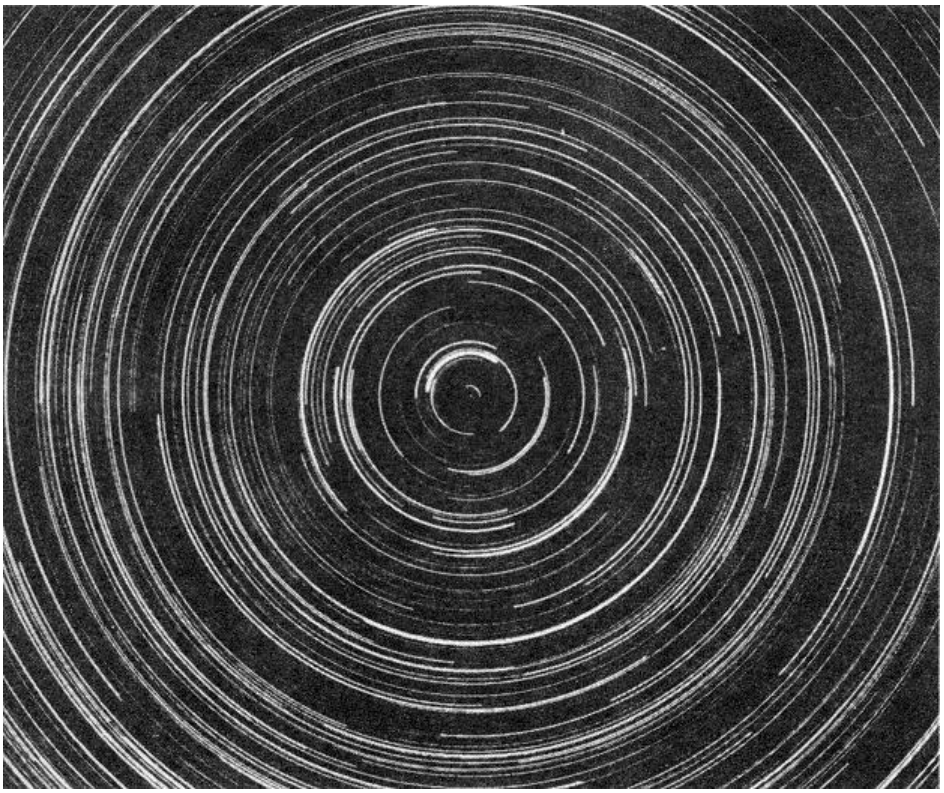
THE ANGULAR DETERMINATION OF THE GREAT PYRAMID

by Pierre Beaudry

In ancient Egypt, an astronomer once asked an architect: "If you were an astronomer, how would you start building an astronomical observatory, which would be perfectly in line with a meridian circle, from which one could observe and teach young people how to determine the transit of all of the stars in the heavens?" In the Morning Briefing of Sunday, January 25, 2004, Lyndon LaRouche answered that question by saying: "You'd build a deep pit, a deep well, and if the well is narrowly fixed, you can actually see stars during the daytime, and particularly in areas which are fairly arid. And that's when a lot of astronomy was done. They had the nighttime sky, which they were able to survey this way, and also the daytime sky. Motions of the planets and so forth, they could see, in the dusk."

What LaRouche was referring to by his answer is that, during ancient times, the study of angular motions of stars based on spherics led to the discovery of physical principles that went into the construction of the Great Pyramid of Egypt. That is to say, since there existed no way to know how far these celestial objects were located that rotated around a fixed point in the sky, as if from the inside of an immense Sphere of the Heavens, the only way to understand the underlying principle of celestial objects was to determined their regular appearance in the night sky, or in the day sky, and note the significance of their angular positions when they passed across the narrow slit opening of an observatory, which was in line with the meridian circle of the Celestial Sphere. This required that the observatory had to be oriented, as perfectly as possible, to the Celestial North Pole of such a sphere. [Figure 1.]

Figure 1



[Figure 1. Time delay photography showing how stars appear to be carried around the North Pole of the Celestial Sphere, during a period of about 8 hours. Pole Stars are any bright star revolving in small circles around the empty center.]

