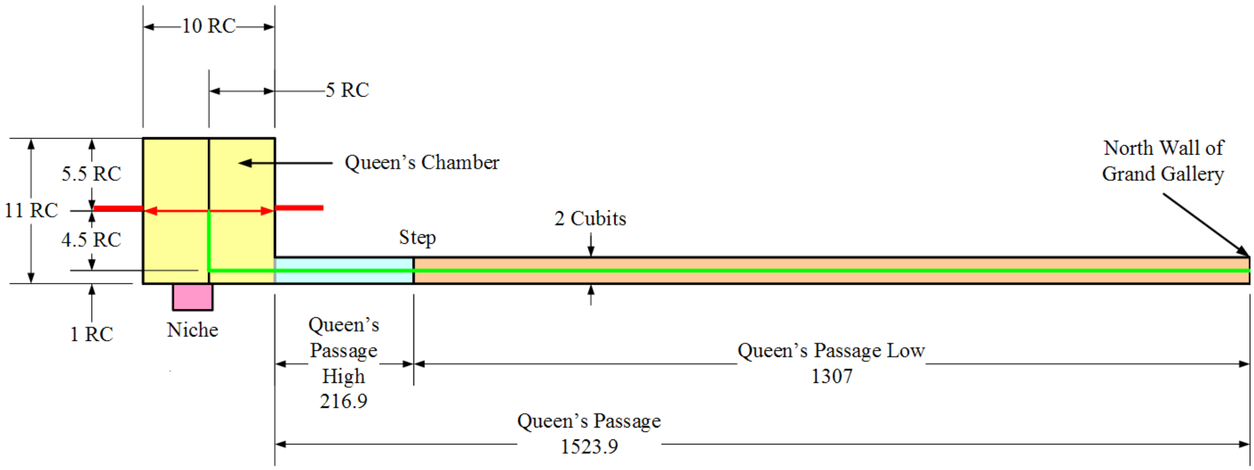


The Arc Lengths for Pathways two, three, four, and eight are Shown in the Figure

The Figure below shows the plan view of the green Pathway for arc length three in the King′s Chamber. In its current position, shown in blue, the Coffer in the King′s Chamber lies across the green pathway. There is evidence to suggest that the Coffer used to lie as shown in dark green about an inch east of the west wall because it would then be in a similar position to the coffer in the Second Pyramid of Gizeh and others. If this is so, then the path length described will end in the center of the Coffer. The magenta version of the coffer shows a probable intermediate position as it was being moved in two phases by tomb robbers. It is assumed that during the first phase, a lever was used on the left-hand side of the coffer to pull it out from the wall. Then a flint pebble was placed under the coffer as a pivot, and the right-hand side was pushed until the coffer reached the position where Petrie found it, as shown in blue. It still had the flint pebble under the SW corner. The theoretical, initial position shown was later confirmed when fitting the Pyramid chronology to the Bible.



If the arc length of the DCS Apex angle, 6878.5 B″ is divided by four, the result is 1719.6 B″. This is Pathway six and is the length of the Queen′s Chamber Passage from the North Wall of the Grand Gallery to the Chamber, (1523.9 B″ P40), plus five cubits or halfway into the Queen′s Chamber then turn right or West and go 4.5 cubits more to the center of the Queen′s Chamber. Just beyond the center lie the Eastern sides of the two Airshafts, which are shown in red. From Petrie′s measurements, this Pathway is 1719.1 B″.



So of the seven angles that were initially investigated, four of them lead mathematically to the lengths of five pathways within the Pyramid with a difference between them and the measured values of 0.1 B″ to 2.2 B″. The meaning of the other three angles turns out to express intended levels within the Pyramid such as the roof level of the Subterranean Chamber, arc length 1, the level of the floor of the Queens′ Chamber, arc length 5, and confirmation of the π base angle, arc length 7. The table was, therefore, an exciting result that warranted further investigation.

The M circle, therefore, provides the ability to define, at least some of the Pyramids′ passage lengths by using mathematical equations. If the length of the radius or circumference of the M Circle can be defined by a mathematical equation, then we have a means of accurately defining the theoretical lengths of the passages. So long as the resulting passage lengths are within the survey tolerances, then they may be taken to represent lengths intended by the designer though a second constraint is that it must be possible to construct an accurate chronology with them.

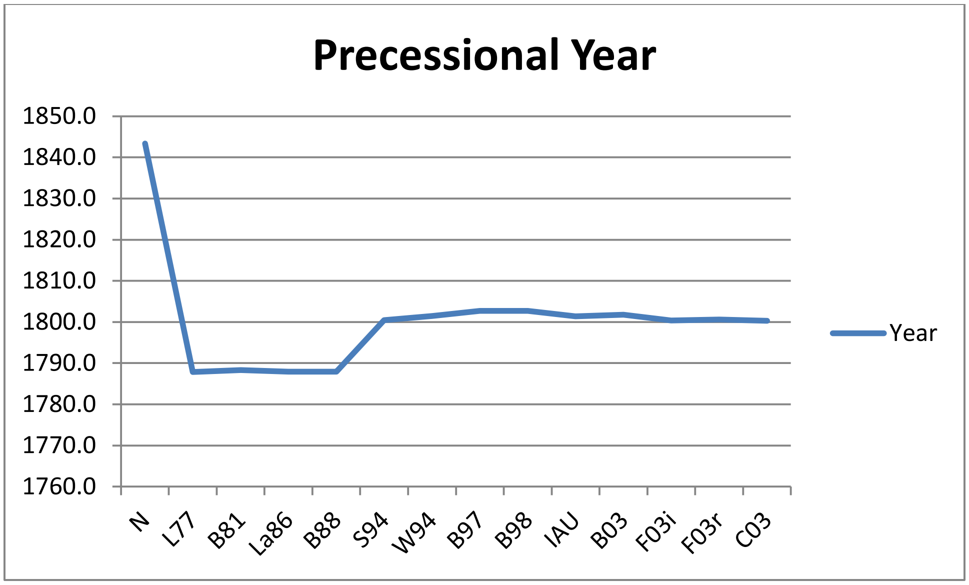
Constructing the M Circle

So how can the dimensions of the M Circle be mathematically defined? Is it related to the Precession of the Equinoxes, as Davidson defined it, or something else?

Davidson calculated the circumference of the M Circle based on the value of the rate of the Precession of the Equinoxes for the year AD 1844. He used Simon Newcomb′s equation, which gives a value of 1843.4, which relates to the year AD 1844.

Precession Rate (Newcomb) $p = 50.2453 + 0.0002222t$

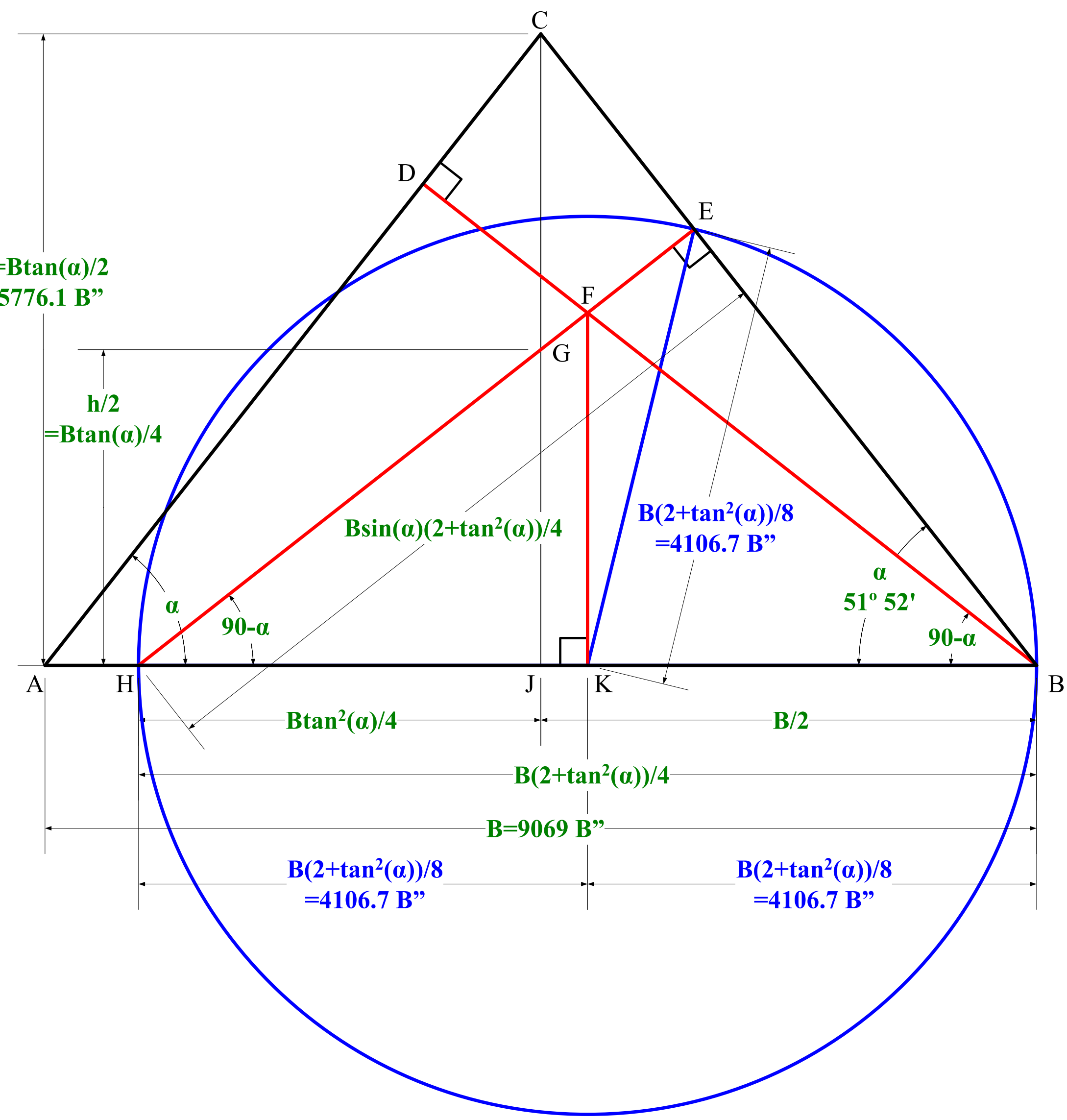
Many years later, the equation ″L77″ was published, which was more accurate and which was used in place of Newcomb′s equation. If Davidson′s year value had been recalculated, it would have moved to AD 1788 and then would have moved back to AD 1802 when the IAU equation was published. Using the Precession value from these equations and others lead to a widely varying chronology, as shown by the following chart. Current equations have settled down and show that Davidson′s Precessional year is AD 1800.



The value of M cannot, therefore, be accurately recovered from precession values, nor can its value be reliably derived from astronomy. One way to meet the constraints of the study is to see if the Pyramid defines an M Circle that relates to the survey data so long as it supports the goal of accurately matching Pyramid and Bible chronology.

Is it possible to construct a circle within the Pyramid that has a circumference of about 25794 B″? As hoped for, the answer is yes!

The Figure below, based on the RCS of the Pyramid, defines how to construct an M Circle using the geometry of the Pyramid. For those whose mathematics may be a little rusty, please remember that a ″perpendicular″ is a line that is at right angle to another line, i.e., at 90° to it, which is the case for the three red lines shown below.



Construction of the M Circle

The line DB is perpendicular to AC and passes through the corner B. The line EH is perpendicular to CB. It passes through the midpoint, G, of the vertical axis of the Pyramid CJ and intersects the base AB at point H. The line KF is perpendicular to BA and passes through point F, which is the intersection of DB and EH.

In the Figure above, it can be shown that triangles HFK and BFK are congruent, which means that they have the same shape and size, and maybe they are mirror images of each other, as they are in this case. Thus HK is the same length as KB. A third line, KE, is added, which can be shown by the lengths dimensioned in green, to be the same length as HK and KB. We, therefore, have three lines that are the same length irrespective of the Base Angle. Furthermore, these lines share a common point K and since they are the same length a circle, centered at K, is drawn in blue, through the endpoints B, E and H. Only two of these lines are required to draw a circle round them so the third line, KE, becomes a valuable third witness.

Given Petrie′s measured values for the base length, rounded to 9069 B″, and his base angle, 51º 52′, the lines KB, KH and KE can all be shown to be 4106.7 B″. At this stage, this is reasonably close to the desired M Circle value, 4105.24 B″.

The above shows, therefore, that the M circle can easily be constructed using the RCS of the Pyramid using three easy to position perpendiculars. The ability to construct the M Circle using the form of the Pyramid directly associates it with the Pyramid. Thus the need to rationalize why the Precession of the Equinoxes defines an essential and fundamental part of the Pyramid is avoided. In my view, this was always a problem with using the Egyptian Book of the Dead and The Egyptian King Lists. Proving their provenance in relation to the Pyramid is difficult, e.g., why would God entrust the definition of His Pyramid to pagan Egyptian priests. Davidson provides evidence, but I do not see the connection as the real Pyramid is not the size defined by these sources.

