THE HORIZON THEORY, PART-I: Original Concept Plan of the Pyramids Plateau

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Paper presented during the International Conference of the UIA-WPAHR-V
On Architecture & Heritage as a Paradigm for Knowledge and Development
Lessons of the Past, New Inventions and Future Challenges
From 2 to 4 March 2002, at Bibliotheca Alexandrina

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1- Abstract.

This paper shows the astronomical criteria that the designers of Giza pyramids may have used in order to design the site plan of the three pyramids. It proves that pyramids designers did study the daily motion of the sun during the year in their days. Based on their findings they set the positions of the three pyramids in the horizon of Giza plateau to encode astronomical information regarding the daily motion of the sun in a specific year, that namely: the meridian angle on vernal equinox, the meridian-altitude angle on summer solstice, and the sunrise angle on summer solstice. Accordingly, the encoded date of design in Giza pyramids was identified as 3055BC approximately. It is based on identifying the tilt of earth's axis (obliquity angle) in their days (24.10°), and reckoning the number of years between it and the current tilt (23.44°) of the earth.

Keywords: Giza Pyramids – Pyramids Horizon – Egyptian Astronomy – Archaeoastronomy

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1- Introduction.

The horizon[1] theory[2] belongs to the ancient Egyptian architects who built the pyramids of Egypt almost five millenniums ago. This paper is the first step towards reviving it. The theory deals with the pyramidal ideology, its design principles and its related knowledge and sciences. It depends on, and draws from, astronomical theories and cosmic sciences. It links time with space dimensions. As we understand from the text of Al-Maqrizi, the following paragraph is a modified version of an old story on the pyramids that was mentioned in an old golden plate that was found and translated during the days of King Philip (father of Alexander), which is based on a dream of King *Soraied*[3]. It should be kept in mind while reading this work.

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[1] -The horizon is the apparent junction of earth and sky -- called also apparent horizon (Webster, 1975, p.401). The term horizon means in this work a circular domain within which astronomical information were encoded in architecture design.

[2] - The term theory means in this work the presumed architectural design principles based on using basic sciences.

[3] - (Al-Maqrizi, 1845, Vol. I, pp. 216-217), the golden plate was duplicated in papyri during different eras.

Based on the order of King *Suraied*, the master priests or *(Jedars)*[4] of ancient Egypt studied the mathematical law of the lifecycle of the celestial bodies, almost five millenniums ago. They were able to determine then, based on their scientific knowledge in basic sciences (mathematics, geometry, chemistry, physics, astronomy, etc.) the timeframe of the frequent super-natural disasters of the earth. Their calculations had ensured them that the coming earth disaster will occur after four hundred years from their days. Soon they informed their King *Soraied* to build an architectonic project to save the accumulated scientific knowledge of the Egyptians for the new generations of the next cycle. It seems that, they believed, as it was dominant in their days that the ordinary people should not know this type of knowledge; hence, it should not be recorded in a written form. They had decided instead, to record their basic sciences in geometric and numeric forms. The structures we name today as the "Giza pyramids" and its integrated-site might be the hard disk(s) that within which all the laws of basic sciences that were discovered and understood by the Egyptian priests of a previous astronomical earth cycle had been recorded. These pyramids and its integrated-site might be the horizons of the earth knowledge. Perhaps, if this was true, one can say that the supreme objective[5] of the pyramids project encouraged the ancient Egyptians to participate financially in their implementation. This story may be seen like those of the nowadays' movies of science fiction. In fact, the scientific proof of the whole story cannot be covered in a single research paper. The scientific findings of the present work show a prelude to its full display.

Scientifically speaking, this primary endeavor will show and translate, in words, simple mathematical formulas, and geometrical diagrams, one of the encoded messages (files) that are related to the design of Giza pyramids plateau. It briefly describes the principles of its original design concept; and how the designers planned it from an astronomical point of view. Besides, it aims to correct some views, conceptions, and information that were inserted in many historic books on the pyramids of Egypt. For example, first, some historians think that the pyramids architects did waste national resources to build nothing more than tombs. Second, some amateurs imagine wrongly that the pyramids builders were extraterrestrials. Third, the authors of books of the history of sciences declared that basic sciences in general, and astronomy in particular, were originated by the Babylonians and then improved by the Greeks; some have argued that the contribution of the ancient Egyptians in astronomy was limited[6]. Fourth, there is disagreement between scientists and historians regarding the time when Giza pyramids were built.

This paper is structured in three parts. The first part discuses the core issue of searching on pyramids' design-principals. It follows the research technique of social sciences that draws its conclusion based on qualitative arguments. The second part is an attempt to retrieve the Egyptian priests' scenario for recording the observed daily motion of the sun. It draws its conclusion based on establishing an array of logical and practical assumptions. The third part discuses the design principles of horizon of the three pyramids in Giza plateau. It follows the research technique of basic sciences that draws its conclusion from facts and based on a mathematical proof.