Thus began the passionate adventure of building Egypt's Great Pyramid of Khufu. Once the location of the bedrock for the Great Pyramid of Egypt was chosen at Giza, the very first step taken was to determine the center of the square floor plan of the pyramid by establishing the north-south direction of a meridian circle centered at the latitude of 29 degrees and 6 minutes. According to Czechoslovakian Egyptologist, Zbinek Zaba, an ancient Egyptian inscription described the ceremony in which the "stretching of the cord" was done to establish the orientation of a pyramid. The inscription said: "Looking up at the sky at the course of the rising stars, recognizing the {ak} (culmination) of the Bull's Thigh Constellation (our Great Bear), I establish the corners of the temple." (1)

THE ORIENTATION OF THE MERIDIAN CIRCLE TO TRUE NORTH

The Meridian Circle is the great circle of the Heavenly Sphere, which goes through the Earth's True North and center, and in whose plane all of the stars culminate, that is, reach their highest point of transit (ak), between the Eastern horizon and the Western horizon, when they are observed from the Earth. The transferring of the true meridian from the heaven to the ground, however, required more than a ceremony of drawing lines in the sand. It required the consolidation of an alignment with the Celestial North Pole by digging, as LaRouche indicated,

a deep descending passage into the bedrock at the same angle that the chosen North Star projected its ray down to Earth. Since Alpha Draconis was the Circumpolar Star, which was located, at that time, at 3 degrees 43 minutes south of the Celestial North Pole, the first descending passage of the Great Pyramid was chosen to be in the inclination of its ray, that is, at 26 degrees 17 minutes.

Midnight would locate Alpha Draconis at the floor level of the passage, while Noon, the next day, would show the same star at the ceiling level of the same passageway. Thus, the choice of digging a tunnel-like passageway, as opposed to an external ramp, should be obvious: an observer located at the bottom of a tunnel, a 100 yards deep, can see stars much more clearly, even during the day, than he would at the base of a 100-foot aboveground ramp. This initial underground descending passageway was built with such precision that its mean variation from its central axis, along the entire length of 350 feet, is a mere 0.1 inch of latitude and less that 1/4 inch of longitude, with an extraordinary 1/50th of an inch discrepancy near the entrance. The Celestial True North was projected directly at the center of the passageway. This meridian alignment was so precise that it is within three-sixtieth of a degree of True North, a greater precision than that found at the Greenwich Observatory of London, which is off by an error of nine sixtieth of a degree.

