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GREAT PYRAMID OF JEEZEH IN EGYPT

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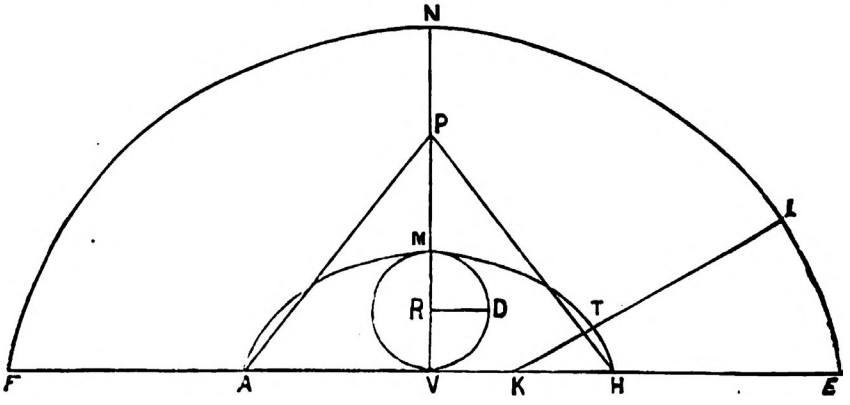
THE BRITISH MILE—II.

In the May number of this magazine we showed that one minute of longitude at the Great Pyramid (lat. 29° 58′ 51″) closely approximates 5280 British feet. That approximation was based upon the theory that the meridional curvature of the earth is elliptical. The ellipse is not claimed to express accurately the true curvature, but it is used in geodesy in preference to other curves because it is a simple curve for treatment and a near approximation to the true meridional curve.

In this paper we take another method to reach a similar result. It may be called the cycloidal method. The basis of it is that property of the cycloid which measures the relation of the circumference to the diameter of the circle, and the number of inches in the British mile, 63,360, taken as so many feet, for the radius of the generating circle of the cycloid.

Let RV in the following figure be the radius of the generating circle. If this circle be rolled along the line VH, the point M will describe the semi-cycloidal curve MTH, and VH will equal the semi-circumference of the circle. The curve MTH= 2MV.

Let PV=2MV. Draw PH and PA. The triangle PAH will exhibit the precise relation which the base and sloping sides of a vertical section of the Great Pyramid bear to one another.



The radius of the generating circle being 63,360 feet, VH= 199,051 feet. Let VE=20,926,432 feet, the semi-equatorial diameter (Clarke's longest), then will HE=20,926,432—199,051 =20,727,382. Let the curve ELNF be parallel to the cycloid AMTH, then will MN=HE. But VN=VM+MN=126,720 +20,727,382=20,854,102; and 2 VN=41,708,204 feet=500,498,448 inches, the polar diameter of the earth. In this computation we have taken Clarke's longest equatorial diameter because it is his estimate of the longer axis of the equatorial ellipse, which has its vextex near the longitude of the Great Pyramid, as shown in our first paper on the British mile.

It is interesting to note how closely this result approximates the estimates given by astronomers for the polar diameter.

The correct computation of the polar axis, is a work of great difficulty, even after the elements of the problem are provided. To obtain these elements surveying expeditions were sent out by several European governments, at great expense, to take the measure of meridional arcs at different latitudes. Eighteen such arcs were measured. The result clearly showed that the curvature of the earth flattens as we recede from the equator. Some of these measurements were so manifestly in error that they could not be admitted into the problem to determine the earth's true curvature. But doing the best they could, the mathematicians have given us an average result. It has been

concluded from the Russian, Indian and French measures, that the polar diameter of the earth is 41,708,332 feet—the estimate given by Captain Clarke is 41,707,796. The mean between Captain Clarke's and the average of the Russian, Indian and French measures is 41,708,253 feet, while that obtained above by the cycloid method is 41,708,204 feet, a difference of only 49 feet.

So far then as the problem affects the polar and equatorial diameters, the cycloidal method of determining the earth's meridional curvature may be deemed correct. But how about the intermediate points between the equator and the poles? Does this method satisfy the observed curvature all along the line of the meridian of 30° east longitude?

It is impossible to answer this question, for the simple reason that we have no report of measures of successive arcs on that meridian. We must be content to test our method by the measure of arcs lying nearest 30° east longitude. In the cycloid the radius of curvature at any point, as T, is equal to 2 KT, hence the radius of curvature of the meridional arc at L is equal to 2 KT + TL. By this formula we can easily determine the earth's curvature in any given latitude, for the angle LKE is the latitude of the point L.

Comparing the length of an arc of one degree at any given latitude as found by actual survey, with the length obtained by the cycloid, we find differences ranging from 30 feet to 200 feet and more. The surveyed degree is sometimes less and sometimes greater. Ten of the surveyed arcs are marked B in Herschel's Outlines of Astronomy, giving these the preference. In five of them the difference ranges from 30 to 70 feet in a measure of over 360,000. When we consider that the radius of meridional curvature is in no case less than 20,000,000 feet, the difference of 50 feet in an arc of 360,000 in such a circle could hardly be detected by instrumental measurement, outside of an astronomical observatory. We ought also to consider that this comparison is made between the theoretical curvature of the meridian of the Great Pyramid, as found by the cycloid, and the surveyed curvature of certain arcs which are neither in the latitude nor the longitude of the pyramid.

The cycloidal method gives to the meridian a longer radius of

curvature near the equator than is found by the ellipse, and a shorter radius near the poles. If this method be true, the meridional curvature of the earth, on first receding from the equator must be a little larger and, on approaching the poles a little shorter than is required by the elliptical form. Now the radius of the small circle, described by the apex of the pyramid in latitude 29° 58′ 51″, is, by the cycloidal method, equal to 18,142,461 feet, and one minute of this circle is 5,277.6 feet; by the ellipse it is 5,278 feet. Whether we adopt the elliptical or the cycloidal curvature of the meridional line, the measure of 1′ of longitude at the Great Pyramid is strangely close to 5,280 feet.

In the foregoing computations one element has been entirely omitted—that is, the earth's uncertain curvature of longitude. We have treated the parallel in latitude 29° 58′ 51″ as a true circle. But we cannot be sure of the curvature of any part of the earth's surface without actual and most careful measurement. Local causes affect local curvature, and it may so have occurred, in the formation of the earth's surface, that the region of North Africa is longitudinally flattened. It may be also that accurate allowance for atmospheric refraction in the exceedingly dry region of the Great Pyramid would affect the observations taken of the latitude. The geometrical approximation of 1′ long. to 5280 feet is so close that it is possible an actual survey would fully establish the proposition we have had under discussion. It is certain that a parallel measuring one British mile to one minute of longitude is within signaling distance of the Great Pyramid. Prof. Smyth, in Life and Work, refers to what may have been a signal station for measuring longitude. It is described by Dr. Leider, as a little pyramid far to the west in the Lybian desert, which may be seen from the top of the Great Pyramid as the sun goes down. It may be presumed that if the Great Pyramid was originally an observatory, signal stations, east, west, north and south of it once existed, though now in ruins or altogether lost.

H. G. Wood.

SYMBOLISM OF THE PASSAGES IN THE GREAT PYRAMID.

If we suppose the vertical axis of the Great Pyramid to represent the celestial equator, dividing the north from the south, and the passage ways from the entrance to the King's room to represent the ecliptic, then the place on the great step at the upper end of the grand gallery where the vertical axis crosses the passage will represent the place of the equinox, where the equator and ecliptic cross each other. Each section of the line of passages represents one of the constellations of the zodiac, each inch in the length of the passage being the symbol of one minute of arc measured along the ecliptic. I propose to show in this manner that the entrance passage represents Cancer, the ascending passage represents Gemini, the grand gallery represents Taurus, as far as the Pleiades, the anteroom and passages represent the remaining portion of Taurus, and that the King's chamber represents Aries ; the whole being designed to mark the epoch when the equinox was on the meridian of the Pleiades.

ENTRANCE PASSAGE—CANCER.

From the entrance, the sides of the passage are formed of two rows of stone for a certain distance which overlap as it were the actual length of the passage, as if the total length designed to be indicated by the architect could not be included in the passage and had to be turned back and overlap to the full extent of the required length. Prof. Smyth says, "distance of axial line where it strikes the floor of ascending passage is 993.3 inches." (See plate IV, p. 41, vol. II, L. and W.) This gives the axial length of the entrance passage, which is its true length. He gives the distance of the wall-joint where the overlap begins as 219.2 inches. I have preferred to use a more correct estimate, $993.3747+219.4063=1212.7810$ inches as the required length.

The entrance passage is a symbolic representation of the

ancient constellation Cancer or Scarabeus, and is precisely the same length in inches, as the constellation is minutes of arc in length, as measured on the ecliptic. The length of 1212.78 inches represents 1212.78 minutes of arc or 20°.213.

Unfortunately the ancients left no maps of the starry heavens, nothing but descriptions; so that no accurate drawing of the ancient constellations has come down to us. A description in words cannot replace a drawing, especially when the question relates to complex shapes and figures. Hence when modern makers of maps, star-charts and celestial globes have attempted to reproduce the outlines of the constellations from the ancient descriptions, they have found it next to an impossibility, and therefore differ in their estimates of the limits and boundaries of the constellations to an extent amounting to several degrees. The Great Pyramid is the only building where definite measurements of the ancient constellations have been recorded.

ASCENDING PASSAGE—GEMINI.

The first ascending passage has the same general angle as the entrance passage. Prof. Smyth gives (Vol. II., pp. 42 and 54, L. & W.) "Axis of ascending passage as cut by axis of descending passage=1291.2+178.8+32.6+29.8= 1532.4 inches." But extending every part of the passage downwards to the floor line of the entrance passage, which Prof. Smyth says is another 28.7 inches, gives 1561.1 inches British, or 1559.54 Pyramid inches.

The ascending passage is a symbolic representation of the ancient constellation Gemini, the Twins, and is precisely the same length in inches as the constellation is minutes of arc in length, as measured on the ecliptic; or 1559.54 minutes=25°.992.

GRAND GALLERY—TAURUS.