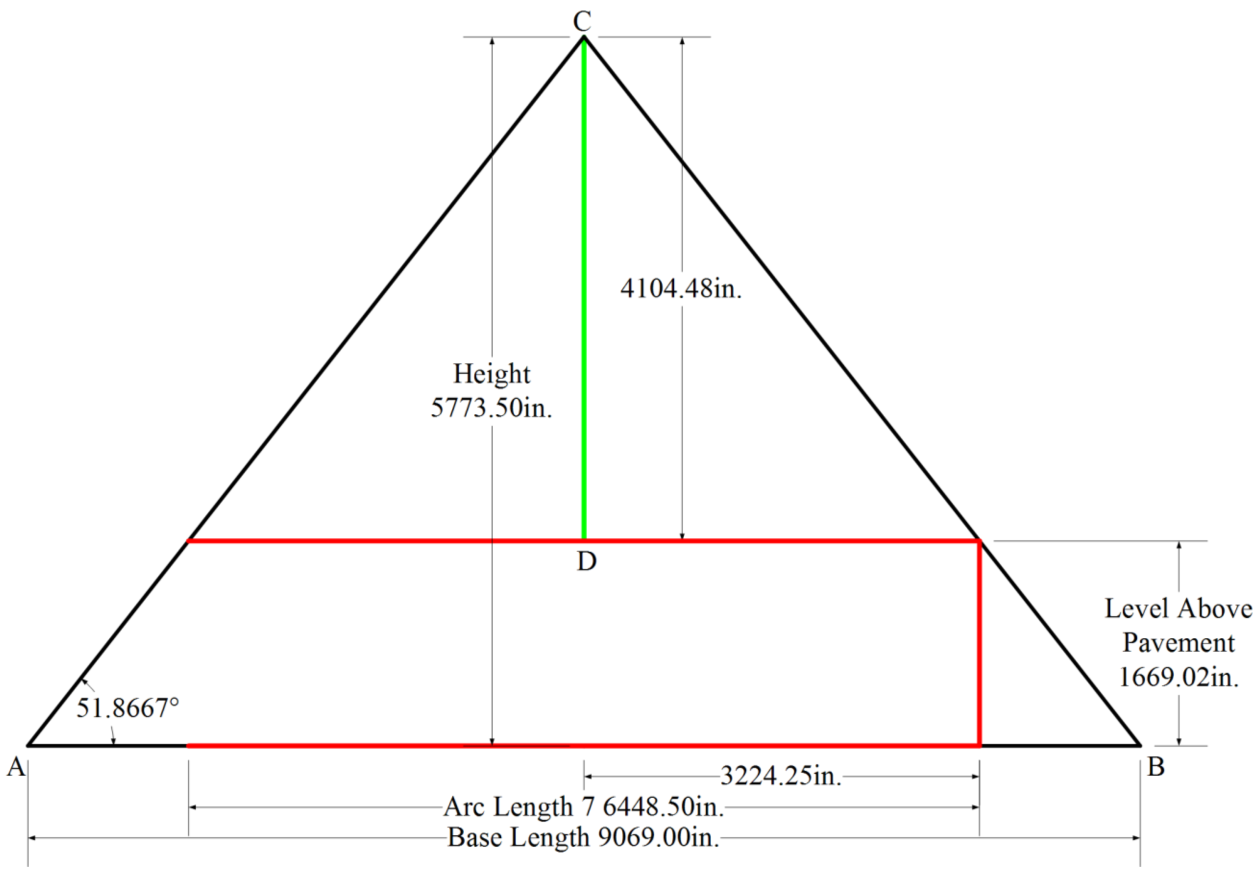
The Base Angle of the Pyramid, Again

It was seen earlier that Petrie′s measured base angle guided us toward selecting the π angle as it is the closest to his mean measured angle. Using the M Circle, we have a reliable witness, which mathematically proves that the π angle is the intended base angle.

Arc length 7 defines a Pyramid level, which is a height above the Base. In the Figure below, arc length 7, which is 6448.5″, is drawn in red along the Base. It is equidistant about the vertical axis of the Pyramid. At one end, a vertical red line is drawn until it meets the face of the Pyramid. At this point, a third red line is drawn horizontally until it meets the opposite Face of the Pyramid. The length of this third line is also the same as arc length 7, i.e., 6448.5 B″. The level of this third line is about one M Circle radius, 4104.48″, below the apex of the Pyramid, C. This distance is shown by the green line drawn vertically from point C, which is $4104.48 \times 2 \times \pi = 25789.21$, which is about 5 B″ less than the M Circle value 25794, in use at this point in the analysis.

The drawing of the first three red lines above is the process for converting an arc length to a level L, above or below the Base which can also be obtained by using the following formula:

$L = (\text{Base Length} - \text{Arc Length})/2 \times \tan(\text{Base Angle } (\alpha)) = 1669.02$ B″.



Arc Length Seven Converts to a Level

If the M Circle is a clue, then since its length is close to the radius of the M Circle, it is logical that its radius equals the length of the green line. If this is so, then it will be seen that most of the other lengths defined by the Arc Length Table are very close to measured values in the Pyramids. Generally speaking, it will be seen that they are within 0.25 B″ or less with a couple of outliers that are rationalized in Paper 5.

The following shows that if the length of the green line equals the radius of the M Circle, then the base angle must be the π angle.

α = Base Angle
AL = Arc Length = $M \times 90/360 \times \tan\alpha = M/4 \times \tan\alpha$
L = Level = $(B - AL)/2 \times \tan\alpha = B/2 \times \tan\alpha - M/8 \times \tan\alpha$
M = Circumference of M Circle
B = Base Length = 9069 B″
H = Pyramid Height = $B/2 \times \tan\alpha$

$$H = \text{Radius of M Circle} + L = M/(2 \times \pi) + B/2 \times \tan\alpha - M/8 \times \tan\alpha$$

$$\cancel{B/2 \times \tan\alpha} = M/(2 \times \pi) + \cancel{B/2 \times \tan\alpha} - M/8 \times \tan\alpha$$

Canceling and rearranging yields:

$\cancel{M}/(2 \times \pi) = \cancel{M}/8 \times \text{Tan}\ \alpha$

Canceling and rearranging yields:

$\text{Tan}\ \alpha = 4/\pi$

$\therefore$ α = The π angle

The M Circle Table above uses an angle, in degrees, divided by 360 degrees to define an arc length. The four 90°angles of the square base can be expressed as $\pi/2$ radians since there are 90° in one-quarter of a circle. It appears to be a rule that all angles included in the M Circle table have to be defined in terms of π when the base angle is the π angle, as shown in the table below.

M Circle Table – Showing All Known π-Based Arc Lengths

Exterior Angle	Degrees °	Equation (° unless otherwise stated)
RCS Base Angle	51.854	$\text{Tan}^{-1}(4/\pi)$
RCS Apex Angle	76.292	$2\text{Tan}^{-1}(\pi/4)$
FCS Base Angle	58.298	$\text{Tan}^{-1}(\sqrt{(16+\pi^2)}/\pi)$
FCS Apex Angle	63.405	$2\text{Tan}^{-1}(\pi/\sqrt{(16+\pi^2)})$
DCS Base Angle	41.997	$\text{Tan}^{-1}(4/(\pi\sqrt{2}))$
DCS Apex Angle	96.006	$2\text{Tan}^{-1}((\pi\sqrt{2})/4)$
BCS Base Corner Angle	90.000	$\pi/2$ radians
Passage Angle	26.303	$\text{Sin}^{-1}\sqrt{\pi}/4$
Queen's Chamber Roof Angle	30.459	$\text{Tan}^{-1}(77\sqrt{(\pi/(16-\pi))}/16-1/43)$

The Base Corners, arc length seven, are equal to $\pi/2$ radians, confirming that the Pyramid Base Angle is $\tan^{-1}4/\pi$. In turn, this angle defines the π-based angles associated with arc lengths 2 to 6, as shown in the Table above. Since all these angles can be expressed as a function of π, then for consistency, the Passage Angle, arc length 8, should also be capable of being expressed as a function of π. $\sqrt{\pi}/4$ is the simplest way of maintaining consistency between the inside and outside of the Pyramid, where the Base Angle is $\tan^{-1}4/\pi$. The equation for arc length nine is derived in Paper 5, but, as shown, it too is related to π.

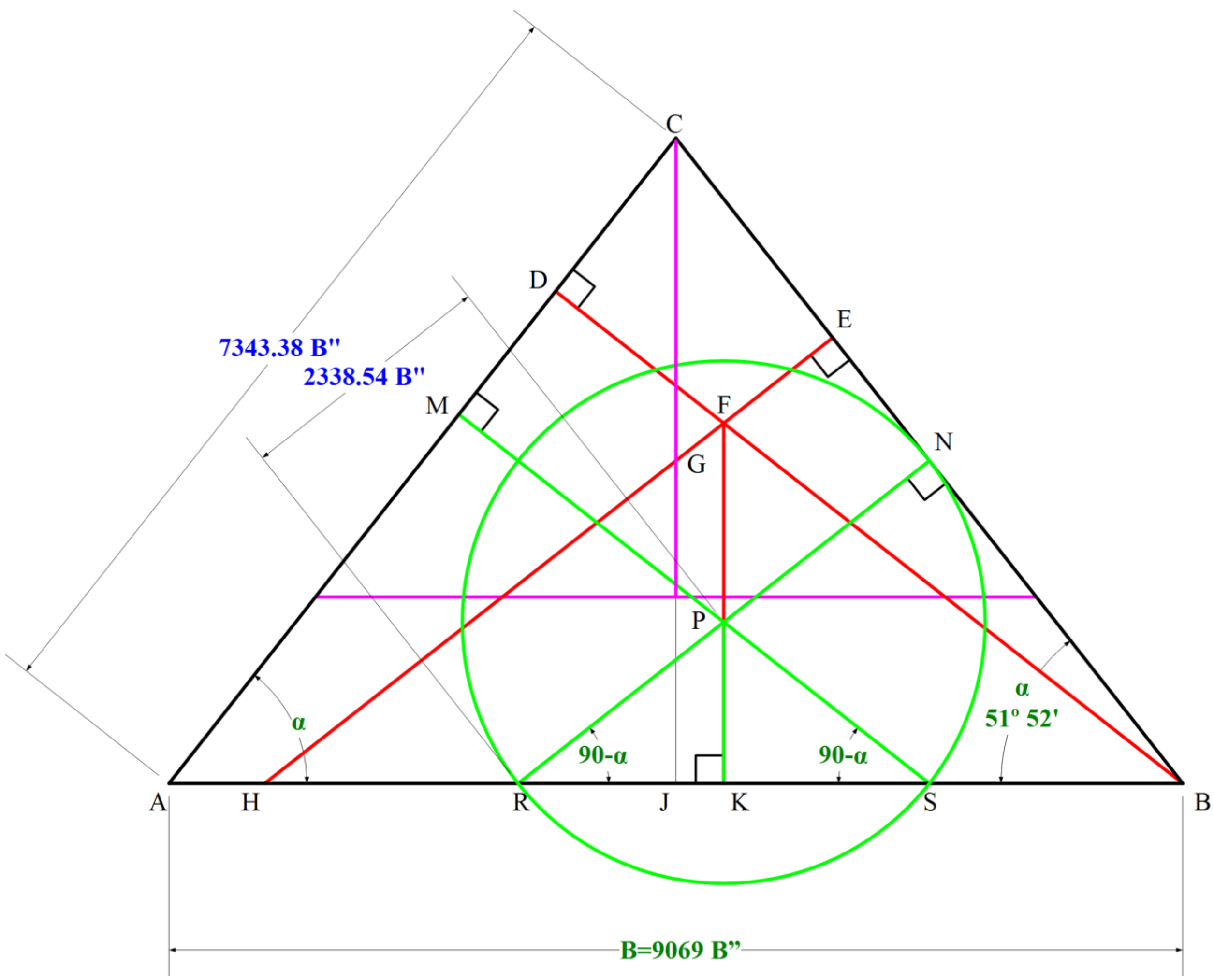
So a few simple rules concerning what angles may be included in the M Circle Table are as follows; the last rule is determined in Paper 5:

- The angle must be associated with a Pyramid feature and be definable in terms of π
- Vertical angles relate to internal features
- Horizontal angles relate to external features
- All external angles in the Table must be enclosed in a triangle or rectangle

- The two angles associated with an external triangle define internal features that are associated with each other, for example, Queen,s Chamber, and floor level
- Only one angle per internal feature is allowed, for example, Passage Angle and QC Roof

The N Circle

The Base Angle can also be defined with a geometric construction similar to that for the M Circle called the N Circle. Construction is similar to the M Circle. Three green perpendiculars are drawn in the Figure below. They are drawn from each edge of the Pyramid. MS is drawn so that S is midway between J and B. NR is drawn such that N is midway between C and B. The third perpendicular PK is drawn from the intersection of MS and NR at point P to the Base at point K. The red perpendiculars are kept from the M Circle construction for reference.



Construction of the N Circle

It can be shown that the point P lies on the line FK from the M Circle construction. It can be seen that there are two congruent triangles, RPK and KPS. These triangles are also similar to triangles ACJ and CJB. The Figure above shows the lengths of equivalent sides, AC and RP, of these similar triangles to be 7343.38 B″ and 2338.54 B″ respectively when the Base Length is 9069.0 B″, and the Base Angle is 51º 52′, which is a ratio of 3.14:1 which is close to the value of π.

Mathematically it can be shown that when the ratio of the height of the Pyramid, CJ, to half the Base Length, JB, is 4 to π, i.e., the theoretical value of the Base Angle, then the ratio of AC to RP, AC to PS and also AC to PN, becomes precisely π. Here then, is another clue which in most respects, is based on a construction similar to the M Circle clue. It shows a double occurrence of the value π at the π Base Angle.

Height Clues

At this juncture, it is appropriate to determine if the height of the Pyramid can be established empirically.

The following are some ways that we can determine the height of the Pyramid by looking at its characteristics. In the end, we'll evaluate them to see if any one or more fits the observations.