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[4] - Al-Maqrizi said they were 130 priests.

[5] - Historians think that pyramids are only tombs. On the contrary, architects may not consider that tombs were the main function of Giza pyramids; if the chambers inside Giza pyramids were used as tombs, perhaps they are similar to the mausoleums that was add to, or found in, the medieval mosques in Cairo.

[6] – (Olaf Pedersen, 1993).

2- Defining the Core Issue.

The pyramids of Egypt were subjects of scientific researches for many centuries. Many scientists and archaeologists focused on the three pyramids in Giza plateau. They were, and still are, trying to find answers for many questions, such as: (i) Why, and how, the Egyptian Kings built the pyramids? (ii) Why the designers used this geometric form? (iv) What their measurement unit was? (v) Has it any relation to basic sciences like mathematics, physics and astronomy? (vi) What is the basic design concept behind the alignments of the three Giza pyramids? During the last two decades, few researchers investigated the supposition that the designer of these pyramids and its site could have been scientists, who create designs based only on sound scientific theories and not based on false imaginations, e.g. the web site of Giza Pyramids Association includes many of these researches (www.gizapyramids.com). However, some are still in the process to find logical scientific answers within the frontier of science that, until then, were discovered by man. Thus, some have argued that they might were aliens and accordingly the design theory of the pyramids is not discovered yet.

In fact, it is difficult to use today's sciences to trace the design principles of such architectonic artifacts that were designed with the aid of undocumented sciences. As time goes on, the frontier of sciences gains newly discovered scientific theories and thus it expands. However, few of the new theories were effective when applied, for decades, in different circumstances. Besides, in the architectonic realm, people always think that the new theories might achieve their welfare-dreams in a more effective way, and thus old theories are usually forgotten if they were not documented. During the short lifetime of a person, in comparison to the lifetime of the humanity, one can hardly observe, in the architectonic field, the consequences of a complete shift-in-application from one theory to another. For example, suppose that universities of the world had stop teaching the design theories of skeleton structures for thousand years and taught instead other new theories, which are completely different and all the documents of the old theories were lost. Most likely, the civil engineers of the future generations will not be able to understand how the still-standing skeleton structures are structurally working, unless they find out how to retrieve the design theories that were used in their designs and implementations. Similar example is arising today, most of the civil engineers that were graduated, during the last three decades, at the universities of many countries of the world know very little about the theories of megalithic, masonry, or bearing-walls' structures. It was due to the shift from teaching the old theories of bearing-walls structures into teaching the nowadays theories of skeleton structures. Thus, in the coming decades many countries will face the problem of lacking the local expertise for restoring the structures of the masonry architectural heritage. In fact, one can argue that similar shifts were occurred in other fields of sciences too.

The above may answer the question: why today's engineers can hardly find out the lifting methods and techniques that were used to construct the ancient megalithic structures? The scientific papyri that describe these techniques were not found in Egypt or elsewhere. The historians[7] did mention few general stories on this subject. Thus, today's scientists are trying to discover these ancient techniques; some believed that the ancient architects were using some sort of anti-gravity systems in order to lift the large stones.

[7] - Herodotus (484-425 BC) mentioned that the ancient Egyptians had used a lifting device called *krosay* to lift the large stones of the pyramids (Herodotus, Arabic edition, 2001, p.190).

Besides, as mentioned earlier, many endeavors have been made towards understanding the basic concept of pyramids design. The world-wide-web includes hundreds of researches and articles on these subjects and that many of them are related to the Egyptian pyramids; however, until now nobody did find a solid scientific[8] conclusion for any of the two architectural issues in hand, that namely: pyramids' construction techniques and pyramids' design principles.

Today, in the industrial field, the term "reverse-engineering" means retrieving the knowledge behind the design concept and the production process of such a machine of a known function and that was produced by others. Similarly, the architects have used to retrieve the design principles of an ancient building of a known function. In both cases, the researchers do succeed in these processes because they know the functional-objective of the machine or the building under consideration. Regarding the pyramids, the problem is completely different; the keen researchers cannot easily decide about what was their functional objective. Therefore, in this case, the retrieval process will primarily focus on the educational paradigm of the ancient Egyptian architects (priests) in order to discover the knowledge behind the design of the pyramids and their integrated-site. Medieval historians[9] said, "Pyramids' designs are based on excellent astronomical knowledge." However, none of the nowadays architects have tested this postulation, i.e., is it correct that they had used the astronomical knowledge as architectural-design-principles, and interpreted it into architectural language. Accordingly, the core issue of the retrieval process is to find out, how had the architects of Giza pyramids plateau learned the basic astronomical knowledge and interpreted it into architectural designs.