The Grand gallery strikingly illustrates the system of astronomy which prevailed during pyramid times. If the groove in the middle course of stones represents the ecliptic, being the axial line of the gallery passage, then its length in inches will represent minutes of arc on the ecliptic as in previous cases. The length of this groove is 1878.21 inches, and 1878.21 minutes=31°.303.

This scheme of masonry was constructed for the purpose of representing the advancement of the equinox 31°.3 into the

constellation Taurus, as far as the Pleiades group of stars. The groove was made of this length, and the grand gallery was there terminated because the epoch for which this gallery was constructed was then closed and at an end.

ANTE-ROOM—TAURUS.

The ante-room and horizontal passages from the grand gallery and King's chamber represent the remaining portion of the constellation Taurus which the grand gallery did not include, and is precisely of the same length in inches as this remaining portion of Taurus is minutes of arc in length as measured on the ecliptic.

The length of the floor line of the grand gallery to the face of the great step is 1812.98 inches; produced through the step to the floor of the horizontal passage it is 81.45 inches longer, or 1894.43 inches. From this point of intersection the horizontal distance to the ante-chamber is 40.14 inches, the ante-chamber length is 116.26, and the passage to the King's chamber is 100 inches. The total distance by this line from the north end of the grand gallery to the King's chamber is 2150.83 inches. The same number of minutes = 35°.847, which is the entire length of Taurus.

Then again, the gallery's length taken at the groove was 1878.21. The south end of the gallery impends about 1 degree, so that a plummet from the end of the groove would fall 4.18 inches north of the passage to the ante-room; the length of this passage is 52.18 inches, and the length of the ante-chamber being 116.26 and that of the next passage 100, by adding all these lengths together we have, as before, 2,150.83 inches or minutes = 35°.847. The distance from the point on the step under the end of the groove to the King's chamber is evidently 272.62 inches, and 272.62 minutes = 4°.544 which is the remaining length of the constellation Taurus from the Pleiades group to its end.

KING'S CHAMBER—ARIES.

The Ram is the leading sign of the zodiac, and the King's room is a representation of this celestial house or mansion of the sun in the heavens. The King's room is 412.13 inches in length, and 206.06 in width, or half its length. Hence the sum

of the two sides and two ends is equal to three times the length of the room, or 1236.39 inches all around the circuit of the chamber. Now 1236.39 minutes = 20°.606, which is the total length of the constellation Aries as measured on the ecliptic.

I think these data demonstrate beyond a shadow of a doubt that the four passages of the Great Pyramid, entering, ascending, the grand gallery, with horizontal passage, and the King's room, were designed by the architects to represent the four mansions of the zodiac, as they were understood in ancient times, known as Cancer, Gemini, Taurus, and Aries.

Directly over the King's chamber are other five unfinished rooms of equal size nearly, with no entrance to any one of them excepting forced entrances made by modern explorers. The following is their intended representation:

Davidson chamber . .	Fishes.
Wellington chamber . . .	Waterman.
Nelson chamber . . .	Sea Goat.
Arbuthnot chamber . . .	Archer.
Campbell chamber . .	Scorpion.

The King's chamber and these five construction chambers placed over it, are on the south side of the vertical axis of the pyramid, and represent the six constellations forming the southern half of the zodiac when the equinox was on the meridian of the Pleiades.

With this key, the pyramid's scheme of masonry becomes at once an intelligible system of astronomical truths and facts, whose grandeur and accuracy challenge the skill and mathematical science of modern times.

Only nine constellations have been accounted for; three others are as yet unrepresented. It seems unlikely that the architect would include the six constellations south of the celestial equator, represented by the six construction chambers, and only include three constellations north of the equator. Therefore three other rooms have yet to be discovered. Where can they be?

As the six chambers are turned westward in their proper order, at the southern end of the passages, it is inferred that the three undiscovered chambers will be turned eastward at the

northern end of the passages, in their proper order, so as to form a series, and thereby complete the entire circle of the twelve signs of the zodiac.

SAMUEL BESWICK, C. E.

[The three unrepresented constellations are Leo, Virgo, and Libra, and by a strange coincidence, a manuscript has just been presented on quite another subject in which occur the following words: "The sphinx is evidently a combination of two signs of the zodiac, Leo and Virgo and perhaps also of Libra, by virtue of guarding the temple of weights and measures between her paws, even as the priests of Isis kept sacred guard therein over the weights and measures themselves."—ED.]

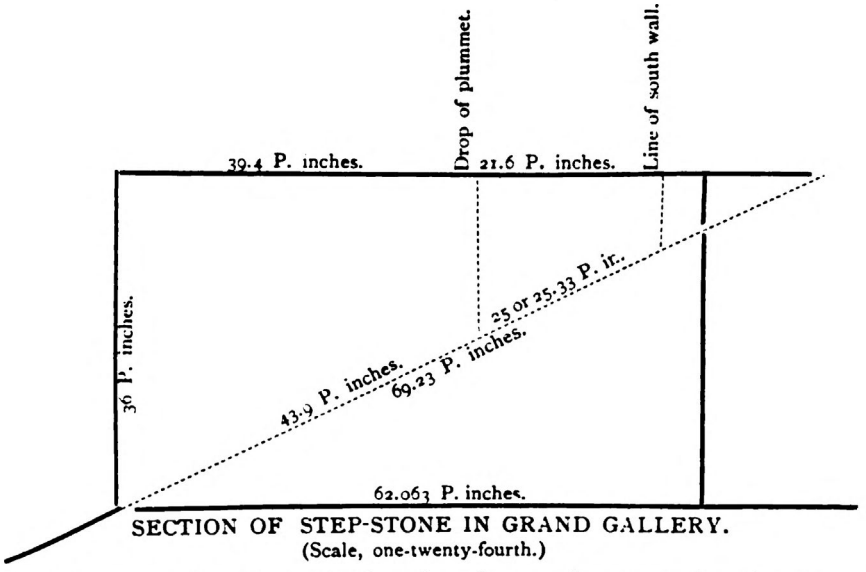
THE BURIED CUBIT IN THE GREAT PYRAMID.

In continuation of my observations on the various lengths of the grand gallery, and as a necessary sequel thereto, I have to point out what appears to be a most remarkable instance of the wisdom and foresight of the architect towards the preservation of his cubit standard, inasmuch as, if the measured dimensions of Prof. Piazzi Smyth may be trusted, we find a fairly approximate, if not mathematically accurate, sacred cubit buried beneath the step in the grand gallery. The mode of its discovery was as follows: The recorded length on the grand gallery ramps of the distance between the two plummets, dropped by Dr. Grant, of Cairo, from the extreme north and south ends of the chamber's roof is 1844.5 Pyramid inches; and assuming this roof to take a generally parallel course to the ramps and the floor, these figures must be taken to give the true length of the ceiling, which, consequently, is shorter than the 1881.6 floor length by 37.1 pyramid inches, or, practically, just one cubit and one foot of difference. A glance at a good diagram of the grand gallery made it further appear that one of these self-same plummets did positively cut off at the north end of the gallery floor just one foot, and the other, at the south end of

the same floor, produced under the step just one cubit. Having no record at hand of the spot of the drop of the northern plummet, we must leave out of the question at present the possibility of proving any marked quantity representing the foot of twelve inches within this chamber, but we may easily examine the indications for the cubit at the southern end, as we have already been informed that the space marked on the step by this plummet was stated by Dr. Grant at 39.25 British inches, and which inches have been shown to be most probably intended for 39.4 Pyramid inches, a rather pluperfect French metre, and the missing quantity required to be added to the grand gallery assumed floor-length of 1881.6 Pyramid inches to make the harmoniously quinto-sextuple quantity of 1,921 Pyramid inches.

Having arrived thus far, I have sought the assistance of a mathematical friend, whose calculations make it plain that, assuming the surface of the step is level and the outline rectangular, then the angle of rise of the floor line, taken at 26° 18′ 10″, precludes the possibility of getting a metre on the surface of the step northwards, and a cubit *within* the chamber on the theoretically continued floor-line under the step southwards. But if the floor-line be further continued as far as the joint between the step-stone and the one next succeeding, we get a little more space—a little too much in fact—something like a third of an inch in excess of the cubit requirement, reckoning to the nearest tenth. A glance at the accompanying diagram will perhaps best explain this. It is to be observed that all this assumes the general rectangularity of the step-stone, and the precision of the average length drawn from the three slightly varying dimensions given by Prof. Piazza Smyth, in Life and Work, Vol. II, page 92. Considering the battered state of the stone at its northern end, and the inevitable difficulty of "making up" a starting point from whence to measure into the passage southwards where the joint occurs, it seems that this apparent discrepancy of a third of an inch may be no discrepancy at all, and that the architect's evident intention has been really accomplished as a fact, and the Sacred Cubit has been buried in the dimensions of the stone, which also exhibits its companion

British yard and the step-measure combination of the two, besides the antagonistic Metre.



SECTION OF STEP-STONE IN GRAND GALLERY.
(Scale, one-twenty-fourth.)

And in consideration of what has been shown to be the usual rule, if not the fixed law of the pyramid's construction—viz: that the cubit and yard do accompany each other throughout the building, not exactly in pairs, but usually the yard very prominent, and the cubit often merely memorialized or hidden altogether, this cubit could scarcely be absent in the present case from the grand gallery; thus, the originally discovered cubit consisted in the enigmatical displacement of the niche in the Queen's chamber, while that chamber itself has been shown to be literally full of yards—linear, surface, and solid. The single cubit is found in two ways, more or less hidden on the granite leaf, where the yard appears twice singly and quite openly. A single cubit is also hidden under the granite leaf, in the radius of a circle of equal area with the remarkably raised surface of the granite stone there; and this stone is of the same dimensions as the entrance passage in transverse section, which, of course, has, as we have before seen, the same remarkable area. Seven cubits are hidden in the circuit of the shallow portion of the passage leading to the Queen's chamber, while six yards very openly form the length of the succeeding deeper portion of the same passage. Seven cubits are also

hidden in the squared quantity of the length of the strip of limestone paving in the ante-chamber, 13.23 inches. Twenty-five cubits are hidden, as the radius of the circle equal in circumference to the extreme length of the ascending passage to the furthest wall of the King's chamber, 3,927 inches. And it may be further pointed out, for the first time, that this same quantity of twenty-five cubits is produced by the meeting of the limestone and granite in the ante-chamber, for the last length of limestone paving, 13.23 inches, when multiplied by the first length of granite paving—viz, the raised stone of 47.24 inches—gives 624.9852 inches, or practically 625 inches, the square cubit, or cubit of cubits, the radius of the complete passage taken as a circle or cycle, and of which its roots form an integral portion. While to go one step further, we obtain Piazzi Smyth's Pyramid mile of twenty-five hundred cubits, by multiplying the sum of the ante-chamber's arris lines, 1,323.04 inches, by the length of the same raised granite stone, 47.24 inches, which yields 62,500.4096 inches, or correct within half an inch for the mile of $\frac{1}{8000}$ of the earth's polar diameter. So having observed these, with numerous other instances that might be given of the peculiar inseparability of the yard and cubit, there need be no doubt that the presence of a hidden cubit is necessary in the step, which exhibits the yard so obtrusively to the visitor to the grand gallery.