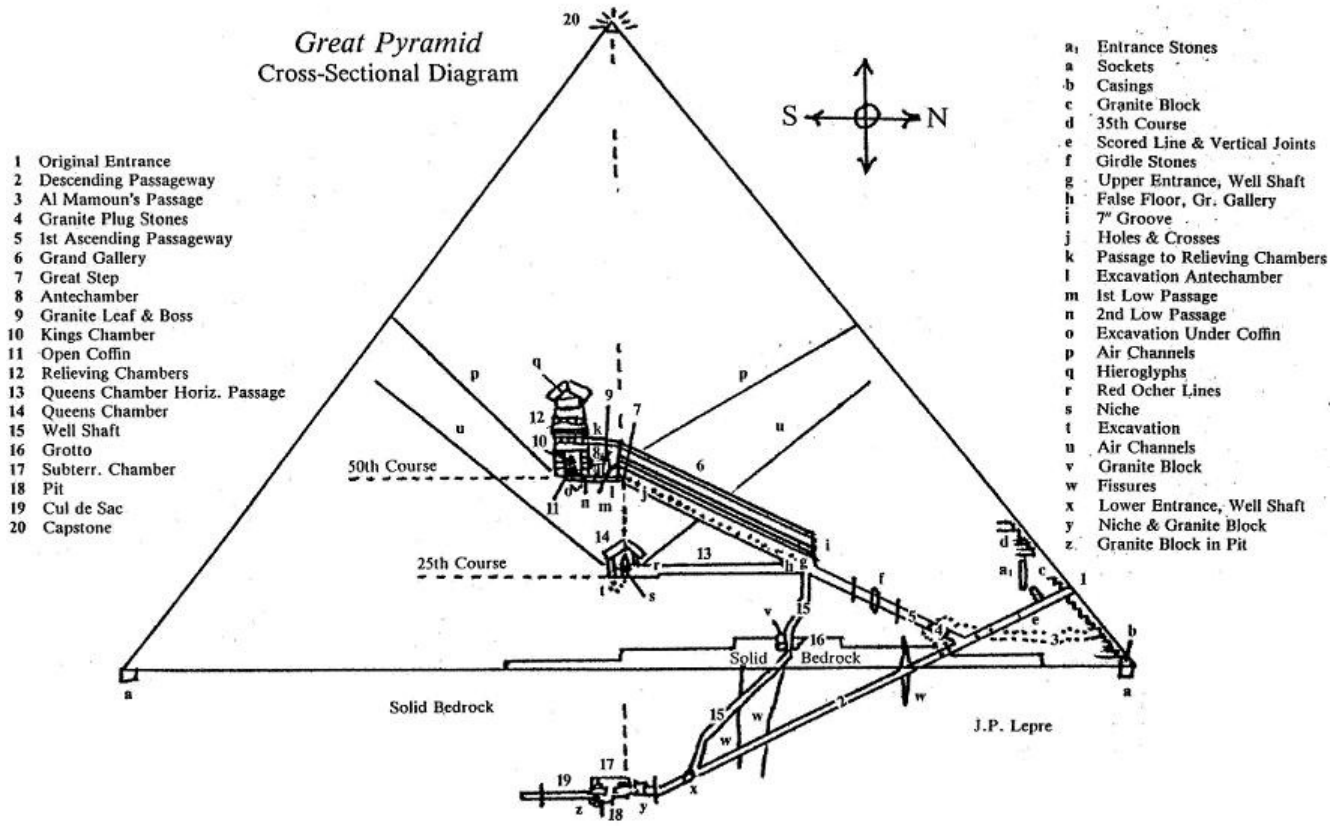
Two things were immediately derived from this first observation passage. One is that the same circumpolar stars would come across the meridian at regular intervals of time and would draw small circles around the Celestial North Pole. Secondly, this permitted the observer to map the precise timing of stars at their upper or lower culmination, which could be calculated by clepsydras (water clocks). Thus was established, in Egypt, the precise study of marking regular angular periodicity of the heavenly bodies, and the variations in periodicity for longer periods of time. The only way to establish such a universal determination was to have two fixed points around which everything else moved: one on earth, and one in the heavens. Once these two points were fixed in stone, the building of the pyramid could begin.

BUILDING THE GREAT ASTRONOMY PYRAMID.

To begin laying the first five courses of stones, the builders had to assure that the ground base was both made absolutely level, and correctly oriented. This was assured by the guiding ascending passageway, which required the fitting of stones precisely in the same inclination of 26 degrees 17 minutes, and necessitated their positioning in the same northern orientation. Above the fifth course of masonry, a new ascending passage was erected at the same angle of 26 degrees 17 minutes, but was oriented along the southern meridian. This is the key feature around which was built the rest of the pyramid, up to the 50th course. It is those passageways, which represent the axis around which the entire pyramid is built, and which provide the only rigorous means of maintaining the constant orientation of the building with respect to the Celestial North Pole. Since the erection of the upper part of the pyramid also requires that the same orientation to True North, it is highly probable that another observation chamber exists, which has not yet been discovered, and which is located in the center of the meridian, at about the 75th course level.

[Figure 2. The meridian triangle of the Great Pyramid, following J.P. Lepre, {The Egyptian Pyramids, A Comprehensive, Illustrated Reference, McFarland & Company, Inc., Publishers, Jefferson, North Carolina, and London, 1990.]