3- The Scenario of Assumptions: the Sun as a Source of Astronomical Knowledge.

To date, Egyptologists did not find any scientific papyrus[10] on the ancient Egyptian astronomy[11]. Today's scientists, therefore, believe that the contributions of the ancient Egyptians in this field were limited[12]. Although the design of the temple of Abu-Simple and the diagram of constellations (zodiac) of Denderah temple does not show the astro-mathematical formulas that support their perfect designs, today's scientists consider them as products of skilled astronomers. However, some scholars believe that the latter was designed during the Hellenistic period[13]. On the other hand, other than the false assumption of adjusting the tilt of the great pyramid's entrance-passage to point to the North-Star, or aligning the pyramids[14], Giza pyramids in general have no other signs in relation to spherical astronomy that could be noticed by normal observation.

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[8] - The term scientific means in this work only what is based on an eternal mathematical formula that its result will be correct regardless the change in place and time. The eternal formulas are the bases of the architectonic structure of the cosmos, which never include local or empirical constants. The ancient philosophers discovered quite some of them. For example, in geometry, what is called the theory of Pythagoras that defines the relation between the sides of the plane-triangle of a right angle is an eternal formula.

[9] - See for example: (Al-Masoudi, 1987, Vol. I, p. 361), and (Al-Maqrizi, Bulaque edition, 1845, Vol. I, p. 216).

[10] - The ancient Egyptians were recording their sacred sciences in papyri that were used only by the priests; it seems that recording sacred sciences on walls or on steles for the public was prohibited in ancient Egypt.

[11] - See for example the conclusions of the archaeologists in (Selim Hassan, 2000).

[12] – (Olaf Pedersen, 1993).

[13] – (Selvie Cauville, 1993).

[14] – (Kate Spence, 2000).

Besides, using the modern astronomical theories to analyze the pyramids design concept is an imperfect methodology. This is because the researchers, in this case, might presume that the pyramids architects were thinking like the astronomers of today. In addition, it seems that researchers can hardly trace the advancements in astronomy during the three millenniums before the days of Pythagoras (approximately 550BC). They faced the problem of defining which theory was discovered first.

Therefore, this part of the paper is an attempt to retrieve some astronomical principles that might have been used in the design of the horizon of the three pyramids in Giza plateau. This retrieval process will be based on establishing a hierarchy of basic-assumptions that together might form a logical scenario. The validity of this scenario will be tested quantitatively, by linking its likely accumulated knowledge with the geometric survey data of the site-plan of the three pyramids in Giza plateau.

As a point of departure, assume that Giza pyramids are the outputs of ideal-thoughts of architects who studied not only some sort of architectural curriculum[15] but also basic astronomy. Then, a question might be asked: how to retrieve their scenario of searching on the basic astronomy? Of course, the retrieval attempt should be supported by both the basic information and the documented history of spherical astronomy[16]. However, this basic information should be kept in mind to be only a scientific reference for guiding the retrieval process without affecting the logical hierarchy of the flow of knowledge to the minds of the ancient Egyptian architects.

Logically, their original source of astronomical knowledge should be identified first, presuming that they were working only during the daytime[17]. Without doubt, in their days, the sun was the only possible source of astronomical knowledge during the daytime. Then, one more question should be asked: how they extracted information from its observed but indirect daily motion[18], using primitive tools? Probably, their scenario was based on recording, in each day of the year, the changes in both positions and lengths of a shadow of a vertical post, which it stands in a leveled ground. It is known today that, the observed daily motion of the sun has an array of two basic-values that were, and still are, used in the field of architecture. The first is the value of the daily horizontal angle (azimuth) of sunrise[19] (or sunset) that architects have used to measure it from the east (or west) coordinate-direction of the place.

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[15]- Al-Maqrizi (1364-1442 AD) the Great Egyptian historian has mentioned that, "there were seven schools in ancient Egypt. Each school was for specific field and was named after one of the seven moving stars: the Sun, the Moon, Mercury, Venus, Mars, Jupiter and Saturn. The period of study at each school is seven years, and each of their graduates was called *Baher* (Brilliant). The priest who graduated from the seven schools, who spent 49 years of study, was called *Quater* (Master); his respectable status was just below the king of Egypt." (Al-Maqrizi, Bolaque edition, 1849, Vol. I).

[16] - Such as: (Olaf Pedersen, 1993), (Carlo Nallino, 1993), & (A. Weigert & H. Zimmermann, 1990).

[17] - The same scenario could be done at nighttime, during the nights of full moon, from the moment of moonrise until the moment of moonset.