And if these two standard measures be really the complement of each other, as cannot now be doubted; and, further, if there be any virtue in the pyramid symbolism which specially hides and buries the one, while it specially thrusts the other before the eye, then, considering to whose keeping these measures have been severally confided, these things become indeed an allegory of the dealings of the Almighty with the dual House of Israel, for the sacred cubit is hidden away in all sorts of places in the Great Pyramid, while the Jew, who is the last person known to have used it, is still a byword and a scorn, and everywhere known on earth; while, in the other case, it goes without saying, it is the people who have been lost or hidden away, and buried in all sorts of places in the earth, while their

measure, the yard (whether or not they used it anciently) is everywhere on the Great Pyramid, not exactly a byword and reproach, but very frequently, as in the great step, a real stumbling block and offense to the student.

However, if we but follow out the allegory as contained in the building, we find that at a time apparently by no possibility very remote, these two nations must become one, because the measures representing them in the Great Pyramid are united in a three-fold way—once simply in the 61 inches of the step surface; again, in the junction of the simply squared elements, which gives the 1,921 inches, the theoretically perfect length of the grand gallery; and, finally, in the grand quantity, the product of the squares of the united measures—viz: the step of steps, 3,721 inches, which takes us from the commencement of the first ascending passage to the entrance of the King's chamber.

Viewed in the additional light thus thrown by the Great Pyramid on this matter, it may very fairly be claimed that, taken in connection with the careful hiding of the sacred cubit, the obtrusive presence there of the British yard provides a special identification of its British owners with the Lost House of Israel.

H. R. SHAW, in "The Banner of Israel."

PROBLEMS CONCERNING THE MOON'S MOTION.

"What was the mean length of a *lunation* 4000 years ago?"—C. PIAZZI SMYTH.

The above question was the origin of the present essay.

The problem of the moon's motion is one which has, perhaps more than any other, exercised the skill and taxed the ingenuity and patience of astronomers during the past hundred years. And the labor bestowed on this problem by mathematicians is probably greater than has been required on all the other problems of celestial mechanics. But I do not propose to speak in detail of the general problem of the moon's motion as affected by the perturbations produced by other bodies. Some little explanation of the general conditions of the problem

is, however, necessary in order to a better understanding of the particular question which gave rise to the following essay.

Without extending these prefatory remarks I will proceed to the consideration of our subject. In the first place, if we have two bodies, one of which is very small in comparison with the other, it is shown by writers on mechanics that the smaller body will revolve around the larger in a fixed orbit, passing through precisely the same path in each succeeding revolution during all time. Now the earth and moon very nearly fulfill the above condition; and were these the only bodies in existence, the moon would describe a mathematical ellipse around the common center of gravity of the earth and moon, forever. But since there are other bodies besides the earth and moon the mathematical ellipse does not exist; for, according to the law of universal gravitation, these other bodies, by acting unequally on the earth and moon by their attraction, derange their relative motions about their common center of gravity, thereby producing inequalities in the moon's motion which are very sensible to observation.

In order to simplify the problem as much as possible and at the same time leave it sufficiently general for our purpose, we may suppose that the moon's orbit is perfectly circular; in which case the moon would move with a perfectly uniform velocity around the earth in the center of its orbit, were it not disturbed by the sun's attraction. But the sun by being nearly all the time unequally distant from the earth and moon, attracts them unequally, and hence arise what are technically called perturbations of the moon's relative motions around the earth. Were the sun's apparent orbit around the earth a perfect circle, the perturbations in the moon's motions arising from its attraction would be few in number, and very easily calculated. In fact there would be but a single correction (called the variation) of much consequence, to be applied to the uniform motion of the moon in order to give its place in the heavens with all desirable precision. The effect of the variation is to cause the moon to be about 2,500 miles in advance of its mean place when in the middle of the first and third quadrants of its orbit, counted from the place of the new moon in the direction of its

motion, and to cause it to be behind its mean place by the same quantity when in the middle of the second and fourth quadrants. The inequality itself therefore depends upon the angular distance between the sun and moon as seen from the earth; or, in technical language, the inequality depends upon the configuration of the three bodies, the earth, the moon, and the sun.

At the time of new moon, the moon being nearer the sun than the earth is, it is more attracted by it than the earth is, and hence the effect of the difference of the attraction of the sun on the moon and on the earth is to separate the two bodies. At the full moon the earth being nearer the sun than the moon is, it is more attracted by it than the moon is, and the effect of the sun's attraction is also in this case to separate the moon and earth. Therefore at and near the times of new and full moon, the general effect of the sun's attractions is to lessen the gravity of the moon to the earth. When the moon is in quadrature, the effect of the sun is to increase the attraction of the moon and earth; but the increase being only one-half as great as the diminution at the times of new and full moon, it follows that, on the whole, the effect of the sun's attraction is to diminish the gravity of the moon to the earth.

We may, perhaps, have a clearer conception of this diminution of gravity, if we suppose the sun's mass to be distributed around its apparent orbit in the form of a ring. The sun's volume is sufficient to form a ring 28,000 miles in thickness around the whole circumference of its orbit of 584,000,000 miles. It is evident that this would have a tendency to draw the moon away from the earth at every point of its orbit; and this constant diminution of gravity arising from the attraction of the ring, is equivalent to the average diminution arising from the sun's attraction in the course of a year. It is evident that a variation in the form of the ring would modify its effect on the moon's motion in the same way that a change in the configuration of the bodies would affect the sun's direct action.

Thus far we have supposed the sun's orbit to be circular, with the earth in the centre. But the real orbit is elliptical; and hence the sun is nearer to the earth and moon at some times of the year than at other times, and must exercise a

greater disturbing influence on their relative motions. Now it may be shown that the mean or average attraction of the sun on the moon, is greater in an elliptical than in a circular orbit having the same mean distance.

We have already seen that the effect of the sun's attraction is to diminish the gravity of the moon to the earth, in a case of a circular orbit; and we have also seen that this attraction is greater in an elliptical than in a circular orbit. It therefore follows that the sun's diminution of the moon's gravity to the earth is greater than it would be if its orbit were circular.

Now since a force may be measured by the effect it produces, it is easy to perceive that the moon must move more slowly in its orbit than it would were it attracted by the earth alone. As a matter of fact the effect of the sun's attraction is to render the moon's sidereal revolution 3h 48m longer than it would otherwise be.

Now the mean effect of the sun on the moon's motion during a year remains always the same so long as the form of its orbit is unchanged. It is a fact, however, that the sun's apparent orbit is slowly becoming more nearly circular. The eccentricity is diminishing at the rate of about thirty-nine miles annually. At present the focus of the ellipse in which the sun is moving is 1,560,000 miles from its centre; and the above value of the diminution of the eccentricity merely shows that the focus of the ellipse approaches its centre by thirty-nine miles per year. At this rate of approach the orbit would become circular in about 40,000 years; but long before that distant age arrives the diminution of the eccentricity will have reached the limit prescribed by the disturbing forces, and the diminution will be converted into an increase. In about 25,000 years the eccentricity will have reached the smallest value it can have between epochs separated by 815,000 years. The focus of the orbit will then be distant only 347,000 miles from the centre, which is less than one-quarter of its present distance.

Since the effect of the eccentricity is to increase the disturbing power of the sun, it is evident that a decrease of the eccentricity will have the effect of diminishing the sun's disturbing power. Now a diminution of the sun's mean disturbing

power is precisely equivalent to an increase of the earth's attraction in its effect on the moon's motion. The problem is therefore narrowed to that of finding the effect of a gradual but inconceivably slow increase of the attractive power of the earth on the motions of the moon.

It is impossible in a popular account of a problem of such intricacy, to give more than a general outline of the process required in its solution. It will, however, be readily understood that an increase of the earth's force would affect the moon's motion in the two following ways:—First, it would cause the moon to revolve faster at the same mean distance; and second, it would cause the moon to approach the earth, by which means the earth's primitive force would cause the moon to revolve more rapidly; and the whole acceleration would be the effect of both of these causes.

The effect of the first cause is very readily found, for it is shown by writers on central forces, that the velocity of a body revolving in a circular orbit varies directly as the square roots of the forces. But the investigation of the rate of approach of the moon to the earth arising from a gradual increase of the earth's force is very complicated, and requires the aid of the higher mathematics. The effects of the two causes of acceleration are, however, connected by a very beautiful theorem, which I have discovered, but which has not yet been published. According to this theorem, the acceleration arising from the diminution of the distance is exactly equal to three times that arising from the increase of the force; so that the total acceleration arising from both causes is equal to four times that which would arise from an increase of the force without any variation of the distance. Now without further explanation and illustration of the nature of the problem, we shall proceed to give the results of our solution—the solution itself being too complicated for the non-mathematical reader.

Analysis shows that the increment of the sun's attraction depends upon the square of the eccentricity of the sun's orbit. It is evident that the solution of the proposed problem, as well as that of several others of equal interest, may be derived from the solution of two other problems which depend upon

the same cause; namely, the distance and velocity of the moon at any given time. If we designate by a_0 and n_0 the present value of the eccentricity of the sun's orbit; and also designate by a, n, and e, the values of the same quantities at any other time, I find the following relations between the various quantities:

$$a=a_0\,[1+0.003206\,(e^2-e_0^2)]=a_0+da. \quad (1)$$

$$n=n_0\,[1-0.006412\,(e^2-e^2)]=n_0+dn. \quad (2)$$

Consequently,

$$da=0.003206\,a_0\,(e^2-e_0^2). \quad (3)$$

$$dn=-0.006412\,n_0\,(e^2-e_0^2). \quad (4)$$

Equation (3) will give the variation of the moon's distance from the earth, in so far as it depends on the eccentricity of the sun's orbit. At present $e_0=0.0167712$; and the extreme values of e are 0 and 0.07. If we substitute these values in equation (3), we find

$da=+18655$ feet $=+3.533$ miles; and

$da=-1136$ feet $=-0.215$ miles.