Clue 1 - $2e\pi^6$ Height Clue

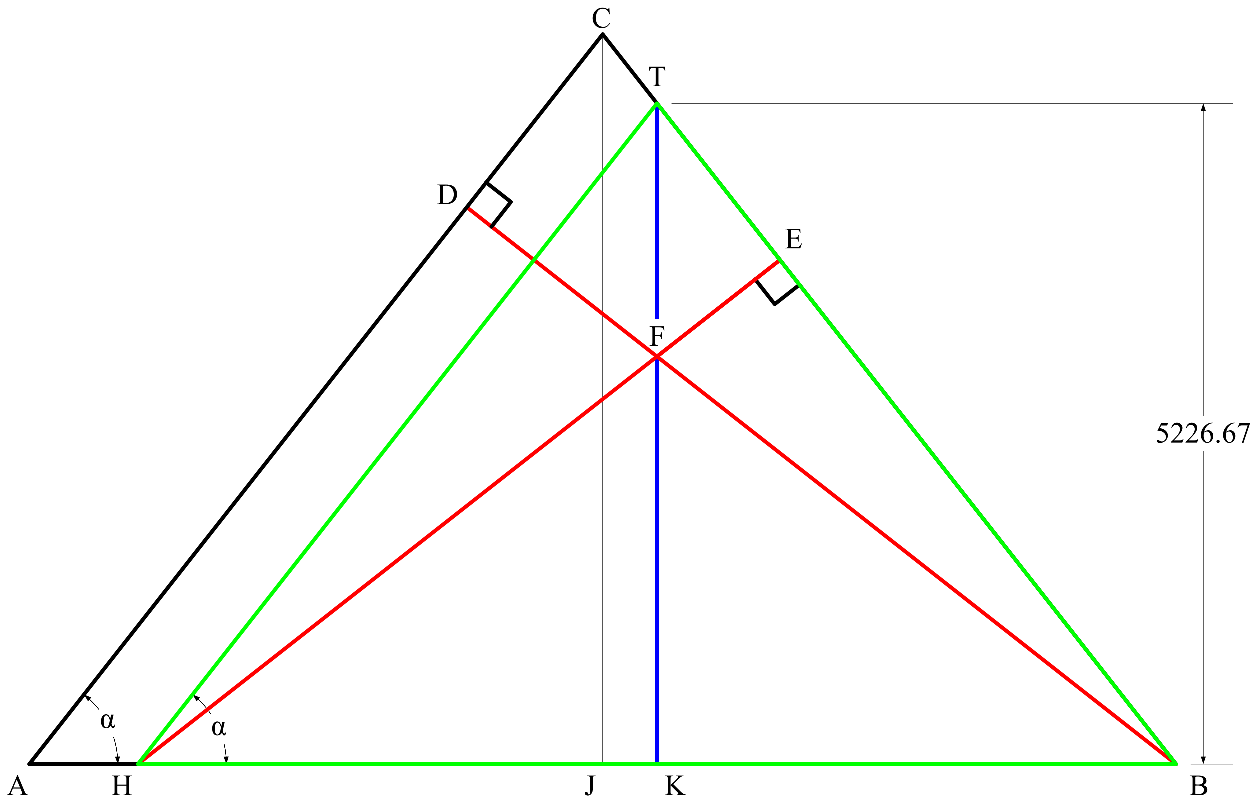
In the Figure below, which shows part of the construction of the M circle, the blue line FK is extended to T. Let us assume the length of KT equals $2\ e\ \pi^6$ units. From [Wikipedia article on the mathematical constant e]

"The number e is a mathematical constant, approximately equal to 2.71828, which appears in many different settings throughout mathematics. It was discovered by the Swiss mathematician Jacob Bernoulli while studying compound interest.. "

π^6 means π to the power of 6 or π multiplied by itself five times, i.e., $\pi \times \pi \times \pi \times \pi \times \pi \times \pi$

The height of KT is, therefore, 5226.654 units.

When the M Circle was constructed, a second triangle, HTB, which is similar to the RCS, was being constructed but not finished at the time. The Base Length of this triangle is the line HKB in the Figure below which is the diameter of the M Circle which was shown earlier to be equal to 2 x B x $(2+\tan^2(\alpha))/8$, where B is the Base Length of the Pyramid and α is the π Base Angle.



If $KT = 2e\pi^6$

then $HK = KT / \tan\alpha = 2e\pi^7/4 = e\pi^7/2$ because $\tan\alpha = 4/\pi$

But HK is also $= AB(2 + \tan^2\alpha)/8 = AB(2+(4/\pi)^2)/8 = e\pi^7/2$

So Base length $AB = e\pi^7/((2+(4/\pi)^2)/8)/2 = 4e\pi^9/(2\pi^2+16) = 9068.979$ units

which says that if we make the units in the above equations equal to B″ then setting KT equal to $2e\pi^6$ B″ is an accurate method of defining the Base length of the Pyramid which tentatively has been set to 9069 B″. However, a second witness is required before making any conclusions, and we still have other height clues to consider.

Based on the $2e\pi^6$ height clue, the height of the Pyramid would be 5773.49 B, which is within Petrie′s 5776 ± 7 B″.

Clue 2 - Φ Height Clue

There is another height clue which permits centimeters to be considered when defining the Pyramid Height, which is based on the constant Φ, otherwise known as the Golden Ratio.

$\Phi = (1 + \sqrt{5})/2 = 1.6180339887498948482045868343656$………………..

Cole measured the Base of the Pyramid, using the Metric System, and his average result for the Base Length is 23036 cm ± 3cm. The expression,

$3 \times \Phi \times \pi^8 / 2 = 23029.15 = 9066.6$ B″

is an approximation of the Base Length as measured by Cole. There is about 7 cm difference, which is not within Cole′s tolerance range.

However, this does not mean there is not some relationship, as yet undiscovered, which would point to the Metric System as being the intended measurement system of the Pyramid. However, there are several more clues that point to the British Inch as the intended measurement system.

Clue 3 - Φ^{18}

Another possible solution is to raise the constant Φ, 1.618, to the 18th power which results in a value for the Height of the Apex of the Pyramid of 5778 B″, which is within Petrie′s calculated limits for the height of the Pyramid, 5776 ± 7 B″. However, the intended base length at the π angle is 9076.06 B″, which is outside Petrie′s range.

Clue 4 - The Ratio Height Clue

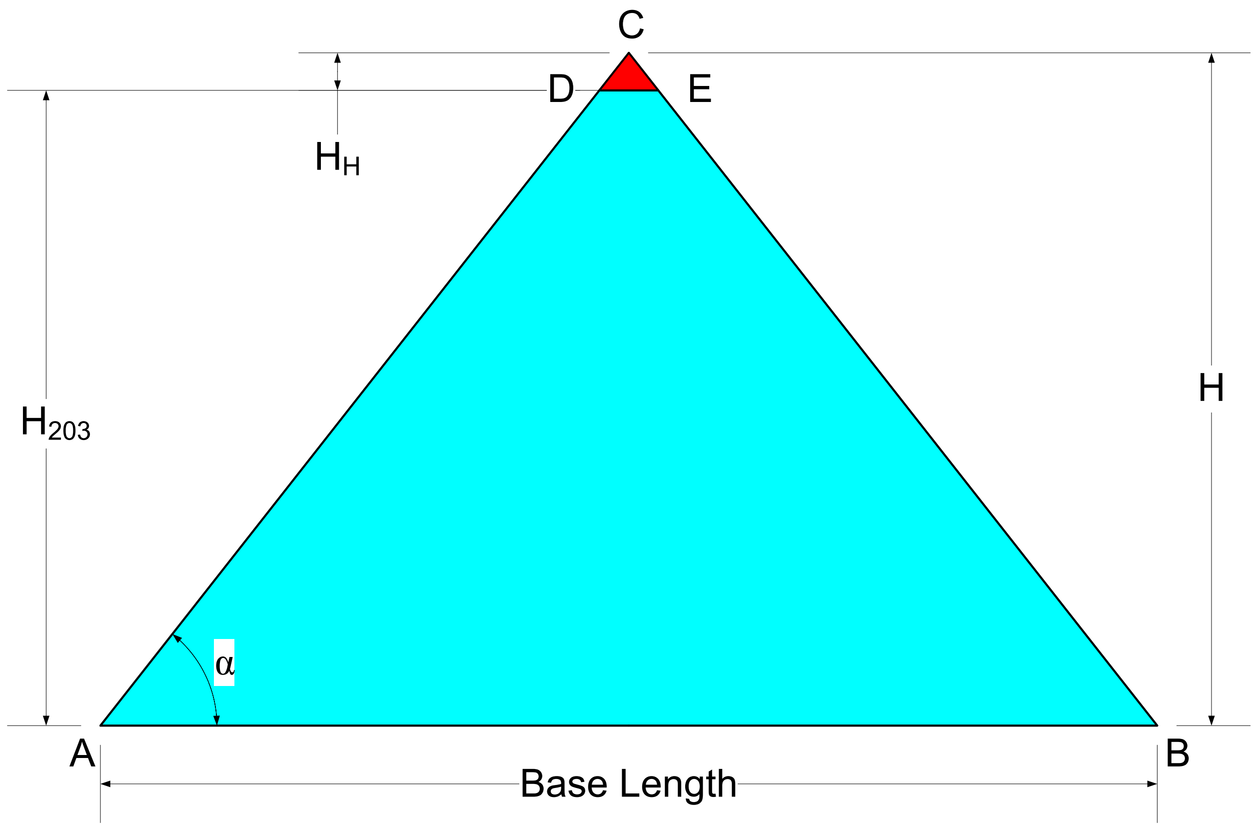
Another clue is the Ratio Clue, which is described as follows:

Regarding the levels of the courses of the Pyramid Petrie says (P23)

"These levels, though important for the heights of particular courses, have scarcely any bearing on the question of the total height of the original peak of the casing of the pyramid; because we have no certain knowledge of the thickness of the casing on the upper parts."

On the face of it, this logic seems reasonable, but as it turns out one level provides a clue which in turn yields the intended height, H, of the Apex of the Great Pyramid, with Casing and Capstone in situ. This level is the top of the 203rd course, which was the topmost course that Petrie was able to measure at 5451.8 B″ (Petrie Plate 8). That part of the Pyramid between the 203rd course and the Apex will be referred to as the Head. It is not assumed that the Head is the same as the Capstone since historical evidence exists of courses above the 203rd. See Paper 3 for a possible reconstruction of the courses contained by the Head. However, this does not work for meters and cubits, only British inches, Sacred Inches, and Pyramid inches.

In the Figure below, ABC is the Pyramid, and DEC is the Head. The height above the Pavement of the top of the 203rd course is $H_{203,}$ and the vertical height of the Head is $H_{H.}$ H is the vertical height of the Apex of the Pyramid above the Pavement, which is point C.



The Ratio Clue

Let R = the ratio of the height of the Pyramid to the height of the Head = H/H_H

Then the ratio of the areas of the RCS of the Pyramid and the RCS of the Head is $R^2 = H^2/H_H^2$

moreover, the ratio of the volume of the Pyramid to the volume of the Head is $R^3 = H^3/H_H^3$

Which is true for any point on the vertical axis of the Pyramid. However it is observed by computation that when the point selected on the vertical axis is the top of the 203rd course, H_{203}, which was the top course that existed when Petrie measured the Pyramid, and for the cases where the dimensions are in inches the following relationships are also true:

$R^2 = H_H$

and $R^3 = H$

but $H - H_H = H_{203} = R^3 - R^2$

So $\mathbf{R^3 - R^2 - H_{203} = 0}$

Which is is a cubic equation that can be solved by a variety of methods. When solved using the Cardan-Vieta method the formula for

$$R = ((H_{203}+2/27)/2+(H_{203}^2/4+ H_{203}/27)^{1/2})^{1/3}+((H_{203}+2/27)/2-(H_{203}^2/4+ H_{203}/27)^{1/2})^{1/3}+1/3$$

From this formula, the value of R is 17.9398 when H_{203} equals Petrie′s measured height of 5451.8 B″ and, hence, is dependent upon the accuracy of Petrie′s measurement. If Excel calculates this formula, a difference occurs in the 6th decimal place compared with calculating it with ″Solver″. Computing R with Solver leads to no apparent errors when substituting the resultant value for R back into the original formula, $\mathbf{R^3 - R^2 - H_{203} = 0}$.

The following Table is intended to show how the Ratio Clue works for the inch cases only. There are seven columns, and the first column defines a parameter relative to six versions of the Pyramid based on different measurement systems.

The second column defines how the ratio clue fits the theoretical Pyramid in B″. The theoretical Pyramid is used here to limit the number of variations discussed to reduce confusion. For this discussion, the differences in the dimensions are negligible. The second row shows the Conversion Factor, 1.00000 in this case, but is different for the other five cases. The third row is the π Base Angle, which is 51.85397° and is the same for all cases. The fourth row is the Base Length, 9069.165 B″, in the case of column 2 but divided by the corresponding conversion factor for the other five cases. The fifth row is the height, which is the base length times 2 divided by π for all cases. Note that for the Sacred Inch case, S″, that the height and base length are those used by Smyth, Davidson, etc., in early Pyramidology except P″ has been substituted by S″.

The sixth row computes the ratio R by calculating the cube root of the height H. The seventh and eighth row compute R^2 and R^3. The ninth row computes $H_{203,}$ and the tenth row converts this back to B″ for all cases. The tenth row shows what is meant above by the statement above *″However, this does not work for meters and cubits, only British inches, Sacred Inches, and Pyramid inches.″.*

Ratio Clue Table

	B″	S″	P″	Royal Cubits	Sacred Cubits	Meters (m)
Conversion Factor	1.00000	0.9932	1.00106	20.60702	24.83008	39.37008
Base Angle	51.85397	51.85397	51.854	51.854	51.854	51.854
Base Length B″	9069.165	9131.250	9059.6	440.1	365.25	230.4
Height (H)	5773.610	5813.134	5767.5	280.2	232.5	146.6
$R = H^{(1/3)}$	17.9397	17.9806	17.9334	6.5435	6.1493	5.2734
R^2	321.8	323.3	321.6	42.8	37.8	27.8
R^3	5773.6	5813.1	5767.5	280.2	232.5	146.6
H_{203} (R^3 - R^2)	5451.8	5489.8	5445.9	237.4	194.7	118.8
Ratio Point B″	5451.78	5452.51	5451.66	4891.27	4834.70	4678.76
Above Course	203	203	202	177	174	166

It can be seen in the B″ case that the height of the ″Ratio Point″ in row ten is 5451.78 B″, which is close to Petrie′s measured value of 5451.8 B″. The other measurement systems in the remaining columns show that the ″Ratio Point″ reduces in height by about one inch in the S″ and P″ cases, 560 B″ in the Royal Cubit case, 617 B″ in the Sacred Cubit case and 773 B″ in the meters case. In other words, the clue only works for the inch cases. Outside of the inch cases, the value of R, based on the cube root of the height of the Pyramid, does not satisfy the value of R required to make the ″Ratio Point″ equal to the top of the 203rd course.