Figure 2

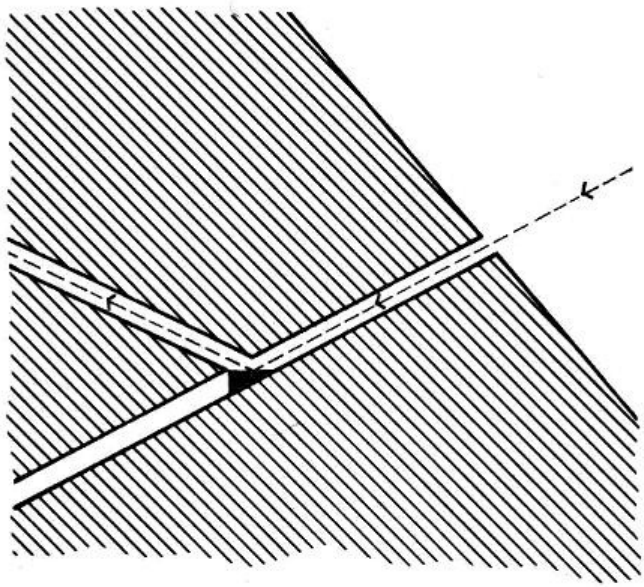


The southern passageway leads to the Great Gallery, to the Queen's Chamber, and to the King's Chamber. It was obvious that, once the truncated pyramid reached about the 20th course, which is the level at which the descending passage reached the outside of the growing pyramid, the architects required another way to maintain the orientation of the building in line with the Celestial North Pole. This is when the change of orientation required a reflecting pool, which was located precisely at the juncture of the descending and the ascending passages. At that moment, the builders had to plug the descending passage and fill the upper part of the plug with water so that it could reflect the Pole Star back into the new ascending southward passage. This represents an extremely important moment for the history of science.

The function of this reflexive pool does not merely represent an extraordinary achievement in architectural alignment by means of a reflected ray of the North Star, but implies an understanding of the properties of light and of liquids, at a very early period in time. In fact, the ancient Egyptians were able to discover and apply an early form of the principle of reflection; that is, the principle by which a ray of incidence and a ray of reflection form the same angle with the horizontal plane.

[Figure 3. Reflecting pool at the juncture of the descending and ascending passages.]

Figure 3

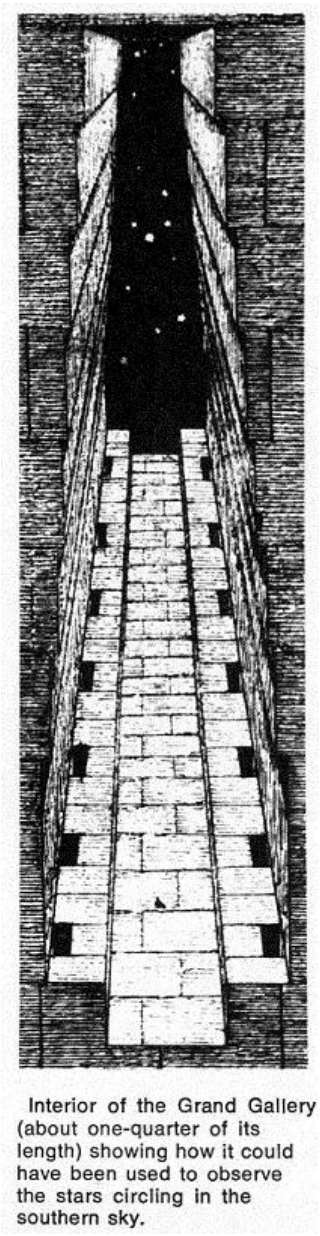


Reflecting pool at the juncture of the Descending and Ascending Passages.

At the level of the 25th course, this passageway opens up into a 28 feet high Grand Gallery, a feature, which maintains an absolute accuracy of orientation with True North for another 25 courses. In other words, the first 50 courses of this giant pyramid had, so far, become a perfect instrument for Astronomy, the greatest observatory window on the universe, during ancient times. For all intent and purposes, the Grand Gallery cannot be of any use but for astronomy, and there could never be any satisfactory explanation for its erection, outside of the purpose of astronomy. Even the pyramididiot Peter Tompkins was forced to admit that British astronomer, Richard Proctor, was right in his astronomical hypothesis of the Great Pyramid. Tompkins stated:

"With various observers in the Grand Gallery, placed one above the other, on the slanted incline, the southing - or transit across the meridian - of every key star in an arc of about 80 degrees, could be observed with remarkable accuracy. As a matter of fact, the most important object of transit observation is to determine the exact moment at which the observed object crosses the meridian. This was obtained by noting the moment when the star was first seen on the eastern edge (left) of the vertical sky space, and when it disappeared past the western edge (right); the instant midway between these two would be the true time of transit." [See figure 4.]