[18] - The earth rotates around the sun, but the observer from the earth sees the opposite of reality; he sees the sun in an indirect motion.

[19] - It is the moment at which half of the sun disk being above the tangent line of the observed horizon. It is also the moment at which the centerline of the sun being the tangent of the plane of the horizon.

The second is the value of the daily vertical angle of the sun, when the sun meets, or being at, the meridian of the place[20]. Their scenario for measuring and recording these angles, during the daytime, might was consist of four steps, presuming that they were able to put tasks in order. Firstly, marking on a leveled site[21] that its perimeter was circular in shape, and that was a small horizon-model similar to the natural observed horizon, the frequent positions of end of a shadow of a vertical-post (like an obelisk), which it stands at its center. Secondly, the identification of the two main coordinates of the place by following the method that will be mentioned in the next paragraph. Thirdly, measuring and recording the values of the horizontal-angles of sunrises and sunsets. Fourthly, measuring and recording the values of the sun's vertical angles (altitude), when the sun meets, or being at, the meridian of the place, as shown in fig-1 & fig-2.

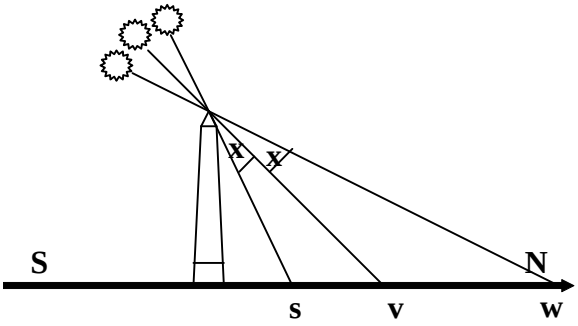

Figure-1: The vertical angles (altitude) of the Sun, when it meets or being at, the meridian of the place; the angles, from left to right, (S) belongs to summer solstice, (V) belongs to vernal equinox, and (W) belongs to winter solstice (looking towards the west); and (X) is the earth's obliquity angle.

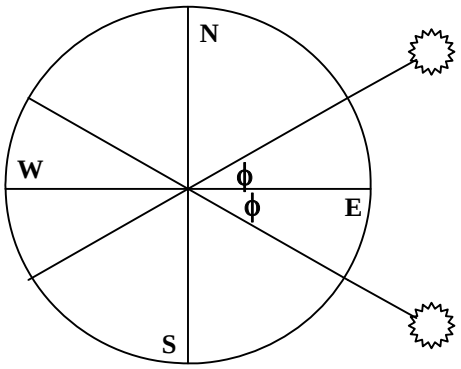

Figure-2: A horizon's plan that shows the horizontal angles of sunrises ϕ; from top to bottom, on summer solstice and on winter solstice. Between these two extremes, the sun goes back and forth during the year, having a specific sunrise angle for each day of the year.

Most likely, they identified the true geographic north[22] at any place, by using the shadow of a vertical post (like an obelisk). In fact, the daily process of marking the end of a shadow of a vertical post draws, an extrovert or introvert, semi-hyperbolic curve on a leveled ground; taking into consideration that each day of the year has a specific curve. The true geographic north-south axis might have been identified then as the line that divides, into equal parts, the angle between any two shadow-lines of equal length that were measured from the vertical post (obelisk) to the marked curve, as shown in fig-3.

[20] - The meridian of any place is the south to north geographic axis, or vertical plane.

[21]- The ancient Egyptians used side dips (canals) that were filled with water to level the pyramids sites, see the findings of Mark Lehner (1983, pp.7-25).

[22]-The true north is the direction of geographic north from the observer, i.e., the direction along the meridian towards the North Pole (Jahon Whttow, 1994, p.554).

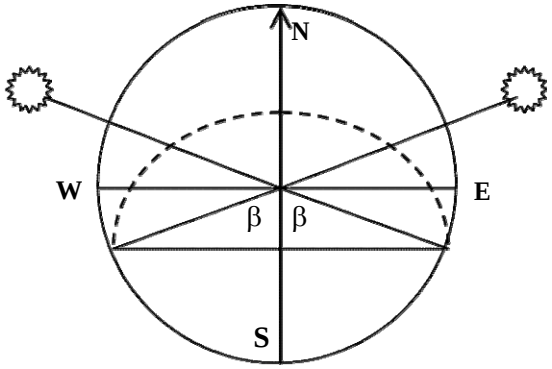

Figure-3: Identification of the true geographic north.