Here, then, is the Ratio Clue that points to the top of the 203rd course being a defining point for the height of the Pyramid when it is expressed in inches.

Second Part of the Ratio Clue

In terms of defining the height of the Pyramid, the second part of the Ratio Clue is the shining star. The solution took a page out of the Ratio Clue playbook, which says that the height of the Pyramid is R^3. If the value 17.6 is cubed, the result is 5451.776, which, if expressed as B″, is just 5 parts per million less than Petrie′s measured value of 5451.8 B″ for the top of the 203rd course. So 17.6^3 can reasonably be substituted for Petrie′s value.

Those who learned and use the metric system may be asking what is so special about 17.6? Those who learned and use the Imperial (British) system of measures at least know that this length is the number of yards in a mile, 1760, divided by 100. 17.6 is the number of B″ traveled in one second at a velocity of precisely 1 mile per hour (mph).

I mile = 1760 yards x 36 B″/yard = 63360 B″

1 hour = 3600 seconds so 1 mph = 63360/3600 = 17.6 B″/second

As stated above the Ratio Clue points to the top of the 203rd course being a defining point for the height of the Pyramid expressed in B″, and here it is seen that the value 17.6 provides this definition because:

- Traveling 17.6 B″ in one second is the unit speed of one mph
- $17.6^3 = 5451.776$ which when expressed as B″ points to the top of the 203rd course
- The equation $R^3 – R^2 - H_{203} = 0$ demonstrates that the need to cube 17.6 is consistent with the need to cube the Ratio R to obtain the heights of H_{203} and the Pyramid, respectively.

Finding the value 17.6, associated with the Ratio Clue, is quite remarkable!

The Ratio Clue also suggested that the P″ or the S″ may be the standard of linear measurement for the Great Pyramid. The only known multiple is that the Sacred Cubit (SC) comprises 25 P″ or 25 S″. There is no equivalent to Pyramid or Sacred feet, yards, or miles, so there is no way to define the unitary speed relating to P″ other than P″/second or SC/hour.

However, if there were the same definitions of feet, yards, and miles, as for the British inch, it can be shown that H_{203} would need to be $(17.6 * 1.001)^3$ or 5468.1 B″, for the value 17.6 P″/second to equal one Pyramid mph. This is 16 B″ higher than the measured value of H_{203}. Regarding the 2nd part of the Ratio Clue, the use of the Pyramid Inch as the standard of linear measure of the Great Pyramid is rejected.

Likewise with the Sacred Inch at 0.9932 B″ H_{203} would need to be $(17.6 * 0.9932)^3$ or 5341.3 B″, for the value 17.6 S″/second to equal one Sacred mph. This is 110 B″ lower than the measured value of H_{203}. Regarding the 2nd part of the Ratio Clue, the use of the Sacred Inch as the standard of linear measure of the Great Pyramid is rejected.

Please note that even though Britain has mostly converted to the Metric System, it is still legal, and current practice, to use miles, yards, feet, and inches when public safety is of concern. Road signs in Britain still indicate distance in miles, and speed limit signs still indicate mph. It is reasoned that by selecting speed as the basis of defining H_{203}, the Designer was aware that every driver in Britain would be familiar with road signs, which show distances in miles and speed in miles/hour, despite metrification, and would thus still recognize the British Inch. The use of miles/hour to define H_{203} is a tacit admission on the part of the Designer that feet, yards, miles, seconds, minutes, and hours were to exist even though the Great Pyramid was designed 4700 years ago. The use of B″ and miles/hour in the United States is still the norm.

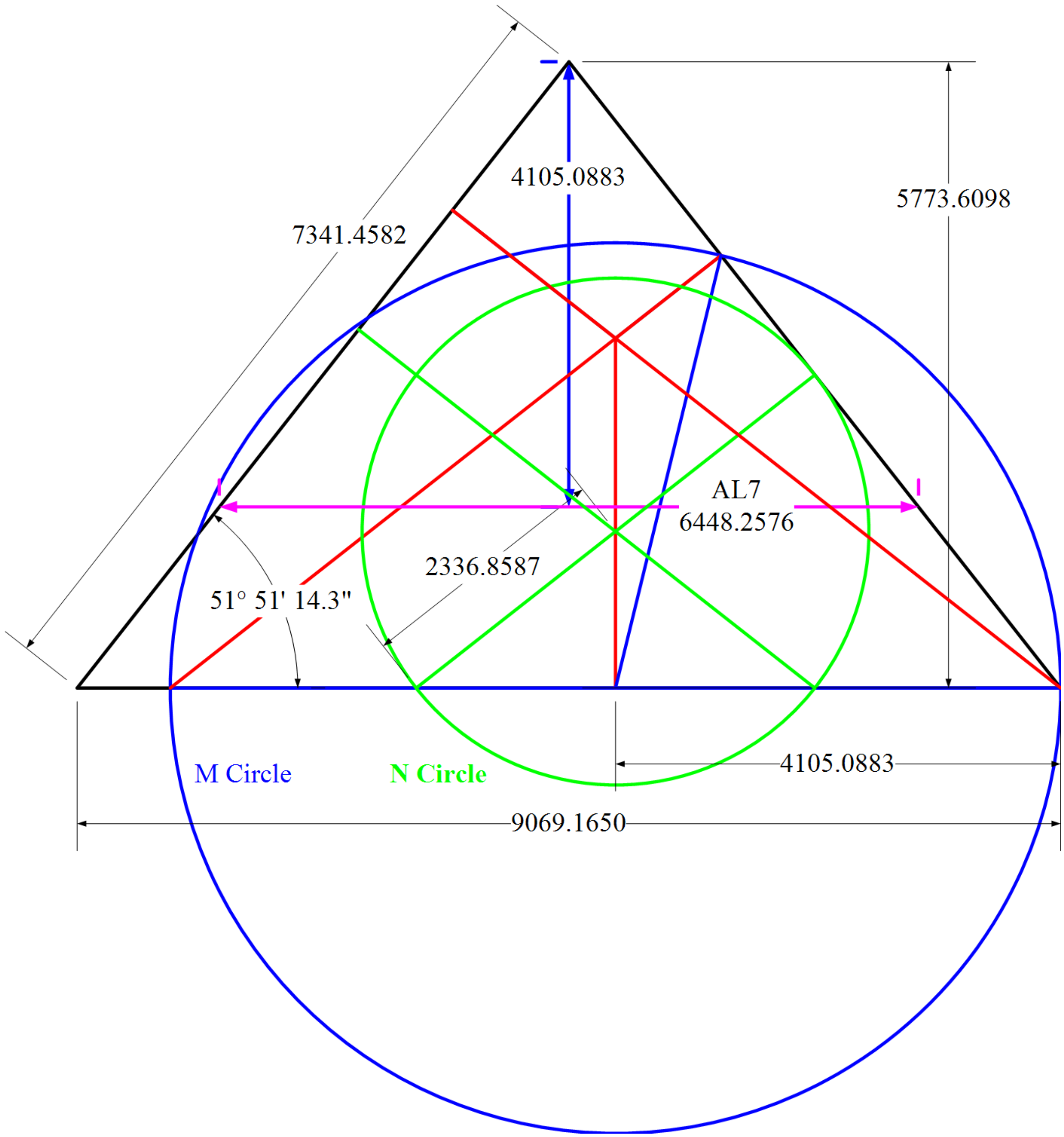
The second part of the Ratio Clue indicates a Pyramid height of 5773.6098 B″.

Since it has been concluded that the base angle is the π angle, 51° 51′ 14, then the base length = 9069.1650 B″, which is within the surveyed range.

When the M Circle was constructed its radius was shown to be = $B/8 \times (2 + \tan^2\alpha)$ = 4105.0883 B″. The circumference of the M Circle is, therefore, = 25793.0307 B″, which is reasonably close to Davidson′s 25974 B″.

The Final Construction of the Pyramid Design Details

Based on the above conclusions, the Figure below is the final construction of Arc length 7, the M Circle, the N Circle, and the Pyramid using the final theoretical dimensions. The blue lines are M Circle radii, and the red lines are perpendiculars used in its construction. The short green lines are N Circle radii and perpendiculars used in its construction. The magenta line is Arc Length 7. The black lines are the Pyramid. Linear dimensions are in B″.



Resolving Petrie′s Too Small Pyramid and the 25.025 B″ Pyramid Inch

In the Bible, we are told that Noah used a ″cubit″ to build the Ark, Solomon used a cubit to build the 1st Temple and other biblical characters used cubits. Sir Isaac Newton tells us that these are the measurement standard referred to by Pyramidology as the sacred cubit. It was Pyramidology that defined the sacred cubit as being divided into 25 Pyramid or Primitive inches, P″, and Pyramidology noted that there were about 500,000,000 P″ in the Earth′s polar diameter.

From NASA′s Earth Fact Sheet, the polar radius is 6356.752 km, which equals a diameter of 500531654 B″. The conversion factor should be 1.001063 B″/P″ based upon NASA′s value in the year 2018. Smyth′s conversion factor is 1.001 B″/P″, whereas Rutherford′s is 1.001064 B″/P″. Based on these values, the range of the sacred cubit is 25.025 B″ to 25.027 B″. Although the known value of the polar diameter appears to be somewhat stable, it is still fluctuating to a minor extent and is not suitable as a measure on which to base a standard.

For example, it is now apparent that the polar diameter is changing due to global warming. Permafrost is melting, causing the land to shrink by up to 15 feet. National Geographic. Against that, we are told that in Alaska, where glaciers are retreating, the land that was under them is now free of their mass and is relaxing, gaining up to 10 feet in height in the last 200 years. N. Y. Times. The difference is 5 feet, which, when compared to the polar diameter, is about 1 part in 8 million. While this may seem insignificant, a measurement of the speed of light, based on a standard that varies this much, would not be sufficiently accurate as it is known to 1 part in 300 million, i.e., 299,792,458 m/s.

To summarize, Pyramidology bases the length of the sacred cubit on the polar diameter, and there are environmental effects that cause variations in its length. Fortunately, it is possible to disassociate the length standard of the Pyramid from these events and replace it with something infinitely more stable, and which also takes into account Petrie′s base length and also Pyramidology′s desired base length. However, doing so will slightly reduce the length of the sacred cubit.

In ″A Dissertation upon the Sacred Cubit of the Jews and the Cubits of the several Nations″ Sir Isaac Newton concluded that the most likely value of the Sacred Cubit is 24.83 B″.

Pyramidology says that the base of the Pyramid should be 365.2424 sacred cubits of 25.025 B″ each, which = 9140 B″ but, on average, it is 9069 B″ by the last 5 surveys. However, 9069 B″/365.25 Sacred Cubits = 1 Sacred Cubit of 24.83 B″. In other words, what Newton discovered is what Pyramidology desired!

The following is the data on which Newton′s value of the sacred cubit is founded. Newton was seeking the value of the sacred cubit to assist in his studies of the theory of gravity. In ″A Dissertation upon the Sacred Cubit of the Jews and the Cubits of the several Nations″ he says:

″The Roman and Greek Cubits were a Foot and a half, and, like the Sacred Cubit, consisted of six Palms, and twenty four Digits. For the Roman and Greek Feet contain'd four Palms, and sixteen Digits. The Roman Foot was likewise divided into twelve Unciæ or Pollices, and was equal to 0.967 of the English Foot, as Mr. Greaves, who examined diligently the antient monuments in Italy, and consider'd the arguments of former writers, as Philander, Agricola, Pætus, Villalpandus, Snellius and others, has determined with the greatest accuracy of all other authors. The Roman Cubit is therefore 1.4505 of the English Foot. ″

Please note that the original showed decimal parts using fractions, i.e., 1.4505 was written as 1 4505/10000. This format did not copy correctly, so numbers like this have been converted to decimal numbers, which is a format in general use today. References and page numbers have been removed to ease the reading of the text, which was initially written in Latin.

"....the sacred Cubit in those times was not less than 25.57, nor greater than 25.79 Unciæ of the Roman foot."

and

"Mersennus in his treatise de Mensuris, Prop. I. Cor. 4. Writes thus: I find that the Cubit, (upon which a learned Jewish writer, which I received by the favour of the illustrious Hugenius, Knight of the order of St. Michael, supposes the dimensions of the temple were formed,) answers to 23.25 of our inches, so that it wants 0.75 of an inch of two of our Feet, and contains two Roman Feet, and two Digits and a Grain, which is 0.25 of a Digit. The Paris Foot, with which Mersennus compared this Cubit, is equal to 1.068 of the English Foot, according to Mr. Greaves; and consequently is to the Roman Foot as 1068 to 967. In the same proportion reciprocally are 23.25 and 25.68. That Cubit therefore is equal to 25.68 Unciæ of the Roman Foot, and consequently falls within the middle of the limits 25.57 and 25.79, with which we have just circumscribed the sacred Cubit; so that I suspect this Cubit was taken from some authentic model preserved in a secret manner from the knowledge of the Christians."