Figure 4

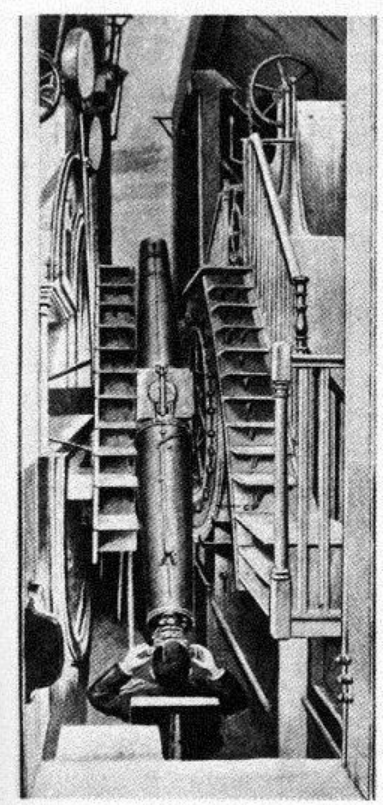


Interior of the Grand Gallery (about one-quarter of its length) showing how it could have been used to observe the stars circling in the southern sky.

[Figure 4. The Grand Gallery of the pyramid of Khufu at Giza. The illustration shows the interior of about one-quarter of the Gallery, and how it was open probably for several years to observe the transit of stars in the sky over Egypt. From Richard Anthony Proctor, {The Great Pyramid, Observatory, Tomb, and Temple}, London, Chatto and Windus, 1883.]

[Figure 5. The transit circle at the Royal Observatory in Greenwich, England.]

Figure 5



The Transit Circle, Royal Observatory, Greenwich.

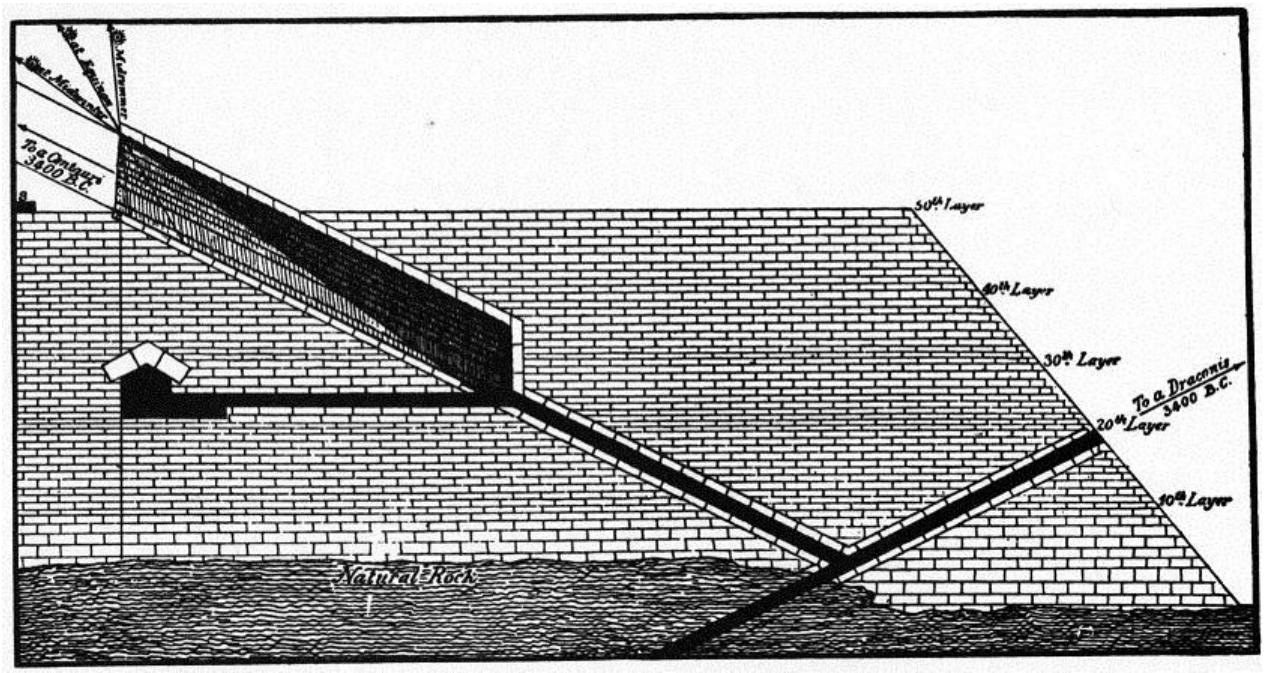
Proctor had understood this purpose very precisely, as Tompkins reported:

"Proctor surmises that someone in either the Queen's Chamber or on the flat platform of the truncated pyramid above the Grand Gallery could keep time by hourglass or water clock in coordination with the observers in the Gallery, who would signal the beginning or end of transit across the Gallery's field of view.

"By looking down the Descending Passage into a reflecting pool, an ancient astronomer could have noted the exact second of a star's transit, because only at that moment will its rays be reflected. The very same system is used today at the U.S. Naval observatory in Washington D.C., where the daily transit of stars is noted to a split second by their reflection in a pool of mercury." (2)

[Figure 6. Proctor's drawing shows how the rays of the mid-day Sun would strike the grand Gallery, during mid-summer, mid-winter, and at the equinoxes.]

Figure 6



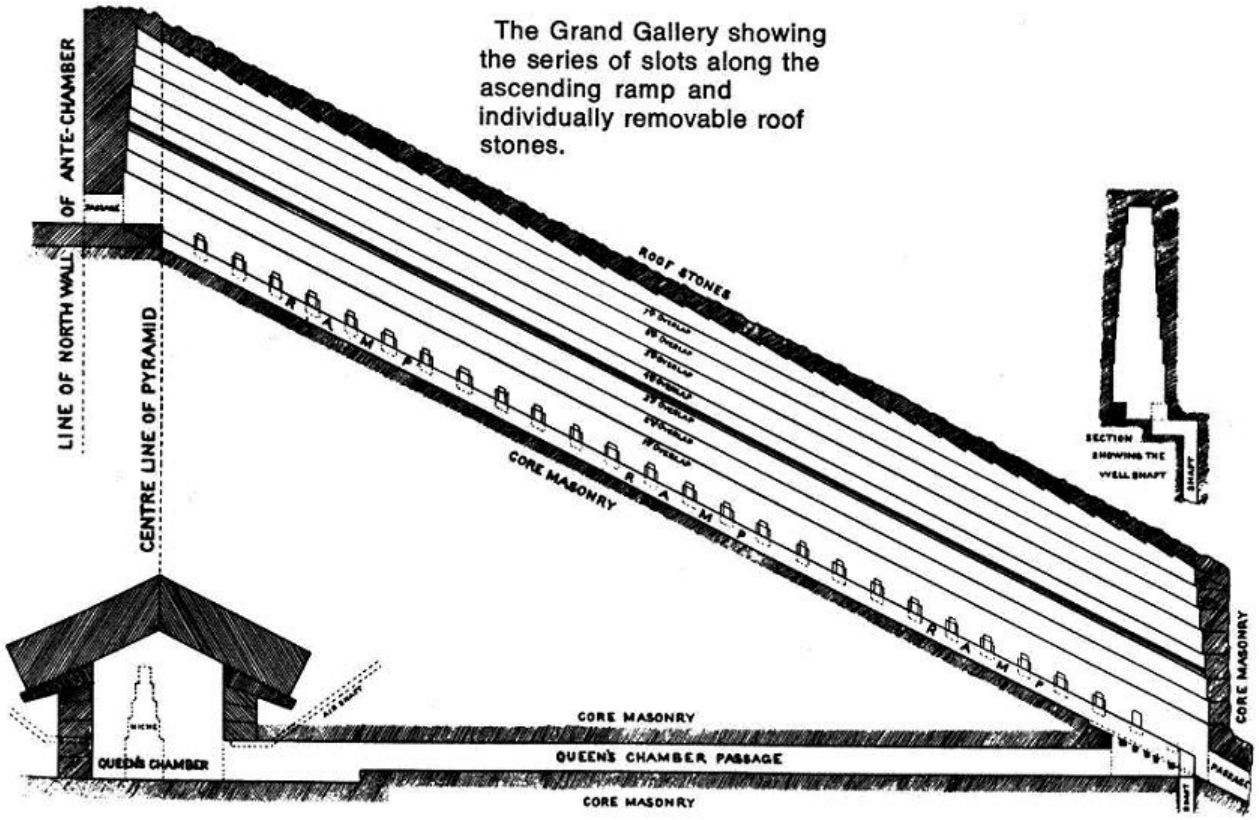
THE GREAT CLASSROOM OF ANCIENT ASTRONOMY