If they were doing the above four steps for years, they might have established an array of yearly records that could be compared in order to draw-out additional results and conclusions, presuming also that they knew how to do comparative analysis. Then, if they were well versed, they might have recognized that those angles were changing every year. Based on the nowadays' astronomical knowledge, the sunrise or sunset angles on both summer and winter solstices are decreasing, the meridian angle on winter solstice is increasing and the meridian angle on the summer solstice is decreasing. However, in their days, they could have noticed the accumulated sum of yearly changes only after several decades. Concerning the meridian angle on winter solstice, at the latitude of 30° north, the shadow of a 20m-height post (e.g., an obelisk) would be increased by almost one centimeter after 75 years. They might have noticed too that the sun was rising from the exact east-direction and was setting to the exact west-direction on only two days of the year, which are known today as the two days of the equinoxes.

Concerning the calculations, suppose that they were untaught about reckoning the value of an angle[23]. No doubt, they could have got the same results by using only the trigonometric ratio of the tangent. The array of tangent ratios would have been enough in order to get the similar hierarchy of relative values, as the case of using the values of angles. The discovered mathematical papyri[24] of the ancient Egyptians show that, during the middle kingdom, they were able to get the breakdown of any ratio, which was the base for comparing fractions of numbers, similar to the nowadays system of comparing the decimal-numbers. However, the architecture of this period was not as sophisticated as that of the pyramids and thus, the mathematics during the old kingdom must was better or at least equivalent to that of the middle kingdom.

Moreover, while they were comparing their results, they might have noticed too that, in each year, there are days that have the same values of sunrise angles. If this had happen, then it is likely that they discovered the fact that the sunrise angles of many days during winter (and spring) were equal to the sunrise angles of other days during autumn (and summer); and the

[23] - Today the ability to define the exact value of an angle, from its trigonometric ratio, is based on knowing the modern value of Pi, which equals 3.141592654 in most calculators. In the so-called papyrus Rhind, Pi = 256/81. However, one can manually get the exact value of an angle, without knowing the value of Pi, using the binary series: 2, 4, 8, 16, 32, 64, etc.

[24] - This link www.noisefactory.co.uk/maths/history/hist006.html shows the 2/n table, in the so-called "Rhind (or Ahmes) mathematical papyrus. It shows the decomposition of the fractions that their denominators are odd numbers. See for example the general explanation of this rule in the works of (G. Sarton, Arabic Edition, 1957, p.102), and (John McLeish, Arabic edition, 1992, pp.72-74). However, their explanations did not include the "the unified original rule" of the ancient Egyptians for getting the architectonic decomposition of any fraction.

order of this array of two matching days (the twins days) was not changing. Then, if they were numbering their days that might were starting from the moment of sunrise and began with the sunrise of the vernal equinox (March 21), they might have established a table of daily sunrise-orientations. The original orientation of the axis of the temple of Abu-Simple, before its relocation, proves that its architect knew that the sunrise angle of the day number 215 (October 21) was precisely matching the sunrise angle of the day number 338 (February 21). In this regards, the scholars who supervised the relocation project of that marvelous temple during the sixties of the last century were not able to conserve the original astronomical orientation of this temple. They changed the dates to October 22 and February 22 with a shift of two days, i.e., October 22 is the twin of February 20, and October 20 is the twin of February 22.

Furthermore, if they did the same experiment at other places in the Delta of Egypt and along the banks of Nile River and compared the data of these places, they might have noticed two facts concerning the value of the meridian angle of the sun on the equinoxes. First, it was changing as they moved along the south-north direction. Second, it was not changing as they moved along the east-west direction. If this supposition was correct, then they might have used this fact to establish a system of east-west geographic axes or latitudes[25]. However, it should be taken into consideration that if they were untaught about that, the earth is spherical in shape, and then their east-west geographic axes might have been named after the values of the meridian angle of the sun on vernal equinox. Their number for the latitude of Giza plateau might was 60°; today's astronomers use its complementing value 30°.

Likewise, if they were comparing the values of the meridian angles of the sun on summer solstice, on winter solstice, and on vernal equinox, they might have noticed other fact. That is, the value of the meridian angle on vernal equinox was always the median between the values of the two extremes, on winter and summer solstices. To explain this based on the nowadays' astronomical information, the meridian angle of the sun on summer solstice is equal to its value on vernal (or autumnal) equinox plus the value of the obliquity[26] angle of the earth. Modern astronomers said[27] ,"the obliquity of the earth oscillates between 24.30° & 21.91° within a period of forty thousand years (twenty thousand years each way); its current value is 23.44° approximately, in the descending path, which diminishes by 0.47 arc-second per-year." Accordingly, today, in Cairo the meridian angle of the sun on summer solstice has a value of 83.44° approximately (equal to 60° plus 23.44°). On the contrary, the meridian angle of the sun on winter solstice is equal to its value on vernal equinox minus the obliquity angle of the earth. This means, today, in Cairo the meridian angle on winter solstice has a value of 36.56° approximately (equal to 60° minus 23.44°).