In the first quote, Newton is saying that the Roman foot is divided into 12 Unciae, and it equals 0.967 of the English foot. Since there are 12 English inches in one English foot, we can deduce that the Uncia is 0.967 inches.

In the second quote, Newton is saying that 25.57 to 25.79 Unciae are the lower and upper limits of the sacred cubit. In the third quote, Newton states the sacred cubit is 25.68 Unciae, which is in the middle of the limits defined in the second quote. It can be said that Newton′s value for the sacred cubit, which came through Mersennus, is therefore 25.68 ± 0.11 Unciae of the Roman foot which translates to (25.68 ± 0.11) x 0.967 B″ = 24.833 ± 0.11 B″.

Taylor is the one who first associates the sacred cubit with the polar radius, he says:

"If the diameter of the Earth were equal to 12 millions of the double royal cubit, or cubit of Karnak, of 41.472 inches, it would be equal to 497,664,000 inches: and, dividing this sum by 20 millions, we obtain the measure of 24.8832 inches for the sacred cubit."

He then points out that the diameter of the Earth, as recorded in the Great Pyramid, is 500,000,000 English inches, which, when divided by 20 million, results in a sacred cubit of 25 inches.

Smyth corrected Taylor′s value of 500,000,000 inches in the Earth′s diameter to 500,500,000 and updated the value of the sacred cubit to 25.025 B″ in ″Our Inheritance in the Great Pyramid, More Rigid Inquiry into the Absolute Length of the Base-side of the Great Pyramid″, page 31.

It is the view of the author that neither Taylor nor Smyth provided any substantial proof that the sacred cubit is linked to the polar diameter of the Earth. The argument that there are 500,000,000 P″ in the polar diameter may be impressive, but it is not proof.

Newton′s research, and even Taylors research into Josephus′ length of the sacred cubit, 24.9 B″, is based on historical data and, therefore, is more believable.

There are four witnesses for the length of the sacred cubit.

- The first witness is from Newton, who gives a value of 24.83 ± 0.11 B″ within a range of 24.72 to 24.94 B″.
- The second witness is from Josephus′ via Newton and Taylor, whose value of 24.90 also fits within Newton′s range.
- The third witness is that there are 365.25 ″units″ of 24.83 B″ in the measured length of the Pyramid base, 9069.158 B″.
- The fourth witness is that there is a theoretical Sacred Cubit of 24.830021 B″. It is based on dividing the theoretical base length of the Pyramid, 9069.165 by 365.25.

It is concluded that the theoretical value of the sacred cubit is 24.83002060 B″.

It is also concluded that the values of 25.025 B″ or 1 P″ do not apply to the Great Pyramid.

During this study, it was noted that the possibility existed of recovering God′s measurement system, which He used, as the architect of Creation, in the design of the universe. Quite probably, this is what Taylor, Smyth, and Newton were seeking. The description and derivation of this measurement system are presented in a later paper.

Summary of the Theoretical Exterior Dimensions of the Pyramid

Just six numbers define the theoretical exterior dimensions of the Pyramid:

1
1.1
2
3
π
365.25

The height of the top of the 203rd course $H_{203} = (1.1 \times 2 \times 2 \times 2 \times 2)^3 = 17.6^3 = 5451.776$ B″

The Ratio R is found by solving the equation $R^3 - R^2 - H_{203} = 0$ for R = 17.9397261466765

The height of the Pyramid H = R^3 = 5773.60977422 B″

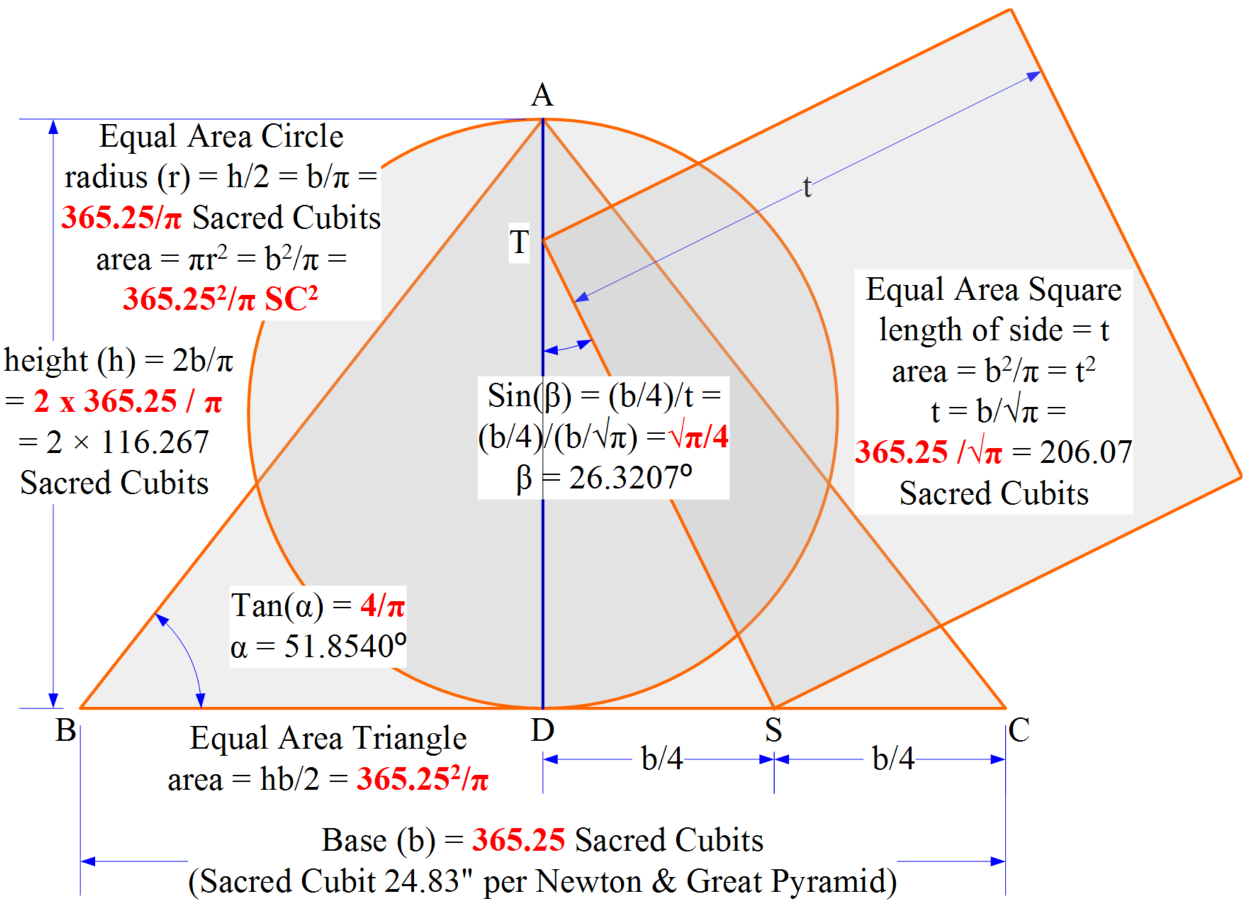
The Base Angle of the Pyramid $\alpha = \text{Tan}^{-1}(2 \times 2)/\pi°$ = 51.85397401°

The Base Length of the Pyramid, B = H × π/2 = 9069.16502569 B″

The length of the Sacred Cubit = B/365.25 = 24.83002060 B″

The circumference of the M Circle is 25793.0307 B″

The Figure below shows the exterior of the Pyramid with dimensions converted to Sacred Cubits.



The Base Length is 365.25 Sacred Cubits

The Height is 2 × 365.25/π Sacred Cubits

The tangent of the Base Angle = (2 × 2)/π

The Area of the RCS = (H × B)/2 = $365.25^2/\pi$ Sacred Cubits^2

The above defines Pyramidology′s Pyramid based on Petrie′s, and four more recent surveys.

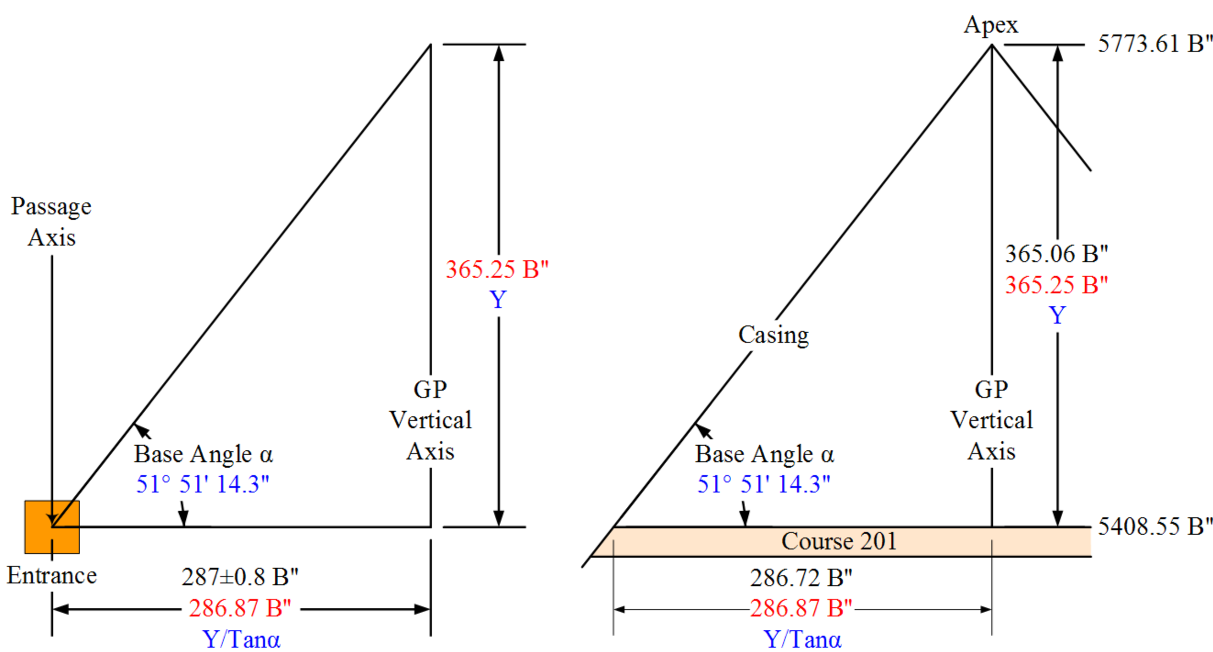
A circle and a square with areas equal to the triangle have been added to the Figure because they reveal additional data.

The area of the circle is $365.25^2/\pi = \pi \times r^2$, where r = the radius of the circle. Therefore r = $365.25/\pi$ Sacred Cubits = half the height of the Pyramid, which is an inherent tenet of Pyramidologogy since the Base Angle is required to be the π angle. The diameter of the circle is, therefore, the height of the Pyramid, and it can be attached to the triangle both at the Apex and the mid-point of the Base.

The area of the square is also $365.25^2/\pi$ Sacred Cubits^2, and so the length of one side t = $365.25\sqrt{\pi}$ = 206.07 Sacred Cubits. The value of 206.07 is significant and will be discussed shortly. The square is originally horizontal with its bottom right-hand corner attached to point S, which is three-quarters of the base length from point B. It is then rotated clockwise about S until its bottom left-hand corner meets the vertical axis of the triangle at point T. In this position, the angle subtended from T to S is $\sin^{-1} \sqrt{\pi}/4°$ = 26.30270169°, which is another π angle and is taken to be the definition of the internal passage angle, the measured average of which is close to this value. Paper 5 discusses the passage angle in-depth, but here it can be seen that it is defined externally, and it matches the constraints for being included in the M Circle Table.

Other Uses of the Year Value 365.25 External to the Pyramid

In Pyramidology, there is a feature called the Displacement Factor, which originates from the fact that the axis of the passage system is shifted 287 B″ to the east of the north-south vertical axis of the Pyramid, as measured by Petrie. To Davidson, it is 286.1 P″ based on his 12 sided Pyramid, which is not viable. Two other methods, or witnesses, are required to show how a revised Displacement Factor can be calculated from Pyramid features and these are shown below.



In the Figure above, the dimensions show a value in black, which is the measured value, a value in red, which is the theoretical value and an equation in blue, which is the theoretical equation from which the dimension in red is calculated.

The lefthand Figure shows that the passage entrance is, according to Petrie (P35), 287±0.8 B″ east of the vertical axis, which Davidson calculates is the Displacement Factor of 286.4 B″. However, it can be seen that if a right-angled triangle has a vertical height of 365.25 B″ and a base angle of 51° 51′ 14.3″, which is $Tan^{-1}(4/\pi)°$, then its base length is 286.87 B″, which is within Petrie′s range and closer than Davidson to Petrie′s measured value of 287 B″.

In the righthand Figure above, the apex of the Pyramid is half the base length, 9069.165/2 × Tanα = 4534.58 × 4/π = 5773.61 B″ above the Pavement. Also, the average height of the top of the 201st course is 5408.55 B″. So the top of the 201st course is 365.06 B″ below the apex of the Pyramid. When the base angle, α is assumed to be 51° 51′ 14.3″ the base length of the triangle is 286.72 B″ which is within Petrie′s range of 287±0.8 B″ for the passage offset. It can be reasonably assumed that the top of the 201st course was intended to be 5408.36 B″ above the Pavement so that its height below the Apex is 365.25 B″.

These two triangles provide witnesses that the entrance to the Pyramid is offset 365.25/Tanα to the east of its north-to-south vertical axis. It is, therefore, consistent with the exterior measurements of the Pyramid, which also uses the value 365.25. For example, the base length of the Pyramid is 365.25 Sacred Cubits, which are determined to be 24.83 B″, on average, by Sir Isaac Newton. The use of British inches in the dimensions of the exterior of the Pyramid is also validated by these two measurements and calculations.