In other words, when the eccentricity of the sun's orbit becomes the greatest possible, the moon will revolve at a distance 3½ miles greater than at present; and when the sun's orbit becomes a circle the moon's distance will be about one-fifth of a mile less than at present. The whole secular variation of the moon's distance from the earth can therefore never exceed 3¾ miles.

If we compute the value of *d*a for an epoch 4000 years ago, at which time we have

$e=0.0182213$, and $e^2-e_0^2=0.000050743$, we shall find $da=+205$ feet.

Hence the moon is at present 205 feet nearer to the earth than she was 4000 years ago. At present she is approaching the earth at the rate of 0.6765 inches annually. The rate of approach is that of rolling down an inclined plane which is 864,000,000 miles long and one inch in height!

In 25,400 years the eccentricity will be only 0.003729, which is the least value it can have during a period of 100,000 years to come. At that time the moon's distance will be 1080 feet less than at present.

The greatest value of the eccentricity during the past 60,000 years occurred 13500 years ago. It was then equal to 0.019756, and consequently the moon has approached the earth by 440 feet since that epoch.

If we denote the length of the moon's sidereal revolution at any time, by T, and its present length by T_0, we shall evidently have

$$T=\frac{2\pi}{n}=\frac{2\pi}{n_0+dn}=\frac{2\pi}{n_0}\left(1-\frac{dn}{n_0}\right)=T_0-T_0\frac{dn}{n_0}=T_0+dT. \quad (5)$$

And if we substitute the value of $dn \div n_0$ given by equation (4) we shall find

$$dT=-T_0\frac{dn}{n_0}=+\ 15138^s.4\ (e^2-e_0^2.) \quad (6)$$

In like manner if we put T′ for the length of a lunation at any time, and T_0' for its present length, we shall have

$$T'=\frac{2\pi}{n-n'}=\frac{2\pi}{n_0-n'+dn}=\frac{2\pi}{n_0-n'}\left(1-\frac{dn}{n_0-n'}\right)=T_0'-\frac{T_0'}{n_0-n'}\times dn=T_0'+dT'. \quad (7)$$

In this equation n′ denotes the sun's mean motion. Whence we get

$$dT'=-\frac{T_0'}{n_0-n'}dn\ =17685^s\left(e^2-e_0^2\right). \quad (8)$$

If we substitute the absolute maximum and minimum values of e in equations (6) and (8) we get.

Maximum $T=T_0+69^s.90$. Maximum $T'=T_0'+81^s.7$.

Minimum $T=T_0-4^s.258$. Minimum $T'=T_0'-4^s.974$.

If we substitute the value of e 4000 years ago we find

$$T=T_0+0^s.7682 \text{ and } T'=T_0'+0^s.8974.$$

It therefore follows that during the past 4000 years the length of a lunation has diminished by only 0.8974 seconds of time; and the sidereal revolution has diminished by 0.7682 seconds.

The same formulas will give for the sidereal and synodic revolutions of the moon after an interval of 25,400 years, when they will be the shortest possible within a period of 100,000 years to come, the following values, namely:

$$T=T_0-4^s.05, \text{ and } T'=T_0'-4^s.726.$$

Therefore in 25,400 years the length of alunation will be only $4^s.726$ shorter than at present.

We thus see that the secular variations of the sun's force produce only very insignificant variations in the elements of the moon's motion during the period over which history extends. It is only in cases where the effects of these variations are cumulative that they become sensible to observation. This is the case with the moon's longitude. The effect of the secular variations of the sun's force is at present to uniformly increase the moon's velocity at the rate of 9.4707 feet yearly; but in the course of time this rate will vary to conform to the law of the variation of the eccentricity of the sun's orbit on which it depends. But small as this change of velocity appears, its effect upon the moon's longitude is very great when it has operated through long periods of time. During the past 4,000 years this very slight acceleration has changed the moon's place in the heavens by more than six times its own breadth, a distance of 13,500 miles. One-fourth of this acceleration, or 3,375 miles, arises directly from the increase of the central force, and three-fourths of it is the effect of rolling down an inclined plane of 864,000,000 miles to the inch. This displacement of the moon would change the time of an eclipse by nearly twelve hours, and shift the place of its visibility to opposite hemispheres of the earth.

JOHN N. STOCKWELL.

BIOGRAPHICAL MEMOIR OF PROFESSOR JOHN GREAVES,

AUTHOR OF THE PYRAMIDOGRAPHIA, AND THE FIRST ACCURATE MEASURER IN MODERN TIMES OF THE GREAT PYRAMID.

COMPILED BY MRS. C. PIAZZI SMYTH.

The Rev. John Greaves, rector of Colmore, near Alresford, in Hampshire, was the father of four sons, all men of eminent learning. John, the eldest and the subject of this short memoir, was born at Colmore in the year 1602. His brothers were: Dr. Nicholas Greaves; in 1627 he was elected fellow of All Souls college, Oxford; in 1640 he was proctor of that university; in 1643 he was appointed Dean of Dromore in Ire-

land. Dr. Thomas Greaves of Corpus Christi college, Oxford, took the degree of bachelor of divinity in 1621, and then became rector of Dunsby in Lincolnshire; in 1661 the degree of doctor of divinity was conferred upon him; in 1666 he was made a prebend in the church of Peterborough, being then rector of Benefield in Northamptonshire, which benefice he resigned some years before his death through trouble from his parishoners, who, because of his slowness of speech and bad utterance, held him insufficient for it, notwithstanding he was a man of great learning as his writings testify; he died in May, 1676, in the 65th year of his age. Dr. Edward Greaves, the youngest son, was born near Croydon in Surrey, and admitted probationer fellow of All Saints college, Oxford, in 1634; entering then on the medical profession he took the degree of that faculty in 1641, became traveling physician to Charles I. Upon the declining of the King's cause he retired to London and practiced there. After the restoration he was appointed Physician in ordinary to Charles II., and became a baronet. He was a great master of the Latin tongue and author of important medical works.

To return to our subject, viz: "John Greaves." He was well grounded (by his father) in grammar-learning, and sent to Oxford in 1617. He there took the degree of bachelor of arts in 1621, and in 1624, being of master's standing, became a candidate for a fellowship of Merton college, when, on account of his uncommon skill in philosophy and polite literature he was the first of the five who were elected. In 1628 he took the degree of master of arts.

Having now read over all the Greek and Latin writers with great attention, he applied himself to the study of natural philosophy and mathematics. He contracted an intimate friendship with the professors of geometry and astronomy, and was animated by their example to prosecute these studies with indefatigable industry. And not content to have read over the writings of Copernicus, Regiomontanus, Purbach, Tycho Brahe, Kepler, and other celebrated astronomers of that and the preceding age, he made the ancient Greek, Arabian and Persian

authors in that science familiar to him, having before gained an accurate skill in the oriental languages.

His reputation was now so great that in 1630 he was chosen professor of geometry in Gresham college at London. About this time he formed the resolution of traveling into foreign countries; in the year 1665, he visited both Paris and Leyden. In 1666 he traveled in Italy, but his grand design was to visit eastern countries—and this he was soon enabled to do through the influence and with the aid of Dr. William Laud, then Archbishop of Canterbury, his grace sending him into the eastern parts of the world to obtain books of the languages for him, and at the same time to carry out his own subjects of investigation. Accordingly Mr. Greaves furnished himself with the quadrants and other instruments necessary for taking the altitudes and distances of the stars, and the latitudes of the cities, for measuring the pyramids, and making observations of the eclipses, at his own expense, having in vain applied for the patronage and assistance of the magistrates of the city of London. This failing him he was obliged to sell most of his own books, which he had taken with him; but aided by the love and care of his brothers, straining their own occasions to supply his, he was enabled in despite of the great and wealthy city, to go on with his designs. He embarked, therefore, in the river Thames in 1637 for Leghorn, from whence he proceeded to Rome; from Rome he went to Padua, then to Florence and back to Leghorn, where he embarked for Constantinople and from thence set sail for Egypt. The vessel being obliged to put in at Rhodes, he went ashore and took with him a brass astrolabe of Gemma Friseus, because he durst not make use of any larger instrument, for fear of giving suspicion to the Turks; he found the elevation of the pole there to be 37° 50′. He never lost an opportunity of carrying out his work, either for the archbishop or himself, in every city and place which he visited, and where he made acquaintance with all sorts of learned and excellent persons, from whom he invariably received attention, and with whom he held much friendly intercourse, thereby greatly extending his knowledge and gaining information. After a tedious voyage he at last arrived in Alexandria, where he stayed four

or five months, and made a great number of useful observations. From Alexandria he "went twice to Grand Cairo to measure the pyramids, carrying with him a radius of ten feet most accurately divided into ten thousand parts, besides some other instruments of precision, for the fuller discovery of the truth."

To a mind like John Greaves', imbued with a love for geometry, mathematics and astronomy, combined with his great appreciation for antiquity in historical and literary lore, it was only natural that the Great Pyramid of Egypt—one of the seven wonders of the world—should have had a special charm for him, leading him to devote his time and talents to measure, explore and relate all his labors and their results concerning that oldest, most remarkable, and most mysterious monument. In 1646, accordingly, he published his Pyramidographia, and well earned for himself the title of "Pioneer of Pyramid Measurers."

In those early days of pyramid research bitter and acrid animadversions were very soon written on John Greaves' labors at the Great Pyramid—such as all his followers have had to experience down to the present day—and of necessity, perhaps, for the full and perfect development of the marvelous truths, scientific, historical, and religious, laid up in that primeval monument.