One can further ascertain that this Grand Gallery was, in point of fact, a great classroom for Astronomy Studies, in which between 15 and 25 nighttime students would sit on reclining benches positioned at the different levels of the Gallery, and study the transit of all of the stars, in the north as well as in the south of the hemisphere. This would not be so difficult, since the top roofing stones of the Gallery were independently removable plates, before they were covered over by the completion of the pyramid, and there are two series of 27 oblong holes cut vertically into the masonry, which had been used as bench holders. On the next day, a new group of 15 to 25 daytime students would replace the night class and, with the roof taken off, they would be able to study the shadows of the sun on the eastern and western walls at different times of the day.

Proctor further suggested that movable horizontal bars, with vertical bars attached to them and marked horizontally, could have been used as a pedagogical device to locate the transit of stars or to locate hourly shadows, at different positions, along the long groves (6 inches wide and 3/4 inch deep) that appear along the entire length of both walls just above the third overlap. This might have been a way to put on record, with a simple color or numbered code system, the precise angular positions of all of the heavenly bodies travelling through the night sky, from day to day, year after year.

[Figure 7. The Grand Gallery showing the series of slots along the ascending ramp and individually removable roof stones.]

Figure 7



In his article on Proctor, Tompkins concluded:

"Proctor adds that for a greater knowledge of the sun's motion, the Grand Gallery slot could have been used to better effect than an obelisk or a sundial by noting the sun's shadow cast by the edges of the upper opening against the walls, sides and floor of the long Gallery. To make observations of the Sun more exact, Proctor envisaged the use of screens: by placing an opaque screen at the upper end of the Gallery with a small aperture to receive the sun's light upon a smooth, white surface at right angles to the sun's direction, a much magnified image of the sun would be formed on which any sun spot could hardly have failed to appear. The movements of the spots would have indicated the sun's rotation on its axis.

"The moon's monthly path and all its changes could have been dealt with in the same effective way, as indeed the geocentric paths of the planets or their true orbits around the sun: these could have been determined very accurately by combining the use of tubes or ring-carrying rods with the direction lines determined from the Gallery's sides, floor, etc." (3)

At the moment of equinox, each year, the students observed that the entire panoply of stars was returning to their original position, but with a slight delay, thus discovering that each year the vernal equinox itself was moving in the opposite direction. This caused astronomers to make the difference between the sideral year and the solar year. A finer observation and accounting of this inverse clockwise motion of the entire visible universe, and of the Northern axis of the pyramid itself, was measuring the greatest angle ever observed in Astronomy, the ANGLE OF PRECESSION, which corresponded to about 1 degree every 72 years, that is covering a full cycle of 360 degrees during a periodicity of 25,920 years.

Conclusively, it was well within the grasp of intelligent pyramid builders, that once the astronomer-architect of the Great Pyramid had located the apparent pathway of the wandering Planets with respect to their Meridian instrument, they had all of the required means of thinking through and determining the anomalous behavior of their irregular and retrogressive behavior, only by means of angular measurements. It was only by such angular proportionality that the Egyptian pyramid builders were able to develop, as all people of the sea before them probably did, a complete understanding of the Solar Hypothesis, and had provided that knowledge to the Greeks, and most emphatically to Thales and to Pythagoras.