So the values of the Displacement Factor of Davidson and Rutherford can be accounted for in terms that are consistent with other features of the Pyramid, namely British inches and the number of Julian days in a year, 365.25.

Timescale

To generate a chronology along the Pyramid passages and through the chambers, we need to understand the concept of time relative to the Pyramid. The timescale is determined from the exterior features of the Pyramid.

Firstly it is assumed that it flows at a constant rate. As we progress through the chronology in later sections, we will see that it is necessary to compute dates along the passage or chamber floors initially at the transition points between them. At first guess, the dates of the Exodus, Jesus′ crucifixion, etc. need to be known since, intuitively, it is most likely we will find them at these transition points.

It is necessary to know the length of the solar or tropical year to create a chronology, but to achieve an accurate result, the use of a single value such as 365.2424 days per year, as Pyramidology does, is insufficient in this day and age. Consider the Table below from Wikipedia′s article on the Tropical_year

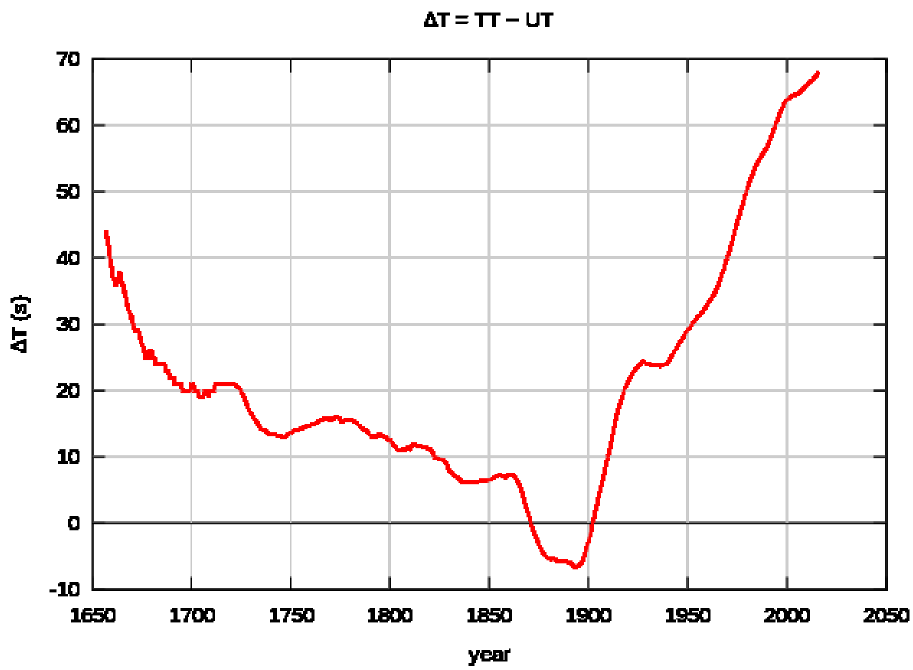
Length of Year Basis	The Year 0 (Days)	The year 2000 (Days)
Between two Northward equinoxes	365.242137	365.242374
Between two Northern solstices	365.241726	365.241626
Between two Southward equinoxes	365.242496	365.242018
Between two Southern solstices	365.242883	365.242740
Mean tropical year (Laskar′s expression)	365.242310	365.242189

It can be seen that there is no single value for the number of days in a tropical year. It varies depending on the way it is measured, such as referencing it to northward or southward equinoxes or the northern or southern solstices. It also varies from year to year as well as century to century. There is another method, which is to use the concepts of modern astronomy to define dates more accurately. Astronomy uses an astronomical year of 365.25 Julian Days, where each Julian Day consists of 86400 seconds based on extremely accurate atomic clocks and methods that correct variations in time that occurred over the years. This approach will be explained in detail in the appropriate section.

However, it is necessary to understand a few things here. A means of calculating a calendar is required, and modern astronomical software is available that enables this. In particular, the software needs to be able to compute the date of the start of every year and every month. The start of the year is related to the Vernal equinox, which is an event that occurs everywhere on earth at the same point in time. This event needs to be calculated first in what is called Terrestrial Time (TT), which, as stated, is a very accurate and uniform timescale with time increments based on atomic clocks.

The position of the earth relative to the sun can be calculated very accurately in TT. However, to determine the start of the year, the time at which the equinox occurred in TT needs to be translated to the time at a specific location on earth, e.g., Jerusalem, which is calculated as an offset from Universal Time (UT). UT is the time along the Greenwich Meridian and is used to determine on which particular day the Vernal Equinox occurred. Complex calculations are required to compute this since it involves determining the transition from one day to the next, which occurs at sunset.

The positions of planets and other objects in the solar system are calculated in TT at any given time in the past or future. However, the rotation of the earth about its axis is not regular, and variations are called Delta Time (ΔT). Over time ΔT both slows down and speeds up, as can be seen in the chart below.



ΔT vs. time from 1657 to 2015. (Edgar Bonet - Own work)

The chart is a plot of ΔT, which as a function of time = TT − UT. This plot combines the data sets Historic Delta T and LOD (1657.0 – 1973.5) and Monthly determinations of Delta T (from 1973.5 onwards) from the IERS Rapid Service/Prediction Center.

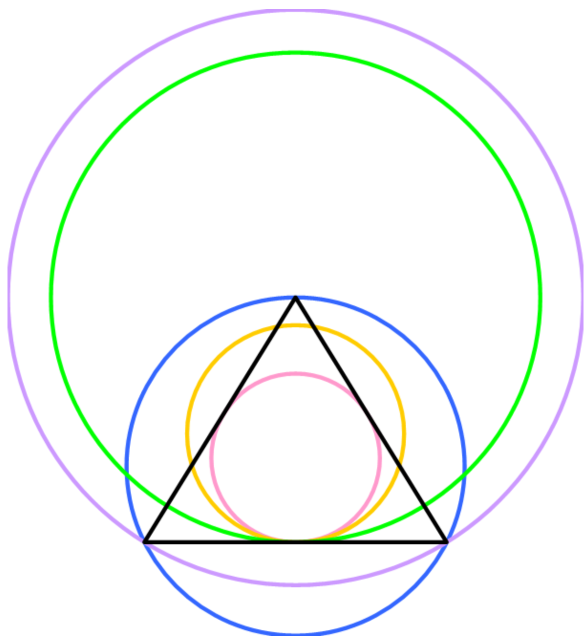
The floor of the passages and chambers can be defined to represent TT since both are uniform and linear. Since UT, with its variations caused by ΔT, is related to TT, it can be overlaid over TT along the passages. ΔT is a few seconds at this time in history, but at the start of Bible history, 4080 BC in this document, it was nearly 111326.6 seconds or about 1.3 days. Since modern astronomical software will be used to calculate dates, it is necessary to use 365.25 Julian days per year and rely on the ΔT corrections provided by the software.

The concept to determine a value for the timescale is to draw circles around the geometrical features of the Pyramid. The basis of this concept is that the sun can be viewed as being behind the Pyramid from many locations. Drawing a circle around the Pyramid, and therefore the sun, symbolizes the Earth′s movement with respect to the sun, or its orbit, with the time taken to traverse the circumference of the circle as a year or multiple years. By computing the circumferences of various circles and looking for exact matches between them, to provide two or more witnesses, three potential timescales are discovered, which are expressed as a length/year.

It is observed that the timescales calculated from this method define a history that is just decades in length. The timescales are therefore divided by 100 to arrive at a history of thousands of years since this is the period that the Pyramid is expected to include if it does mimic Bible chronology. The value of 100 is used today by astronomy to reduce a long period of days to a more acceptable and shorter period of years. The Year Length Clue is examined later, which shows that it is correct to divide each timescale by 100.

To ensure the approach taken is thorough, as many relevant circles as possible are drawn and their timescale values computed. Matches between them are then sought. Since the sun can be overhead, circles should also be drawn around the base. The Pyramid has three vertical cross-sections around which circles can be drawn and one horizontal cross-section. These are the Right Cross Section (RCS), the Face Cross Section (FCS), the Diagonal Cross Section (DCS), and the Base Cross Section (BCS). The vertical cross-sections are defined as follows:

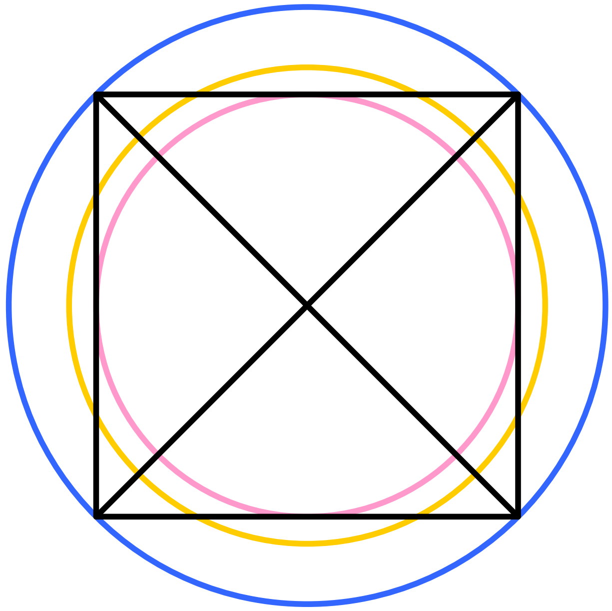
Five circles are drawn around these cross-sections. Representative circles for any of the cross-sections are shown in the Figure below:



In order of size, from the smallest upwards, the five circles are:

- a pink circle internal is the largest that can be fit entirely within the cross-section which is tangential to the sides and base
- an orange circle, with an area equal to the cross-section of the Pyramid, has no specific attachment point to the cross-section like the other four.
- a blue circle which is the smallest circle that can be drawn external to the cross-section and which passes through the Apex and two Base Corners
- a green circle which is centered on the Apex and tangential to the base
- a purple circle centered on the Apex and which passes through the two Base Corners

Three circles are drawn around the Base, as shown in the Figure below:



In order of size, from the smallest upwards, the three circles are:

- a pink circle which is the largest circle internal to the cross-section which is tangential to each side of the base
- Circle with an area equal to Base area (Orange)
- A blue circle which is the smallest that can be drawn external to the cross-section and which passes through the four Base Corners

The formula for the radius of each circle around the RCS, FCS, DCS, and Base is shown in the Table below.

	RCS	**FCS**	**DCS**	**Base**
Base Angle	A	F	D	
Base Length	B	B	B*√2	
Largest Internal	B/2*tan(A/2)	B/2*tan(F/2)	B/√2*tan(D/2)	B/2
Equal Area	B/2*√(tan(A)/π)	B/(2*√(π*cos(A))	B/2*√(2^0.5*tan(A)/π)	B/√π
3/(4) Corners	B/(4*sin(A)*cos(A))	B/(4*sin(F)*cos(F))	B*√2/(4*sin(D)*cos(D))	B/√2
Apex/Base	B/2*tan(A)	B/(2*cos(A))	B/2*tan(A)	
Apex/Corners	B/(2*cos(A))	B/2*√(2+tan^2(A))	B/2*√(2+tan^2(A))	

The circumference of each circle, 19 in all, is calculated and recorded in the Table below. For comparative purposes, the perimeter of the base has also been included since previous theories have defined that it equals the circumference of the circle centered on the apex and tangential to the base. The Circle Type column has been color-coded to match the Figures above. Exact matches, or multiples, are shown in red, blue, or green depending upon the value. The timescale values are divided by 100, as described above. The theoretical value of the Base Length, Basse Angle, and number of days in the year have been used.

Definitions	**Units**	**RCS**	**FCS**	**DCS**
Base Angle	**A°**	**51.85397401**	**58.29770909**	**41.99722395**
Base Length	**B″**	**9069.16502569**	**9069.16502569**	**12825.73617873**
Height	**H″**	**5773.60977422**	**7341.45819240**	**5773.60977422**
Days in Solar Year	**Y (Days)**	**365.25**		
Circle Type	**Section**	**Radius B″**	**Perimeter B″**	**B″/Year/100**
Largest Internal Circle	RCS	2204.51500361	13851.3763	0.37923001
Equal Area to Triangle	RCS	2886.80488711	18138.3301	***0.49660041***
3 Corners of Triangle	RCS	4667.53127579	29326.9639	0.80292851
Apex/Tangential to Base	RCS	5773.60977422	36276.6601	**0.99320082**
Apex/Base Corners	RCS	7341.45819240	46127.7422	**1.26290875**
Largest Internal Circle	FCS	2528.98299841	15890.0688	0.43504637
Equal Area to Triangle	FCS	3255.25401377	20453.3642	0.55998259
3 Corners of Triangle	FCS	5071.16195483	31863.0503	0.87236277
Apex/Tangential to Base	FCS	7341.45819240	46127.7422	**1.26290875**
Apex/Base Corners	FCS	8628.98875631	54217.5354	**1.48439522**
Largest Internal Circle	DCS	2461.49117502	15466.0052	0.42343614
Equal Area to Triangle	DCS	3433.00891137	21570.2312	0.59056074
3 Corners of Triangle	DCS	6448.25766447	40515.5978	1.10925661
Apex/Tangential to Base	DCS	5773.60977422	36276.6601	**0.99320082**
Apex/Base Corners	DCS	8628.98875631	54217.5354	**1.48439522**
Largest Internal	BCS	4534.58251284	28491.6222	0.78005810
Equal Area to Base	BCS	5116.72843897	32149.3529	0.88020131
4 Corners of Base	BCS	6412.86808936	40293.2386	1.10316875
Perimeter of Base	BCS		36276.6601	**0.99320082**

The top area of the Table defines the various angles and lengths used in the calculations for each of the cross-sections. Below that, the first two columns define the color-coded circle type and the cross-section to which it relates. In the third column are the calculations of the radius of the circle, and in the fourth column are the calculations for the circumference or perimeter. The fifth column contains the calculations for the potential timescales.