Having likewise made a curious collection of Greek, Arabic, and Persic manuscripts—with a great number of gems, coins and other valuable antiquities, John Greaves returned to Leghorn about midsummer, 1639, it having occupied two months in sailing from Alexandria to Leghorn. From Leghorn he proceeded to Florence; from there he again visited Rome in order to repeat the observatioes which he had made there before, though his desire of returning to his own country induced him to shorten his stay; and on the observations being finished, he went to Leghorn, where he took ship for England and arrived there in the summer of 1640. In 1643 he was chosen Savilian professor of astronomy in Oxford, and superior reader of Linacre's lecture in Merton college; having also a dispensation from the King for holding his fellowship of that college as well, because the stipend belonging to the professorship, at all times

very small, was extremely lessened during the civil war, and he had lost his other professorship of Gresham college, in London, on account of his absence in the east. In 1647, Mr. Greaves published his discourse on the Roman foot and Denarius: "From whence, as from two principles, the measures and weights used by ancients may be deduced." The same year he published at Oxford Dr. John Bainbridge's *Canicularia*, to which he added *Demonstratio Ortus Sirii heliaci pro parallele inferioris Ægypti, et Insigniorum Aliquat Stellarum Longitudines et Latitudines ex Astronomicis Observationibus Mag Beigh, Tamerlanis Magni Nepotis.*

The growing troubles of the country at this time seriously affected him; and on October 30, 1648, he was ejected from his professorship of astronomy in Oxford, and fellowship of Merton college, by the Parliament visitors, and obliged to quit the university. At the time of his ejectment, his chests were broken open by the soldiers, and his papers and manuscripts taken from him; part of which were lost, and a few only, recovered by him, through means of his friend Mr. Selden. He then retired to London, where he married, and prosecuted his studies with great vigour. He was a most learned and extensive writer, and published many valuable works on various subjects, including his Pyramidographia, and Roman foot and Denarius. Dr. George Hooper, Bishop of Bath and Wells, writes thus of John Greaves: "It is a great pity for many reasons, that the accurate judgement and exquisite learning with which he was furnished met with those unhappy times in which an honest man was not only discouraged, but disabled from the prosecution of such studies as those in which he engaged."

Our author's last work was published in 1652 in quarto: *Astronomica quædam ex traditione Shah Cholgii Persæ.* (He lived in 1461 B. C.). Professor Greaves did not live long after the publication of this book, for he died 8th October, 1652, being then fifty years of age, and was interred in the church of St. Bennet Sherebog in London. Dr. Gerard Langbaine, in a letter to Mr. Selden, of Queen's college, Oxford, 22d October, writes thus upon the occasion of our author's decease: "For

Mr. John Greaves, I was seized of the sad news of his death. I have in him lost a friend, and learning a great support. What he had of his own, as author, I hope his brothers or some knowing friends will be careful to preserve. He was owner of some Arabic books, which are not to be found in Europe again, and which I would willingly put in for this University. And methinks it is a disgrace to our nation, that such commodities should pass from hence to France, Sweden, or the Low Countries."

Our author left his brother, Dr. Nicholas Greaves, executor of his last will and testament, which had been made the year before his death; and the latter left by will our author's astronomical instruments to the Savilian Library of the University of Oxford, where they are reposited. A great many papers of Professor Greaves, as well as letters to and from him, were sold by his brother Dr. Nicholas's widow to a bookseller for an inconsiderable price, and lost, or dispersed into a variety of hands. This is much to be regretted, as all his writings were of value, also his collection of letters, as he had corresponded with many learned individuals both at home and abroad.

Such was the honorable opinion of Professor John Greaves as held and expressed by the learned men of his own and the following day. Oxford, too, in general, and the Savilian Library in particular, meant well by him, for they still keep with honor the wooden case which once contained his remarkable iron radius "of 10 feet divided into ten thousand parts" wherewith he measured, in an age when Islam was strong, the exact size of the granite King's chamber of the Great Pyramid.

What became of that measuring rod, no one knows, and probably it does not much matter, for a manufactured piece of iron might alter its length in 250 years; but not so the almost eternal, nature-formed granite blocks of the chamber, and Greaves had done his work when he recorded and published the length of that chamber in the British feet and inches of his day. For nations rise and nations fall, travelers come and travelers go, but that Pyramid chamber remains, even as Greaves' own hypothesis of it was, a standard of linear reference to anyone who will measure it in the scales of his own country, and

having been remeasured 230 years after Greaves' time by another British Professor of Astronomy, and found to be sensibly of the same number of feet, inches, and parts of an inch, the length of the British inch is thereby shown to have remained constant through the interval, as well as to be a very noble and valuable standard of length measure.

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*THE LIMESTONE OF THE GREAT PYRAMID.

Articles are frequently appearing in the newspapers claiming that the stone of which the Great Pyramid is built is artificial. Whatever arguments may be urged in favor of this theory, a brief but careful inquiry into the physical and chemical construction of the stone will effectually cut off further argument and prove that it is of natural formation, and belongs to the class of fossil limestone known as nummulitic or nummulite limestone, which is found most abundantly throughout the world, notably on the Himalaya mountains at an elevation of 16,000 feet above the level of the sea, from whence it originated, and in Egypt, where the whole of the Mokkadaan mountains are formed of it. The name nummulitic is derived from the Latin *nummus* (a coin), the nummulites being of that form and called in Egypt Pharaoh's Pence. The fossil nummulites exist in such vast numbers that all the thousand of miles (perhaps millions) of the earth's surface which is covered with this formation is composed almost entirely of them, varying in size from that of a pin head to an inch in diameter. The nummulites are plainly visible in the specimen of the pyramid which Mr. Latimer has shown us, in immense numbers, and so well preserved that there can be no doubt as to their identity. This of itself would remove any doubt as to the origin of the stone, but an analysis has been appended which still further fixes the certainty, as it would be impossible to make an artificial stone with ninety-five per cent of carbonate of lime. The iron present is a sesquioxide, which gives the stone a yellowish cast. It may

*Read before the Institute August 15, 1883.

have been formerly a protoxide which by exposure has been changed to its present condition; in that case it was originally of a bluish color. We have also appended its specific gravity merely as a matter of interest in connection with some of Mr. Latimer's calculations. Great difficulty was experienced in arriving at the exact specific gravity from the fact that it was too porous and friable to be weighed in water in the usual manner. Recourse was had to pulverising to an impalpable powder and introducing a known quantity into a very light glass tube which had been previously counterpoised in water, suspended from the delicate balance belonging to the Institute, by a fine hair, and after wetting and expelling all air by boiling and again reducing the temperature to 62° Fahrenheit, the weight was again taken in water, the loss of weight being, of course, the amount of water displaced. This method I consider more accurate than by the ordinary pygnometer.

Analysis of limestone from the Great Pyramid:

Carbonic acid	42.1
Silicic "	2.224
Iron and alumina	1.417
Lime	53.580
Magnesia	Not weighed.
Organic matter	"
Sulphur	"
Phosphoric acid	"
	99.321

Specific gravity, 2.6916+

N. B. Wood,
Analytical Chemist and Assayer.

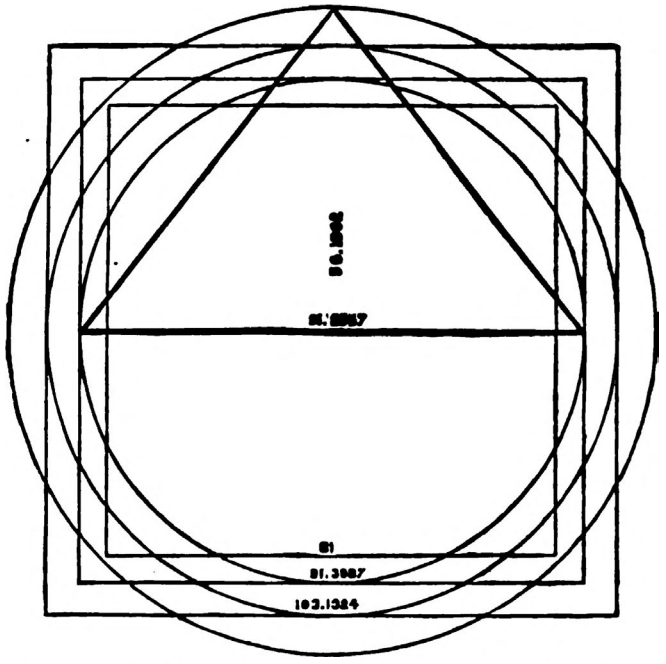
We acknowledge with pleasure the high compliment paid us by M. l'Abbé F. Moigno, who has translated into French and published entire in the Cosmos Les Mondes for July the article by President Latimer on the Parallax of the Sun, as given in the first number of this Magazine. The Latimer Diagram is also reproduced.

CHINESE MEASURES.

A writer in the *North China Herald* gives some curious information respecting the foot-measures in China. At present it varies largely in different parts of the country and according to different trades; thus the foot of the carpenter's rule at Ningpo is less than 10, while that of the junk-builders at Shanghai is nearly 16 inches. But a medium value of 12 inches is not uncommon. The standard foot of the Imperial Board of Works at Peking is 12½ inches. A copper foot-measure, dated A. D. 81, is still preserved, and is 9½ inches in length. The width is one inch. The small copper coins, commonly called cash, were made of such a size, sometimes, as just to cover an inch on the foot-rule. In the course of two centuries it was found that the foot had increased half an inch, and a difference in the dimensions of musical instruments resulted. Want of harmony was the consequence, and accordingly in A. D. 274 a new measure, exactly 9 inches in length, was made the standard. Among the means employed for comparing the old and new foot are mentioned the gnomon of official sun dials, and the length of certain jade tubes used according to old regulations as standards. One of these latter was so adjusted that an inch in breadth was equal to the breadth of 10 millet seeds. A hundred millet seeds, or 10 inches, was the foot. The Chinese foot is really based on the human hand, as is the European foot upon the foot. It strikes the Chinese as very incongruous when they hear that we measure cloth, wood work, masonry, etc., which they regard as especially matters for the hand, by the foot. Of the jade tubes above mentioned there were 12, and these formed the basis for the measurements of liquids and solids 4,000 years ago. They are mentioned in the oldest Chinese documents with the astrolabe, the cycle of 60 years, and several of the oldest constellations. It is likely that they will be found to be an importation from Babylon, and in that case the Chinese foot is based on a Babylonian measure of a span, and should be 9 inches in length.