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[25] - The latitude of any place is equal to 90° minus the value of the meridian angle of the sun on the equinoxes, i.e., on March 21 or on September 23 (Carlo Nallino, Second Edition, 1993, p.270).

[26] - Obliquity is the angel between the planes of the earth's equator and orbit, having a mean value of 23.44° in 1960, and diminishing 0.47 second of arc per year (Webster, 1965, p.582), see also (A.Weigert & H. Zimmermann, 1990, p34, p205 & p521).

[27] - (A. Weigert & H. Zimmermann, 1990, p 205).

Based on the results that were concluded through doing their previous experiments, they might have also known how to measure the time and define the year. Apparently, they defined their year as a cycle that contains 365 sunrises. It may was starting on the sunrise of vernal or autumn equinox, in theirs days. Al-Maqrizi (1364-1442 AD) said, "the beginning of the ancient Egyptian agriculture year (probably during the new kingdom) was few days after the autumn equinox". Besides, probably, they used the values of the meridian angles of the sun on summer solstices as a tool in order to record specific moment in their history.

To conclude this part, the above scenario of assumptions shows that the ancient Egyptian architects and priests (*Jedars*), could have been able to know some basic astronomical knowledge via recording the observed daily motion of the sun, using the primitive tools. The third part of this research is an attempt to prove that they used this basic knowledge as design-principles in order to formulate the contents of the first encoded file in the horizon of the three pyramids in Giza plateau.

4- Original Concept Plan of the Pyramids Plateau.

It was assumed earlier that Giza pyramids and its integrated-site are the hard disk within which all the laws of basic sciences of a previous astronomical earth cycle were recorded (a cycle is 10 degrees of arc in the tropical zodiac, about 720 years). Some may argue that this postulation is illogic. In fact, a similar example is quite well known today. During the twentieth century, computer scientists had invented the binary codes that enabled modern societies, among other useful uses, to record many forms of data (text, graphics, sounds, etc.) on computer disks. However, those who know nothing about computers might not be able to recognize the value of a compact disk that contains, for example, the Encyclopedia Britannica (or Americana). They may see it as only a fine piece of plastic/metal. Similarly, some may see the pyramids as only hills or pieces of stones. On the contrary, one can argue that, the designer of Giza pyramids and its integrated-site did the same thing; he might have used special numeric and geometric codes to record his knowledge, e.g., the encyclopedia of the ancient Egyptian sciences. The analyses of this part of the paper will be based on a presupposition that Giza pyramids' designer used the horizon model of two-dimensions.

As a background-information, the horizon of Giza pyramids includes seven main elements, that namely: three large pyramids, Sphinx, causeway of the second pyramid, and two temples. As a primary postulation, the design concept of this horizon includes files of encoded messages that describe some of the basic theories on spherical astronomy and mathematical sciences of the Egyptian priests of the old kingdom. Here below is the translation of one of these files on "basic astronomy," which forms the main design concept of the horizon of the three pyramids in Giza plateau. It was based on the horizon's model that has been discussed earlier. This file includes the idea of the alignments of the three pyramids, based on the knowledge that were extracted only from the observed daily motion of the sun, and which accordingly defines the encoded date of design or implementation of Giza pyramids.

Based on studying the exact locations of the three pyramids and the sphinx, using survey maps and the published results of Petrie's survey[28], it was found that the site plan of Giza pyramids forms a horizon model in the plane of two-dimensions. The center of this horizon is the point of intersection between the north-south axis of the great pyramid and the east-west axis of the Sphinx; they are the two main axes of the horizon of Giza pyramids.

[28] - (Petrie, 1883, p.125).

Through long process of trial and error, the radius of this horizon was found 746m. Fig-4 shows the basic concept-plan that followed the recorded data of the daily motion of the sun in their days, presuming that an imaginary vertical post (or an obelisk) of 746m height, which it stands at the center of this horizon in their days, as shown in fig-5. The following discuses the geometrical alignment of the three pyramids in relation to the observed daily motion of the sun.