Circles that have the same perimeter value are color-coded the same, and it can be seen that there are three matching sets. The green and blue sets have two circles with the same perimeter, whereas the red set has three and one-half circles with the same perimeters. The half in this set is the perimeter of the circle whose area is equal to that of the RCS, which is precisely half that of the other three. Though all three matching sets have at least two witnesses, we can select the third, the red set, as it can be considered to have four witnesses. The red group thus has four witnesses, and, therefore, it should be concluded that this is the principal timescale. Its equation and value are as follows:

$$T = B*\pi*\tan(A)/Y \approx 0.99320082 \text{ B″/year of 365.25 days}$$

Where A = Base Angle
B = Base Length
Y = Number of days in 100 years = 36525 days

It should be noted that theoretically, Newton′s Sacred Cubit = 24.83002060 B″. Pyramidology divides the 25.025 P″ Sacred Cubit by 25 to define its timescale, 1.001 B″/year, and if this division is carried out on Newton′s sacred Cubit, then the result is 0.99320082 B″/year, precisely the same as calculated by the circle method above.

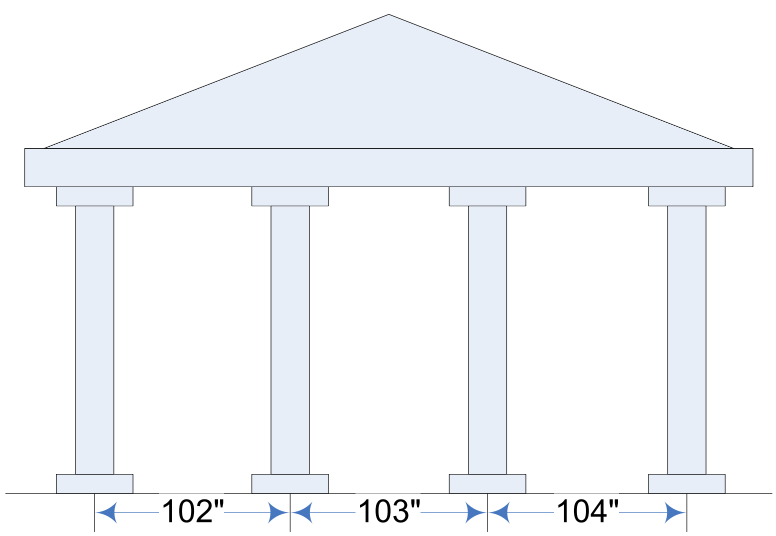
The point that is being made here confirms what Pyramidology has been telling us, which is that four times the base length divided by the timescale equals the number of days in 100 years. From the Table above, the perimeter of the base = 36276.6601 B″. Divide this by the timescale, 0.99320082 B″/year = 36525.0000 Julian days = 100 astronomical years.

The division by 25 is the result of the assumption that four times the Base Length equals 100 years, so one Base Length equals 25 years.

Remember this is Petrie′s 9069 B″ Pyramid now, not Pyramidology′s 9131 P″ Pyramid!

Inductive Metrology

The M Circle is an adaptation of Inductive Metrology. To understand Inductive Metrology in its simplest form let′s measure the columns of the temple entrance below:



The average distance between the columns is 103″. Let′s say that the temple is in Egypt where the Royal Egyptian Cubit equals 20.62″ according to Petrie. Therefore five cubits equal 103.1″

and Inductive Metrology allows us to conclude that the architect intended the columns to be five cubits center to center. Mathematically we can say that in the above example:

Length in cubits = Measured Length in B″/ 20.62

which can be written more generally as

Length in units 1 = (Measured length in units 2)/(conversion factor units 2 to units 1)

The M Circle is as simple as that, and the equation is as follows:

Arc length (B″) = Measured Angle °/360° * conversion factor (25794 B″)

moreover, this can be written generally as

Arc length (Units 1) = Measured Angle °/360° *conversion factor (units 1)

The adaptation to Inductive Metrology here requires us to define what each arc length relates to in terms of Pyramid dimensions. In the Table above, each arc length defines from one to three passage lengths or a single level, either above or below the zero level, which is the topside of the pavement. A process has been defined to convert each appropriate arc length to a Pyramid level.

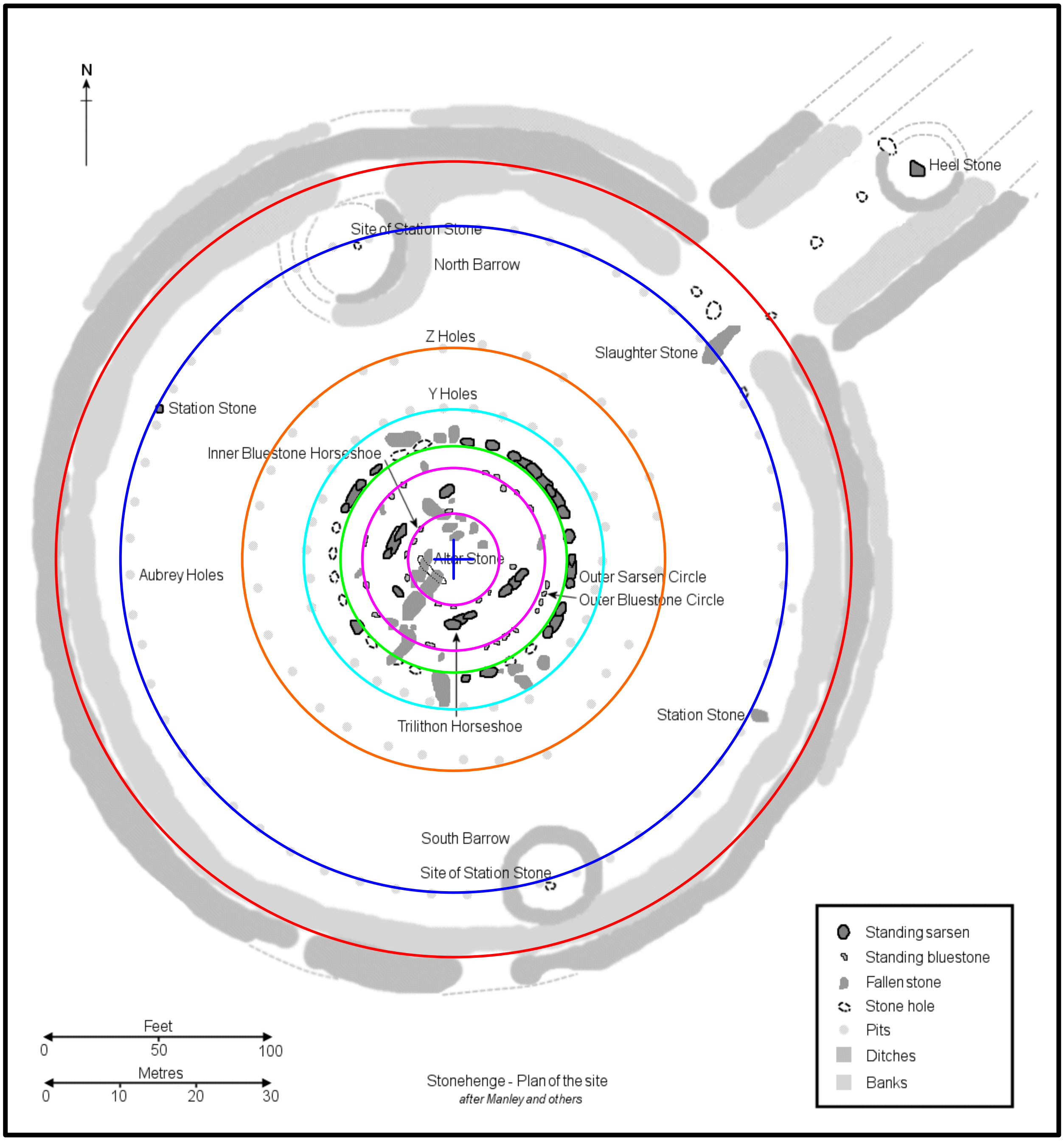
The M Circle not only defines the intended dimensions of those parameters shown in the above table but assists in discovering others such as the perpendicular height of the sloping passages, the height of the small step into the Kings′ Chamber, and the position of the Scored Lines in the Entrance Passage.

Stonehenge and the M and N Circles

The plan below was copied from stone-circles.org.uk, which is a useful site for providing the details of Stonehenge.

The ″henge″ part is a circular ditch, shown in dark grey, with a primary bank, shown in lighter grey inside of the ditch. The chalk dug out of the ditch was used to make the bank. Along with the Aubrey Holes, the henge was constructed during phase 1 of Stonehenge, about 2900 BC or 200 years before the date of the building of the Pyramid. The Great Pyramid is unique, on account of its upper passages, and similarly, Stonehenge is unique in that the primary bank is inside the ditch. With many other henges, the primary bank is outside the ditch. There is a smaller secondary semicircular bank outside of the ditch from the NW to SE. Petrie accurately surveyed Stonehenge in 1877 before he surveyed the Pyramids at Gizeh. However, it was more dilapidated at that time compared with today since it has been partly restored. The scale at the bottom of the plan appears to be too large by about 1%, so the inner diameter of the Outer Sarsen Circle was matched with the green circle.

In Petrie′s opinion, the most likely points of measurement of the henge are the inner edge of the bank, the neutral point between the bank and the ditch, and the outside edge of the ditch, which is shown as a white area between the dark gray ditch and the light gray bank.



Stonehenge Plan View Reveals Dimensional Matches with the Great Pyramid

The red circle is precisely half the diameter of the M Circle, and it appears to fit the neutral point between the bank and ditch in most places. Petrie gives this diameter as 4045″. The half M circle fits the henge at all four cardinal points, but there appears to be a long bulge in the henge at the

NW and a smaller bulge at the SSW. Apart from these bulges, the half M Circle is a good fit for the neutral point of the henge.

The Aubrey Holes were dug in the earth, and no evidence of stones or timbers have been found in them. However, they are spaced such that 56 of them will fit within their circle, which corresponds with the 56 holes in the Ramps and Great Step of the Grand Gallery of the Great Pyramid. The dark blue line drawn through them has a diameter of 3439″, which is the DCS apex path length 6, divided by two, which fits the Aubrey diameter quite well.

The orange circle, diameter 2182″, is derived from a circle within the Pyramid, the Z circle, which provides the final tweak to the position of the upper passages that makes the Bible and Pyramid chronologies align perfectly. It fits the circle of the Z holes well, but they are not well laid out.

The light blue circle, diameter 1547″, is the length of the Ascending Passage. It fits the circle of Y holes well.

The Sarsen Stones were added in phase 3 of the building of Stonehenge, and they are the familiar ring of stones, with lintels. The green circle has a diameter of one-quarter of the N circle, which fits the inside of the Sarsen Stones. At one-quarter size, the green circle diameter is 1168.5″. Petrie measured this as 1167.9″ ± 0.7″, so it fits in terms of the limits of the surveyed measurements.

There are two other circles drawn in magenta. The larger of these two circles has a diameter of 942″, which is half the length of the1884″ of the Grand Gallery, which fits the Outer Bluestone Circle. The smaller circle has a diameter of 471″ which is one-quarter of the length of the Grand Gallery, and it fits the curved part of the Inner Bluestone Horseshoe.

There are, therefore, two significant provable correlations between the Great Pyramid and Stonehenge, the inner diameter of the Sarsen stones, and the number of Aubrey holes. The M circle may have fit the henge, but erosion of the banks may have washed away the evidence. There are no dimensions for the other circles at this time, so it is difficult to know if they fit or not. However, with two witnesses, it can be concluded that Stonehenge acts as a witness to a relationship between the Great Pyramid and Great Britain.

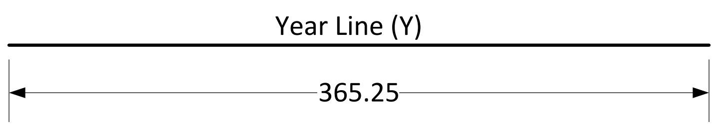
Pyramid Measurement Systems

Number of Days in a Year

Why is it essential for there to be 365.24 or 365.25, sacred cubits in the base length of the Pyramid? It is because the architect wants to draw our attention to the relationship between the Pyramid and time, specifically years. Time divisions during the day may change throughout history, but the length of the year in days is a measurable and definable value irrespective of history, language, or location. It does not change significantly. Its length is close to 365.24 or 365.25 days, which is a relationship that is so unique it cannot be missed or misinterpreted.

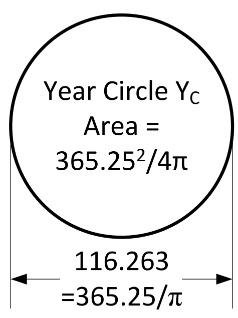
As will be seen, it has been determined that there are five different measurement systems used in the design of the Pyramid. These are the B″, the Sacred Cubit, the Royal Cubit, Remens, and the Nippur Cubit. Each system has a point to make. First, the relationship between the inch and the Egyptian cubit will be evaluated. Previous Pyramidologists have studied this relationship, which leads to a better understanding of the surveyed dimensions of the Pyramid. It also leads to a candidate measurement system, which is a dual system comprising the B″ and the Royal Egyptian Cubit. It uses the value of the number of days in a year, 365.25, which we have just seen in relationship with the exterior of the Pyramid.