A DISCUSSION ON THE LATIMER DIAGRAM.

Referring to the diagram given upon page 29, vol. I, of this magazine (reproduced below), and which I shall designate the "Latimer Diagram," I wish to call attention to a few important and interesting facts, most of which seem to have been hitherto overlooked in its discussion.



Commencing with the interior square, whose side is 81, let us designate the series of squares respectively by the letters a′, a″, a‴, etc. Let the functions of the square be respectively represented as follows: the sides by S′, S″, etc., the perimeters by P′, P″, etc., and those of the circles as follows: The radii by $r_{,}$, $r_{,,}$; the diameters by $d_{,}$, $d_{,,}$; the circumference by $c_{,}$, $c_{,,}$, etc. Now it is manifest that, starting from the abstract number 81=S′, we may, after discovering the law of development, continue the series of squares and circles upwards to infinity and downwards to zero. Let us develop the several functions of the ascending series through any number of terms, say for instance through five. By so doing we obtain the following:

$$S^{I}=\frac{180^2}{20^2} = 81 \qquad r_{I}=\frac{180^2}{20^2\sqrt{\pi}}=\frac{81}{\sqrt{\pi}}$$

$$S^{II}=\frac{180^2}{2\cdot10^2\sqrt{\pi}}=\frac{2\cdot81}{\sqrt{\pi}} \qquad r_{II}=\frac{180^2}{2\cdot10^2\pi}=\frac{2\cdot81}{\pi}$$

$$S^{III}=\text{etc.}=\frac{4\cdot81}{\pi} \qquad r_{III}=\text{etc.}=\frac{4\cdot81}{\pi\sqrt{\pi}}$$

$$S^{IV}=\frac{2\cdot4\cdot81}{\pi\sqrt{\pi}} \qquad r_{IV}=\frac{2\cdot4\cdot81}{\pi^2}$$

$$S^{V}=\frac{4^2\cdot81}{\pi^2} \qquad r_{V}=\frac{4^2\cdot81}{\pi^2\sqrt{\pi}}$$

etc.

$$P^{I}=4\cdot81=324 \qquad C_{I}=2\cdot81\sqrt{\pi}=324\sqrt{\pi}$$

$$P^{II}=\frac{2\cdot4\cdot81}{\sqrt{\pi}}=\text{etc.} \qquad C_{II}=4\cdot81=324$$

$$P^{III}=\frac{4^2\cdot81}{\pi} \qquad C_{III}=\frac{2\cdot4\cdot81}{\sqrt{\pi}}\ \text{etc.}$$

$$P^{IV}=\frac{2\cdot4^2\cdot81}{\pi\sqrt{\pi}} \qquad C_{IV}=\frac{4^2\cdot81}{\pi}$$

$$P^{V}=\frac{4^3\cdot81}{\pi^2} \qquad C_{V}=\frac{2\cdot4^2\cdot81}{\pi\sqrt{\pi}}$$

etc.

$$a^{I}=(S^{I})^2=81^2=\pi r_{I}^2$$

$$a^{II}=(S^{II})^2=\frac{4\cdot81^2}{\pi}=\pi r_{II}^2$$

$$a^{III}=(S^{III})^2=\frac{4^2\cdot81^2}{\pi^2}=\pi r_{III}^2$$

$$a^{IV}=(S^{IV})^2=\frac{4^3\cdot81^2}{\pi^3}=\pi r_{IV}^2$$

$$a^{V}=(S^{V})^2=\frac{4^4\cdot81^2}{\pi^4}=\pi r_{V}^2$$

etc.

From a study of these equations the following laws of development are apparent:

I. The diameter of the first circle = the side of the second square, that of the second circle = side of third square, and generally the diameter of any circle (say the n^{th}) is equal to the side of the next (*i.e.*, $n+1^{st}$) square.

II. The primeter of the first square = the circumference of the second circle, that of the second square = the circumference of the third circle, and so on, so that generally the perimeter of the n^{th} square = the circumference of the $n + 1^{st}$ circle.

III. The area of the first square = that of the first circle, that of the n^{th} square = that of the n^{th} circle.

IV. A Pyramid triangle may be based upon the diameter of any circle, as for instance that of the first, and have for its height the radius of the second therefrom. Thus the diameter of the first circle and the radius of the third gives us a Pyramid triangle, and the diameter of the n^{th} and the radius of the $n+2^{nd}$ another.

From the foregoing it follows that since to the diameter of the first circle there can bê given any numerical value from 0 to infinity, such a sequence of squares and circles may be made to represent the nucleus of any desirable series of Pyramid triangles, and hence that there is a series which corresponds to the base side of the Great Pyramid as the side of a second square, and the diameter of a first circle. Now it is a fact that the height of this Pyramid so far as we can measure and estimate, be it in the terms of any linear measure whatsoever, corresponds to the radius of a third circle of a such a series. Hence we are justified in believing that the Great Pyramid of Gizeh was built as an intentional exponent of such a geometrical series, rather than that it is a gigantic accident. To this conclusion we are forced without reference to any knowledge of the absolute unit of measure actually employed by its builders.

Now whether we believe in the Parker modulus or not, $\frac{20612}{6561}$ as an accurate, and as the only accurate realization of the true circummetric ratio (commonly called and symbolized by π), it is manifest that it is an extremely close *common fractional* approximation thereto, and that it is far closer 3.141594+, than the form $\pi = 3.1416$ generally adopted in modern practice as "accurate enough," while its common fractional form, always correct to a farther decimal than the usual $\pi = 3.1416$, is more convenient than the latter in the development of intricate calculations.

If it be only an approximation, it is nevertheless an astonishingly close one, and one whose great possible utility is not to be lightly ignored by modern scientists, who have already shown their willingness to employ such conveniences in their quiet adoption of the number 206265″ as an astronomical multiple, in lieu of the more accurate π value 206264.806, etc., or Parker value $206264\ \frac{3608}{5153}$ for the length of the radius of a circle in seconds of arc. It is to be noticed moreover that no consistent objection can be offered to $\pi = \frac{20612}{6561} = 3.141594$ as erring in the seventh place of figures, either by those who use $\pi = 3.1416$ which errs in the fifth, or those who employ 206265″ which errs in the sixth place.

But while the ratios remain constant, no matter what unit of linear measure we employ at the base side of the Pyramid, it is a remarkable fact, discovered by Mr. Charles Latimer, that if we take the number 81 as the side of the first square in such a sequence as we are discussing, the diameter of the first circle will be 91.398+, or equal to 1-100th of the measure of the Great Pyramid base side, in present Anglo-Saxon inches, and that thence at 1-100th their actual measures, all the pyramid dimensions result in English inches. This is enough to attract our attention not only to the Pyramid but to the Anglo-Saxon inch of which we are so distantly the inheritors.

Nor is this all, for in the abstract the number 81 is an important radical in various branches of metrology as well as in the science of pure "Number" as such. Thus it is peculiarly perfect in being the square of 9, which itself is also the square of 3. So it is directly related to the ancient division of the circle into 360°,—a division with which the iconoclastic French philosophers, when they decimated so recklessly for an universal metric system, dared not tamper. 81 as the side of a square gives us 324 as its perimeter, and 324 seconds are the .001 of a right angle. The remarkable series of circular functions, which express the various Pyramid dimensions in terms of seconds of arc or of radius result directly and solely from this fact, and we must term it a numerical intimacy rather than a mere coincidence.

The Pyramid itself is built upon pure circummetric (*i. e.* circumference to diameter) relations. The development of its series of particular dimensions from the abstract number 81, as the diameter of the primary circle in the Latimer diagram, is the gate through which enter the circular (*i. e.* 360° to a circumference) relations, in seconds of arc. It is also through this same gate that the inch enters into Pyramid dimensions as a unit, and by means of it these relations become significant to its present Anglo-Saxon possessors.

Now a still closer examination of this Latimer diagram will show that if within its primary square (81) another circle is inscribed (*i. e.* with diameter = 81) it will not only form a subordinate link in this same sequence of geometrical circular, circummetric, inch, and Pyramid properties, but also so complete the diagram as to afford us the identical squares and circles employed by Mr. Parker in his demonstration of the rectification or quadrature of the circle. These are the circle whose diameter is 81 and whose area, Parker essays to prove, is 5153; the square whose side is 81 and whose area is 6561; and the circle whose area is also 6561.

From the foregoing brief review of some of the properties of the Latimer diagram, it is manifest that it not only fits the Pyramid as an architectural fact, but that it clearly demonstrates the monument to be an exponent of both circular and circummetric ratios. This is so numerically or "in the abstract"—that is, independently of any particular "unit" of measure. If, however, the fractional division, 81, of the primary diameter be taken in inches—*i. e.*, present Anglo-Saxon inches—then we are at once attracted not only by the diagram as actually related to the particular dimensions of the Pyramid, but to a more thoughtful consideration of the actual, or at least practical, value of the Parker Modulus, $\frac{2061}{6561}$.

C. A. L. Totten, U. S. A.

ZECHARIAH'S VISIONS OF THE PYRAMID CAP-STONE, AND OF THE WICKED MEASURES.