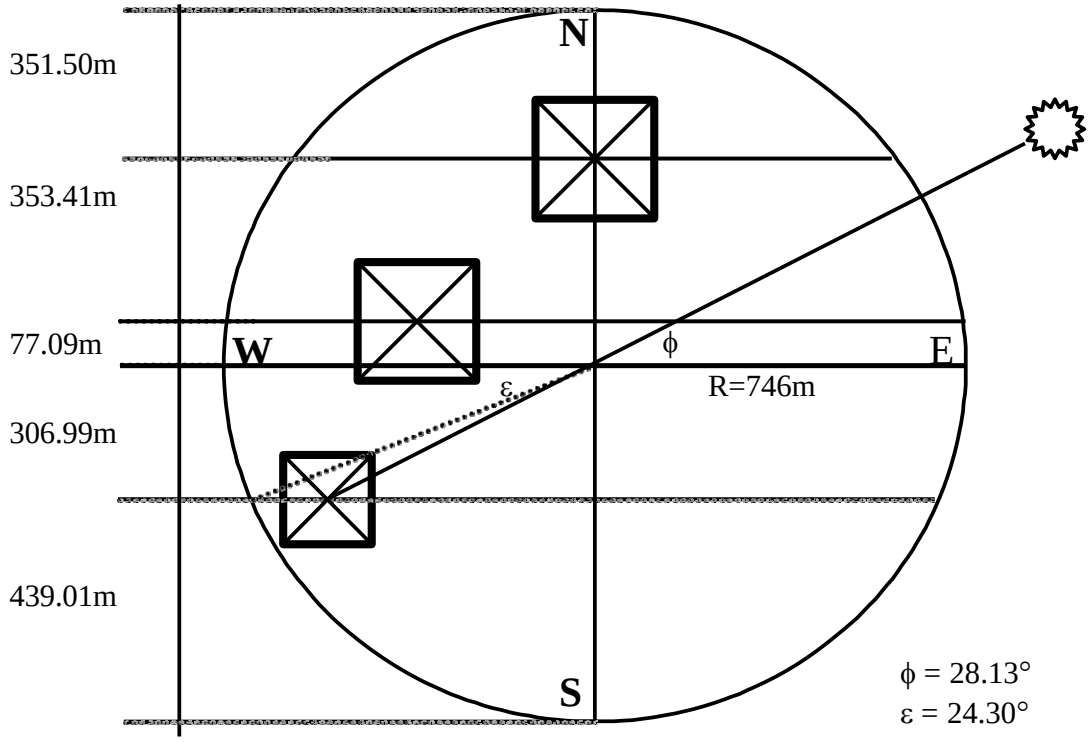

Figure-4: The original concept plan of the horizon of the three pyramids in Giza pyramids plateau.

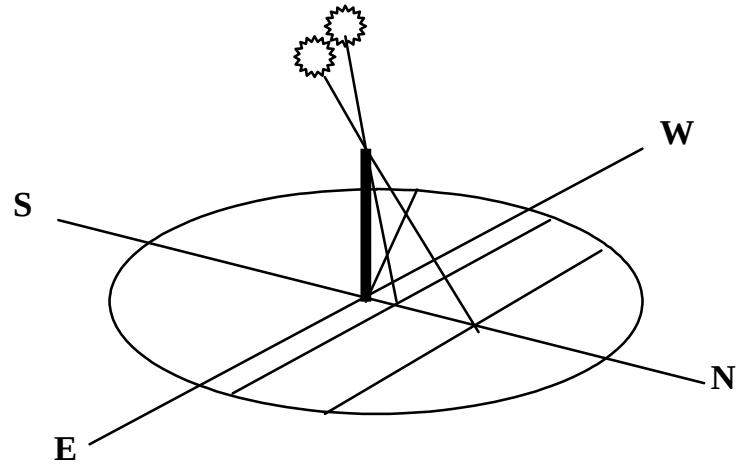

Figure-5: A perspective shows the three basic information of the horizon: the meridian angle (altitude) on vernal equinox, the meridian angle on summer solstice, and the sunrise angle on summer solstice.

First, the center of the great pyramid followed the meridian angle of the sun on vernal equinox (θv), at the end of the obelisk's shadow. Therefore, the location of the great pyramid (or its center) was identified to link the horizon with the latitude of the place, or to identify the latitude to which the horizon was linked. Thereupon, the distance from its center to the center of the horizon (L1) could be reckoned as follows:

θv = 60°
L1= 746 / (Tan θv)
L1= 430.70m

Second, the center of the second pyramid followed the meridian angle of the sun on summer solstice (θs), at the end of the obelisk's shadow in their days. Therefore, the location of the east-west axis of second pyramid (and its center) defines the exact date of implementation of the horizon. The north to south distance from its center to the east-west axis of the horizon (L2) defines the obliquity angle of the earth in the year of implementation (or the encoded design date) of the horizon, and its basic architectural elements. However, the east-west alignment of this pyramid followed the astronomical knowledge of another encoded file, which is out of the scope of this research. Thereupon, the distance (L2) and the implementation date could be identified as follows:

Tan θs= 746 / L2
L2= 77.09m (it was measured from a survey map and corrected through trial and error)
Tan θs =746 / 77.09 = 9.6767
θs = 84.1° approximately.
θs = 60° + Obliquity angle in the year of implementation (or date of design).
Obliquity angle in the year of implementation = 84.1° - 60° = 24.1° approximately.
Today's obliquity angle = 23.44° approximately.
The difference between obliquity values = 24.1°- 23.44°= 0.66° approximately.
The diminishing value of the earth's obliquity per year = 0.47 arc-second approximatel.
Total difference in years = (0.66° * 60 * 60) / 0.47 = 5055 years approximately.
Then, the encoded date of design (or implementation) was 3053 BC approximately.