The length of the solar year will be taken as 365.25 Julian days, which is a reasonable approximation as the Romans used it thousands of years ago, and astronomers use it today. As pointed out earlier, the actual number of days in a solar year does vary, so the use of a fixed value, such as 365.25, is wise compared to a value that varies over time. Slight variations in the length of the year are mostly understood and are catered for by modern astronomy through a function called delta time, ΔT. We can represent 365.25 days as a theoretical ″Year Line″, length Y, as follows:



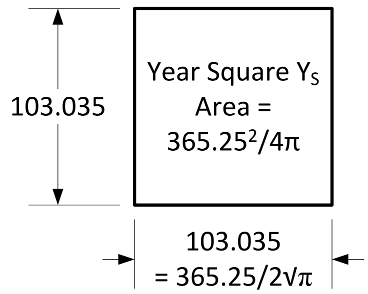
Year Line

If we wrap the line into a theoretical ″Year Circle″ so that its circumference (C) is 365.25″ then the diameter, Y_C, of the circle = Y/π = 116.26″ as follows:



Year Circle

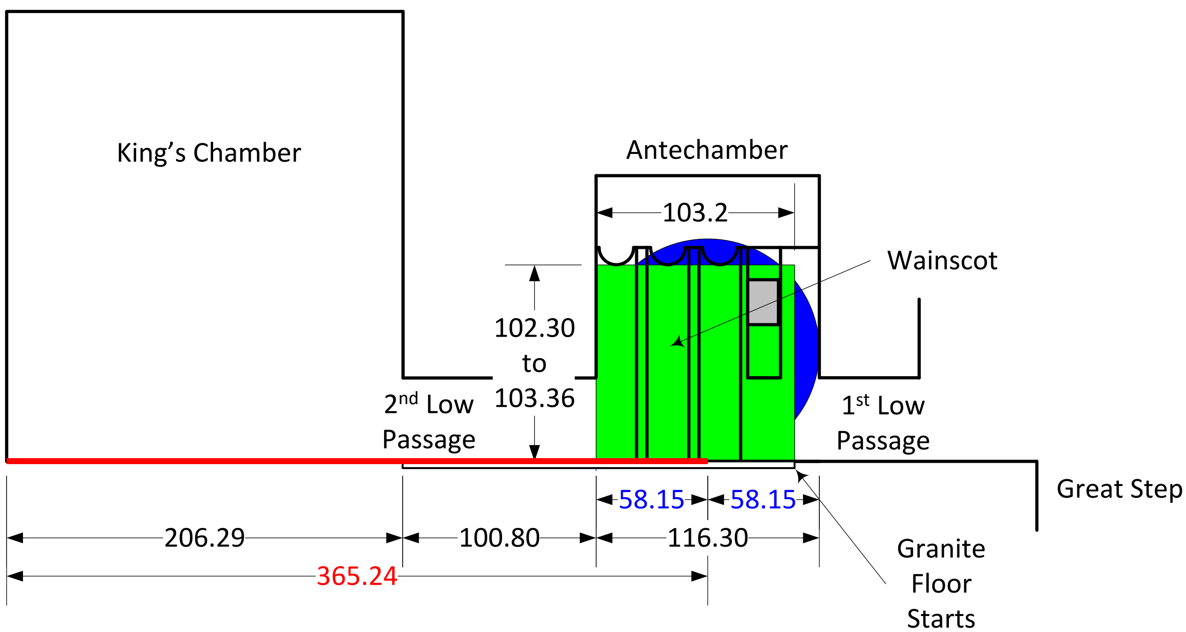
If we create a theoretical ″Year Square″ with the same area as the Year Circle, then the sides, length Y_S, are $Y_C/(2\sqrt{\pi})$ = 103.035″, which is about five cubits and is shown below:



Year Square

If we double this value, the result is 206.07, and it is noted that the values in the above Figures, 365.25, 365.25/π (116.263), and 365.25/√π (206.07) are all found in the Figure above where the external dimensions of the Pyramid are expressed in sacred Cubits of 24.83 B″.

Close approximations of all these features can be found in the low passages leading to the King′s Chamber, the Antechamber and the King′s Chamber itself as shown below:



All of the dimensions can be found in Petrie′s book ″The Pyramids and Temples of Gizeh″. The paragraph in which one of Petrie′s dimensions can be found will be denoted as ″Pxxx″ where ″xxx″ is the paragraph number in the above-referenced book. So in the above figure, the King′s Chamber width is from the ″Mean″ row in P52 for the east wall, 206.29″. The length of the 2nd Low Passage, 100.80″, is from P47, and the length of the Antechamber is 116.30″ from the last sentence in P48.

The sum of the King′s Chamber width, the 2nd Low Passage length, and half the Antechamber length is 365.24 B″ as shown in red in the Figure, which is 0.003% less than the proposed Year Line of 365.25 B″.

A Year Circle, based on the mean length of the Antechamber, is drawn in light blue with a diameter of 116.30 B″ is 0.03% longer than the theoretical Year Circle, 116.26 B″.

A Year Square is drawn in green in the Antechamber, which partly overlays the Year Circle is drawn around the perimeter of the wainscot, which is on the east and west sides of the Antechamber. The horizontal edge of this square is indicated by 103.2″ inches of granite on the floor at the south end of the Antechamber and the height of the wainscot up the wall, which is between 102.3 and 103.36″. Strictly speaking, since they fit within the ranges given by Petrie in P54, for five cubits, we can say that this portion of the wainscot indicates a square of five cubits or a Year Square.

Not so strictly speaking, it should be recognized that significant deformation has occurred from the Great Step in the Grand Gallery to the south-west corner of the King′s Chamber, which is due, undoubtedly, to earthquakes and subsidence. The survey measurements do vary significantly, as Petrie points out, but none-the-less these three features are intended to depict the Year Line, Year Circle, and Year Square. The fact that all three features are present and coincide in the middle of the Antechamber supports this conclusion.

The three features, therefore, indicate a relationship between the number of days in a solar year and the length of the cubit. If we take the length of the Year Line to be 365.25 B″, then the length of the cubit is the length of the side of a Year Square divided by five, which is 20.607 B″ which is one of the candidate measurement standards of the interior of the Pyramid. The equation for the candidate cubit is:

1 cubit = $365.25/(10 \times \sqrt{\pi}) / 5 = 20.60702$ B″

Petrie′s Cubit

It may seem a little out of place to search for the possible length of a candidate theoretical cubit, that is used internal to the Pyramid, with Petrie′s cubit at this point in the study, but it is essential to establish, or not, that it is in the right range. Petrie computes the most likely length of a cubit within the Great Pyramid in Chapter 20. His result is expressed as follows, P136:

"If a strictly weighted mean be taken it yields 20.620 ± .004; but taking the King's Chamber alone, as being the best datum by far, it nevertheless contracts upwards, so that it is hardly justifiable to adopt a larger result than 20.620 ± .005."

The cubit calculated above, 20.607 B″, is therefore 0.06% less, which is not within Petrie′s range of 20.620 ± 0.005 B″. The next step is to evaluate Petrie′s cubit calculations because, despite his opinion of the accuracy of his measurements, the same can not always be said of his calculations. For example, Petrie quotes, P18, that the value of the unit of coordinates associated with his triangulation data, in B″, is 0.00508259 ± 0.00000003. When the lengths of the sides of the Pyramid, according to Petrie, were checked, they were found to be about 0.75 B″ less than he calculated them to be. Petrie′s conversion unit was adjusted to 0.005083014 to match his results. Glen Dash had the same problem when he compared his survey results with Petrie as he reported in ″Where, Precisely, are the Three Pyramids of Giza? ″

As a second example, Petrie′s calculations for the angle of the Ascending Passage could not be understood based on the data in his footnote to P38, which could lead to large uncertainty in the length of this passage. Petrie′s calculations should be checked wherever possible as of course should those presented herein.

Petrie′s logic needs to be checked, too, regarding the data he uses to compute the probable length of the cubit, which is copied from P136.

Location	Cubit Length B″	σ_i	$1/\sigma_i^2$	Weighting Factor $1/\sigma_i^2/\Sigma_i(1/\sigma_i)^2$	Weighted Value
By the base of King′s Chamber, corrected for the opening of joints	20.632	0.004	62500.000	0.108	2.228
By the Queen′s Chamber, if dimensions squared are in square cubits	20.610	0.020	2500.000	0.004	0.089
By the subterranean chamber	20.650	0.050	400.000	0.001	0.014
By the antechamber	20.580	0.020	2500.000	0.004	0.089
By the ascending and Queen′s Chamber passage lengths (section 149)	20.622	0.002	250000.000	0.432	8.906
By the base length of the Pyramid, if 440 cubits (section 143)	20.611	0.002	250000.000	0.432	8.901
By the entrance passage width	20.765	0.010	10000.000	0.017	0.359
By the Gallery width	20.605	0.032	976.563	0.002	0.035
Weighted Average		$\Sigma_i(1/\sigma_i^{2)}$	**578876.563**	1.000	**20.621**
		$\sigma^2=1/\Sigma_i(1/\sigma_i^{2)}$	1.72748E-06		
Total Uncertainty		**σ**	**0.0013**		

The first three columns are Petrie′s data, excluding the last three rows. In the third column, σ_i is the individual uncertainty in the measurement of the cubit, which is assigned by Petrie. The fourth column is a step toward calculating the weight in the fifth column. The last column is the weighted value and the sum of the individual values to the value shown in the third from the last row. In the last row, the total uncertainty is calculated in column four. Petrie should have reported 20.621 ± 0.0013 B″, but it seems he made an error in the total uncertainty and reported 20.620 ± 0.004 B″. The total uncertainty is computed by summing $(1/\sigma_i)^2$, which is the inverse of the square of the individual uncertainties σ_i and then taking the square root of this in the last three rows of the fourth column. It seems Petrie may have taken the square root of 1.72748E-05 instead of 1.72748E-06. However, these are small errors and are insignificant.

Now some parameters need to change in the above table to comply with the theoretical Pyramid being defined herein, which is why this evaluation at this point in the study may seem out of place. However, continuing, Petrie′s logic says, P52:

"Probably the base of the chamber was the part most carefully adjusted and set out; and hence, the original value of the cubit used can be most accurately recovered from that part. The four sides there yield a mean value of 20.632 ± .004, and this is certainly the best determination of the cubit that we can hope for from the Great Pyramid. "

and in P51 Petrie says:

"This diagram will represent with quite sufficient accuracy, without numerical tables, the small errors of this chamber; especially as it must be remembered that this shows its actual state, and not precisely its original form. On every side the joints of the stones have separated, and the whole chamber is shaken larger. By examining the joints all-round the 2nd course, the sum of the estimated openings is, 3 joints opened on N. side, total = .19; 1 joint on E. = .14; 5 joints on S=.41; 2 joints on W. = .38. And these quantities must be deducted from the measures, in order to get the true original lengths of the chamber. I also observed, in measuring the top near the W., that the width from N. to S. is lengthened .3 by a crack at the S. side."

Selecting the base of the King′s Chamber as being the most carefully adjusted and set out is not necessarily the logical approach. As Petrie notes, the whole chamber has been shaken apart, and he knew, though sometimes seems to ignore, that it has been distorted through subsidence. It would have been more logical to have selected the circuit of the course with the shortest length as this would be the one that is the least shaken apart. Also, Petrie had to have observed the gap between the raised floor and the walls as he used it to insert a rule to measure the depth of the walls below floor level. Surely this would have told him that the lowest course of the walls had been shaken apart more than he allowed for as one would have expected no gap between them and the floor. He should have taken the shortest course as better, representing the chamber dimensions, which is the top course. Also, this course has only seven stones and, therefore, fewer gaps to be shaken apart compared with twenty-six for the bottom course. In the following table, the dimensions of the top course have been substituted for the dimensions of the lowest course and assuming the width to be ten cubits and the length twenty cubits.

Petrie also assumed that the basic dimensions of the King′s and Queen′s Chambers were based on square roots of round numbers like 100. For the Queen′s Chamber length, he assumed it was $\sqrt{120}$ rather than, more simply, eleven, which made the cubit representation 20.674 for the length versus 20.585 for the width. Had he used 11 instead, then the length would have given a cubit value of 20.588, which is closer to that obtained for the width, and is a more consistent value for that chamber. The heights of the walls in this chamber are also in cubits but not round numbers, so they have been ignored. As a result, the value of the width of the Queen′s Chamber is ten cubits, while its length is eleven cubits.

It will be shown in the new theory that the Subterranean Chamber, Antechamber, Ascending and Queen′s Chamber Passages and the Base of the Pyramid were designed in Remens or inches, or derivatives thereof, so they have been omitted from the revised Table below.

The Entrance Passage has been extended to include the Descending Passage, too, and the Gallery width has been maintained as in the Table above.

So the revised Table, based on the new theory and relevant parts of Petrie′s survey data, is shown below:

Location	Cubit Length B″	σ_i	$1/\sigma_i^2$	Weighting Factor $1/\sigma_i^2/\Sigma_i(1/\sigma_i)^2$	Weighted Value
By the mean of the top course of King′s Chamber	20.606	0.004	62500.000	0.946	19.491
By the Queen′s Chamber, if dimensions are in integer cubits	20.587	0.020	2500.000	0.038	0.779
By the entrance and descending passages width	20.910	0.100	100.000	0.002	0.032
By the Gallery width	20.605	0.032	976.563	0.015	0.305
Weighted Average		$\Sigma_i(1/\sigma_i^{2)}$	**66076.563**	1.000	**20.606**
		$\sigma^2=1/\Sigma_i(1/\sigma_i^2)$	1.5134E-05		
Total Uncertainty		σ	**0.004**		

Therefore the new theory indicates the most likely value of the cubit, based on Petrie′s data, is equal to 20.606 B″ ± 0.004 B″. The value computed earlier based on the Year Line, Year Circle, and Year Square/5 of 20.607 B″ fits within this range.

It can be concluded that this single candidate, the Royal Cubit, is also a strong candidate for one of the measurement systems of the interior of the Great Pyramid. It requires at least one more witness to confirm this conclusion.

The Royal Cubit is based on the B″ and a derivative of that, which is the Remen, and a derivative of the Remen, which is the Nippur Cubit, are both used in the interior. The latter two are, therefore, derivatives of the B″.