When the excavated records and relics of ancient times are exhibited to us, as coming from the sites of ancient places recorded in history, we obtain from them new evidences of historic facts, which we already knew. It should not be less so, when we succeed in digging out from a record in the most ancient book, the Bible, a confirmatory evidence that the prophets of Judah knew of the Great Pyramid as a monumental symbol of truth against error. Like those ancient places, some records in the Bible are covered with the debris of false and obscuring translations and interpretations, through which one must dig, until he comes to see a truth, which is not only interesting, but an *inter esse*, an important concern between two, God and man, and also man and man. Such an important find I desire to exhibit here in the visions of the prophet Zechariah. I regret that the character of this Magazine, and the limited space of an article do not permit me to give a full and corrected translation of the 3d, 4th, and 5th chapters of that prophet's book. I must confine myself to an outline of the visions, and call attention to those most perverted translations only, which obscure the entire meaning of the record. In the third chapter the prophet sees Joshua the High Priest, standing before the Angel of Jehovah in soiled garments, in which he could not enter the Holy of Holies. (See Lev. VI: 8–11; XVI: 1–4, and 23). Satan stands by him to gainsay; but Jehovah commands Joshua's garments to be changed, and gives him a charge to keep, on which faithful performance he promises him a free intercourse among certain personages who were there and then present. The reader will find who these are in Rev. I: 12, 13, 20; and II: 1. But in the eighth verse a new point is made by the announcement that a certain person by the name of *Tsemahh* is to be brought into the world. The common English rendering of this name by "The Branch" is twice faulty. In the first place, a name of a person can not have an article before it, either in Hebrew or English. Secondly, a

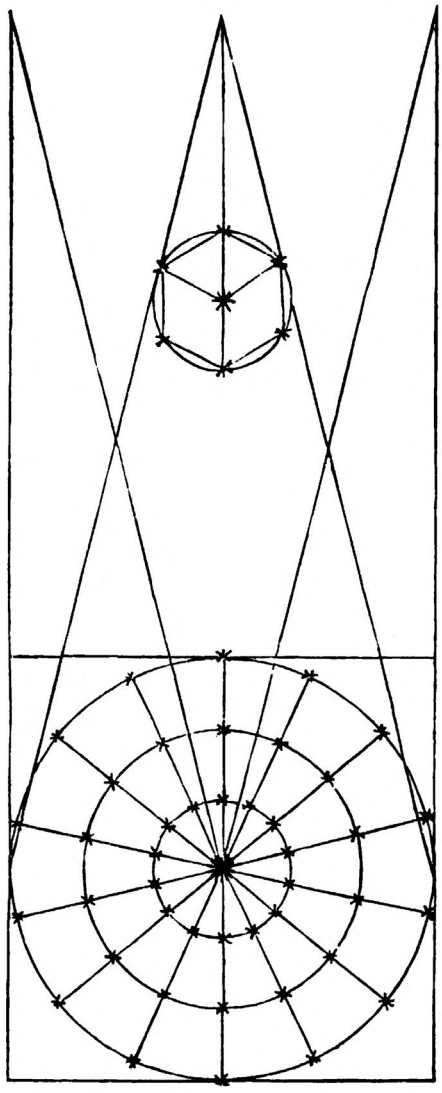
branch is a derived growth, while *Tsemahh* denotes an entire plant. This false rendering induced the further false rendering of VI: 12, which should be, "And from underneath himself he shall sprout forth."

This name, *Tsemahh*, is numerically very significant. The Kabala reckons with numbers in two ways: 1st. The small numbers, *i. e.*, the integers from 1 to 9; and 2d. The great numbers, *i. e.*, the multiples of the integers by ten, and multiples of ten, which for brevity I would denominate *Decapla*. In integers, *Tsemahh*=9+4+8 = 21. This is the same number of the *Naitser Yeeshai*, = the "Sprout of Jesse," of Isaiah XI:1, which contains the numeric integer letters, 5+9+2+1+3+1=21. Again the words *Tsemahh Yeeshai*, which mean "The Plant of Jesse," contain the numeric integer letters, 9+4+8+1+3+1 =26, and 26=10+5+6+5, which are the decapla letters of the name Jehovah. But the letters of Jehovah as integers are 1+5+6+5=17, and this is the integer value of the letters in the name Jesus, viz. 1+3+6+7=17. In investigating Biblical words numerically, this counting with integers and decapla must never be lost sight of; a caution which I see our Christian G'matrists do not always observe.

The solemnity of the announcement in the 8th verse is induced by reason of the announcement in v. 9: "For behold the stone, which I have placed before (= *ante*) Joshua! Upon one stone, seven eyes, behold, I engrave an engraving, (or, open an opening), saith the oracle of Jehovah Zebaoth, and I put away that sin of the earth in one day."

The Hebrew words for "one stone," contain again the numeric integer letters, 1+2+5+1+8+4=21. For the meaning of the seven eyes, compare the same prophetic book II: 8, where "his eye" is put euphemistically for "my eye," since it seems irreverent to say, that a man should touch God's eye, but it means it just the same. Compare also the "seven stars" in Revelations. For "that sin of the earth," compare v. 4, "the soiled garments," and gainsaying Satan; also Isaiah LXIII, 1-6. Then it is announced in v. 10, that at the complete removal of sin from the earth, general peace will ensue. For the figurative language, compare I Kings IV: 25.

The stone with the seven eyes was not an object of ocular sight in this vision, of the prophet, but in the next. The scene is changed; the prophet wakes up as from a dream and sees a candlestick and a wheel over it. The objective forms of the prophet's vision here was wrongly conceived by commentators generally, and this influenced the very inadequate and linguistically wrong translation in our common version. The literal and correct translation of verses 2 and 3 of chapter IV is this: "And he said unto me, 'What seest thou?' And he (or I) said, 'I saw, and lo, a candlestick all of gold, and a cycle upon her head; and her seven lights upon her; seven and seven are streaming out unto the lights, which are upon her head.'" The words "bowl" and "pipes," are unjustifiable renderings, and the forced results of misconceptions. The accompanying cut gives the ocular, objective vision of the prophet strictly according to his description here, and in ver. 11 and 12. There are "seven and seven lights," of the candlestick spoken of here, as "outstreaming" to the "seven lights" of the cycle above the head of the candlestick. The candlestick would, therefore, have had 7×7 lights, but as it is natural to think, that each 7 lights crossed the other, so that all would have a common, central, seventh light, hence the lights would be $7 \times 6 = 42 + 1$, disposed upon three concentric circles, as it were upon an equatorial plane of three concentric spheres, each



pair of corresponding lights being the termini of a half great circle, while the central light had the place of the axis. There were here then 2×21 lights plus one; 14 radii, or 7 diameters. Who cannot see in this the 7 churches, or the 7 holy enlightened communities of Jehovah—Jesus in the world—each one completed by the same one, sanctifying and illuminating seventh, holy light? But more: each set of seven lights was streaming out to one of the seven lights, which were suspended over them in the cycle above. In the cut I took the proportion of base to height from the Pyramid, and the size of the cycle I made the same as the inmost circle of the candlestick. This, too, seemed to me appropriate. The disposition of the seven lights (the eyes) on the cycle could not, I think, have been otherwise than I give it, and they surprise us with the figure of a cube in perspective.

On either side, right and left of the cycle, there were two olive trees, and according to v. 11, the trees stood by the candlestick, which in the cut I represented by the two tangents. The prophet did not understand the meaning of the objects before him and on inquiry the angel told him that these denote a message, or word from Jehovah to Zroobabel. The meaning of this name is, "The scattered ones by (means of) Babylon." The message, therefore, is to the tribe of Judah, and it said: "Not by force, nor by power, except if it be my spirit, saith Jehovah Zebaoth." This is a correct rendering of v. 6, and differs importantly from the common rendering, which eliminates human agency, while the words of the original included this agency, but on condition of divine inspiration. The 6th verse contains all the message of Jehovah for the present moment. The next verse (7) is what the angel exclaims himself, and its enigmatic language is the *crux interpretorum*, to those who do not, or wish not to, know of any pyramid and its construction in the Bible, to whom the entire subject of the Pyramid is "supremely ridiculous." The correct translation of this verse is this: "Who art thou, O great mountain before Zroobabel? (before = *ante*, in time and space direction, east and west.) To the plane! and bring forth *The Stone*, the one of her head! Shoutings! grace! grace! unto her!".

In Job xxxviii, 4–6, Jehovah speaks to Job of the planning and building of the earth under the figure of a pyramid, thus: "(4) Where wast thou when I founded the earth? Say on, if thou hadst known understanding! (5) Who put her outmeasing? For thou shouldst know! Or, who bent upon her a line? (6) Upon what were her sockets sunk? Or, who taught (= cast = forecast) her pinnacle stone?"—And the angel in Zechariah speaks of the earth in the same figures. Mountain and stone are nouns of the masculine gender in Hebrew, while earth is feminine. It is, therefore, of the earth's pinnacle stone, and of the salute of grace! grace! to the earth when her pinnacle stone is put on her, that the angel speaks, when her sin shall be removed at a certain day. Compare iii:9. The expression "To the plane," evidently refers to the plane on the top of the unfinished pyramid, where the pinnacle-stone is to be laid.

Now, what the prophet heard and saw in this series of visions becomes finely unified, and the numerical values of certain salient words in these are of great help. Thus, "Pinnacle-stone," in Hebrew *Even Pinah*, are equal to 26 in decapla, or "great numbers," and this is the value of the name IaHVeH = Jehovah. But IaHVeH in integers = 17, and this is the integer value of IaiSHuGHHa = Jesus. Again, the shouts, "Grace! Grace!" in Hebrew "HHaiN! HHaiN!" are = 13 + 13 = 26, in integers. Then the 2 × 21 lights, plus the central one, which points to the hexagonally arranged lights of the cycle above, are precisely the numbers of the great Name of promised ever presence given to Moses (Exod. iii: 14) "I shall be Who I shall be!" In Hebrew, EHIeH ASHeR EHIeH = 21 + 6 + 21. The 21, we already know is the number of the "Tsemah"=Plant, (see above, p. 3). Patriotic Zechariah expected, no doubt, that the joyful consummation of placing the pinnacle stone would take place then and there on the temple, which was then being rebuilt. But it did not take place then, and Jehovah next told him that it would not. His words, however, in verse 9, were strangely mistranslated, and misunderstood by interpreters. The oldest of them, the LXX, give the Greek word "*epitelesousin*,"—they shall finish, for

the Hebrew word "*Tbatsajhhnoh,*" which means, without exception, "they shall break her down." The very contrary, therefore, of what Zechariah then expected, and of what false interpretation puts into this verse, is here foretold. It says: "The hands of Zroobabel (= the scattered ones by Babylon) founded this house, (of which the prophet thought then), but his hands shall break it down."

Then the question is, why then the rejoicing expressed in v. 7? And the reason for it is given in the 10th verse: "For whoever may despise a day of small things, . . . (then let him do so), but they shall rejoice and see the stone, the separated one, (*i. e.* the famous one of Psalms CXVIII: 22; here the words may mean also, 'the plummet stone'), in the hand of Zroobabel; these are the seven eyes of Jehovah, which wander about in all the earth."