Third, the center of the third pyramid followed the sunrise angle on summer solstice (ϕ) in the year of design/implementation of the horizon. By calculation, the value of this angle was found 28.13° approximately. The author has developed the following (geocentric) formula in order to identify the approximate value of this angle[29]; it should be measured from the east coordinate of the place.

Sine sunrise angle on summer solstice = Sine obliquity angle / Cosine latitude angle
Sin. ϕ = Sin. 24.1° / Cos. 30°; then, ϕ = 28.13° approximately (a geocentric value).

[29] - The proof of the above formula is out of the scope of this research. The reader may check its accuracy by comparing its result with the published data of any place on earth. For example, the data that was mentioned in (Neufert, 1975, pp.80-81) shows, at latitude 51.5° the sunrise angle on winter solstice was 50.2°, which was measured from the South coordinate. Accordingly, its value was 39.8° from the east coordinate of the place. The above formula gives the same result. The reader may also test it in the field on winter or summer solstices.

The center of the third pyramid was placed at the intersection between the shadow of the imaginary obelisk and the east-west chord that defined the maximum obliquity angle of the earth[30], which has a value of 24.30°. This is because the plan of the horizon is like a rotated cross-section in a spherical coordinates system where its center represents the earth, i.e., the center of this system. This shadow occurred at the moment-of-sunrise, on summer solstice in the year of implementation of the horizon. So, the north to south distance (L3) from center of the third pyramid to the horizon's main east-west axis could be identified as follows:

$$L3 = 746 * \text{Sin } 24.30°$$
$$L3 = 306.989\text{m}$$

In addition, the east to west axial distance (E3) from center of the third pyramid, to the north-south axis of the horizon, and the great pyramid, could be identified as follows:

$$E3 = L3 / \text{Tan } 28.13°$$
$$E3 = 306.989 / 0.53462$$
$$E3 = 574.21\text{m}$$

Fourth, table-1 compares the results of the survey that was carried out by Petrie in 1883[31] and the results of the above calculations, which shows very minor differences.

Table-1: Comparison between the Petrie's surveys data and the results of reckonings.

Ranges of distances	Petrie 's survey data, 1883	The results of Reckonings
North to south axial distance from center of the great pyramid to center of the second pyramid	353.86m * (13931.6 inches)	353.41m (L1- L2)
North to south axial distance from center of the second pyramid to center of the third pyramid	385.32m * (15170.0 inches)	384.08m (L2+L3)
East to west axial distances from center of the great pyramid to center of the third pyramid	574.44m * (22616.0 inches)	574.21m (E3)

* (One inch = 0.0254 meter)

5- Conclusion.

This paper extracted and attempted to explain the first, and possibly the simplest, file in the concept plan of the horizon of the three pyramids in Giza plateau. Apparently, the horizon, including its basic architectural elements, was one project; however, the implementation of these elements might have lasted for several decades. No doubt, its designer was a knowledge-based architect, who creates architectural concepts based only on scientific theories. Although, the ancient Egyptians have used primitive tools in their researches on basic astronomy, perhaps,

[30] - (A. Weigert & H. Zimmermann, 1990, p.205).

[31] - (Petrie, 1883, p.125).

they were able to establish a complete picture on spherical astronomy, i.e., the horizon theory of multi-dimensions. The introductory part of this scientific reference has been discussed in this work. The most interesting result that was found in this attempt was that the ancient Egyptians knew the maximum obliquity angle of the earth. This means that, at the time of implementation of Giza pyramids, the Egyptian astronomical records were including the data of at least 1500 years. May be they were able to calculate its correct value. In the field of mathematics, the alignments of the three pyramids prove that the ancient Egyptians were able to reckon the value of angles; or at least, they used the trigonometric ratios of the tangents.

Moreover, the horizon's concept should be taken into consideration when formulating and implementing the conservation projects in Giza pyramids plateau as well as in the future processes of excavations within the plateau. Besides, the above should support the view that it is highly unlikely to find a room of records inside or outside the pyramids. The scientific and holistic knowledge of the ancient Egyptians might was recorded only in the concept design of these pyramids and its horizons.

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