The prophet could understand now the meaning and connection of what he heard and saw in these visions. The stone with the seven eyes of Jehovah opened on it, appointed before Joshua the high priest, as a capstone for the mountain, which existed before Zroobabel, shall yet be an object of rejoicings in the hand of the scattered ones by Babylon, who are wandering in all the earth, yet with the loving, fostering eyes of Jehovah ever over them. How surprisingly, and unforcedly unified are now these visions of the prophet! But he asks still further about the meaning of the two olive trees, which he sees now better, than in v. 3, are standing right and left of the candlestick. And again he asks, (v. 12) about another arrangement of the candlestick. But his words were again mistranslated, and misinterpreted; they are thus: "What are the two streams of the olive trees, which empty *from upon them* the gold, by means of the two golden channels?"

He asked two questions, and was answered by one comprehensive explanation, that these two olive trees denoted the two sons, or men, of Iee TS HaR, who stand by the Lord of all the earth. Iee TS HaR means "bright," "shining," and is used figuratively for pure, illuminating oil. A full explanation of these men will be found in Rev. xi: 3–12. They are, I have no doubt, Moses and Jesus, the two mediators, or imparters of divine, inspired

materials of light, in the Old and New Testaments. Their oil does not come through the press of human manufacture, but directly from the trees, which though standing by the churches on earth, reach up to the seven eyes of Jehovah, the Head and Capstone of a redeemed church, and a to-be-redeemed world. The earth builds up the coarser skeleton of the tree, but the leaves of it draw from the upper air the finer materials for the production of flowers and fruit. And the oil comes down in channels from above (see the two hypothenuses in the cut), keeping the lamps of the seven churches ever supplied. But the world hates the light and hates the two witnesses, the Old and New Testaments, and always tries to kill them; but they rise again, and then there is consternation in the rationalistic camp outside and inside the churches. Read those passages in Revelations.

I would here ask some student of the Pyramid to kindly take into consideration the numbers and figure of Zecharias' visions here, and compare them with Pyramidal numbers, and those of the Tabernacle, as given in my "Key" to it.

In the fifth chapter we have two remarkable visions again. The first one was that of a flying, evidently open, scroll, measuring 20 × 10 cubits, *i. e.* divisible into two squares of 10 × 10, a perfect measure. On his asking, it is explained to the prophet to denote the oath, (not necessarily a "curse," for it is not to those who keep it,) which went out upon the face of all the earth.

Grievously inadequate is the common translation given of verse third. It says this: "This is the oath that went out upon the face of all the earth; for every one who stealeth from it shall according to it be avenged from, and every one who swears more than it, according to it he shall be avenged from." The meaning of these words is according to the idea of Rev. xxii, 18, 19. It is against taking away, or adding to the Old and New Testaments, either of which is a perfection inviolate. The next verse is also badly rendered commonly. It says this: "I have brought her out (*i. e.* the oath), saith the oracle of Jehovah Zebaoth. And she (the oath) shall come into the house of the thief (= the garbler of the Bible), and into the house of him who swears by my Name falsely (= he who adds to the Bible

false meanings), and she shall lodge in his house (=the Bible has a place by all Jewish and christain sects), but she will consume him, and his woods and stones," *i. e.*, his perishable and more permanent idols.

This vision of the prophet was, as it seems, in further explanation of the office of the two witnesses, the olive trees, and the work they do for the seven churches of Jehovah-Jesus in all times. The next vision is, reverently said, a curious one. It is a vision of the mystery of iniquity under the figure of a measure and a weight, carried about spiritedly by what I would call huckstering women. Satan always apes God.

The earth Pyramid and its capstone, the 7×7 candlestick with its cycle of seven eye-lights over it, is aped by an epha and a round talent weight of lead. The prophet sees an epha and a woman sitting in it, and a round talent weight of lead over them, all carried about in the air. The angel explained to the prophet, that this is the wicked woman; and saying so, he thrust her into the epha, from which she must have stood out before, and clapped the leaden stone-weight over the mouth of the epha. Then there came out two other women with spirited wings, wings like those of the grave-looking swamp bird, the stork, and they carried the epha between heaven and earth. Very likely taking the measure of a curved meridian, to pronounce it a straight line. The name of the stork in Hebrew is, "Pious female," or, one making the world happy. On asking, whereto they are carrying the epha, the prophet is told, that they are to build her an house in the land of Shinar; and that it is already prepared, and they will put her there at rest upon her basis. Shinar is where the defying tower of Babel was built, and is a fit name for the place where the metric system originated.

EPH. M. EPSTEIN, M. D.

Vermillion, D. T., July 17th, 1883.

THE UNVEILING OF ISIS.

What is Isis? What has Isis to do with the subject of weights and measures? What is the meaning of the "Unveiling of Isis?" These are all pertinent questions; and I shall not be surprised nor annoyed to be asked, Why do you go down into Egypt, digging into the history of ancient gods and goddesses, groping amidst the mythology of heathendom, for the means of preserving and perfecting Anglo-Saxon weights and measures? I shall be neither annoyed nor offended, for no one could have been more sincere in considering the subject of the unveiling of the mysteries of the Sa-itic Isis as inapplicable to our subject of study and research than the writer of this paper. It was not until a comparatively recent date that I became convinced that the subject of Isis is relevant to present history as well as to weights and measures.

One prominent historical fact must be my main support at this time for the assertion of the relevancy of the subject, namely, the kings of ancient Egypt were required by the priests of On, or God, to swear upon the altar of Isis to preserve the calendar and the weights and measures. These, therefore, must have been very precious in the sight of that ancient and learned people. In the light of that example we may well pause and examine before we agree to change our weights and measures, to barter away our birthright without understanding either its value, or the value of the system offered in its stead. If it be true that the kings of Egypt were required to swear upon the altar of Isis to preserve the weights and measures of the race and the calendar, then it behooves us to inquire, "What is Isis?"

The subject has a wide range, yet those who best know its scope are most urgent in asking us to begin a series of papers, unfolding the studies of years, and presenting them to the readers of the STANDARD in a popular way, just as they have come to the writer from time to time. I propose to show in this and the succeeding papers that the study of Mythology is

intimately connected with Astronomy, Astrology, Mathematics, Religion and Science, and with human History, and that it leads us, through weights and measures, to unfold the mysteries concerning the children of Eve, or in other words, leads us to the solution of that great Egyptian enigma of "The Unveiling of Isis," and to the full understanding of that remarkable inscription upon the great temple at Sa-is, namely,

I, Isis, am all that was and is and is to be, and no man hath hitherto me unveiled.

Be it therefore my purpose to endeavor to draw aside the veil which for so many centuries has clouded the vision of the worshipers of God, and which has been and is to-day the puzzle of the Kabala. It may be well here to state that I have been led to the study of this most interesting and, I may well add, wonderful subject, through the study of the prophecy concerning our country contained in the Holy Scriptures, the study of history, and the symbolism of our National standard, the stars and stripes. It has been asserted that there is nothing new under the sun. It would be a curious fact if it could be proven that our Standard or "Ancient" was over 4,000 years old; and yet I propose to show that it existed certainly as a symbol long before then. I also propose to prove that the settlement of the New World, the establishment of the government of the United States of America, was the great end and aim of the myths and of the prophecy as contained in the Scriptures and as written in the rocks of the great stone Pillar of Witness of Jeezeh in Egypt. I propose to prove that they can and will be established finally by the measures and weights of the Anglo-Saxon race; of *The Angel-eis sivi Saxoni* (*i. e.* The angels or messengers of Isis and of the stone kingdom), and only through them; and it therefore behooves us not only to measure the Pillar of Witness or Temple of God with the utmost exactness, but to understand perfectly the mind of the Architect. The Kabalist claims that the old riddle of Isis is again brought forward in the first verse of the 12th chapter of the Revelations of St. John. To this I accede. This verse says: "And there appeared a great wonder in heaven; a woman clothed with the

sun, and the moon under her feet, and upon her head a crown of twelve stars."

If that old inscription upon the Temple at Sa-is, "I, Isis, am all that was and is and is to be, and no man hath hitherto me unveiled"—refers to the woman clothed with the sun of the Apocalypse, then must the myth and the prophecy refer to one and the same thing. The symbol of the former is shown by the labarum or banner of Isis, which was carried in honor of Isis, and it represented a woman clothed with the sun, standing upon the moon, and twelve stars above her head as a crown. Let the artist paint either one and he has the Stars and Stripes represented in the heavens. With this as introduction we propose, in the next article, to take up the historical and prophetical analogies, and let the reader judge how far the one confirms the other. CHARLES LATIMER.

STANDARD TIME.*

A familiar way of computing geographical relations is by latitude and longitude. The former is reckoned north and south from the great circle of the equator; the latter is reckoned from the meridional circle, passing through any certain point on the earth's surface. The equator, or starting line for latitude reckonings, is determined by the daily revolution of the earth on its axis. Only one such line is possible, hence there is no difference among the nations as to the base of latitude. But the reckoning of longitude being east and west from any given meridian, there is no natural base for it; it is, therefore, optional with any nation to fix the starting point for its own reckoning of longitude.

The ancient geographer, Ptolemy, selected the meridian of Alexandria as his base line from which to reckon longitude. The French have selected the meridian of Paris; the English have added Greenwich, and the Americans Washington, to the

* A summary of the views of the Committee on Standard Time, by Rev. H. G. Wood, chairman; read before the Ohio Auxiliary Society, August 29, 1883.

list of first meridians. So long as these several nationalities make their reckonings of longitude apart from one another no inconvenience is experienced, but when they compare their maps or meet at sea, or in any way make geographical communications one with another, reference must be had to their several bases of longitude. To remedy this, and other confusion and inconvenience arising from the adoption of diverse meridians in reckoning longitude is the object of the committee of the society on cosmic time. But inasmuch as it cannot be realized without the concurrence of the civilized world in the selection of one meridian as the base line of longitude, much difficulty must be expected, not only in weaning nations from their established customs, but in bringing men generally to see the need of uniform longitude reckoning. However, the committee have taken the subject in hand and some progress has been made.

In May last the chairman of the committee addressed a circular of inquiry to the several members, viz: to Professor C. Piazzi Smyth, Astronomer Royal for Scotland; M. l'Abbe F. Moigno, canon St. Denis, Paris, France; Sanford Fleming, C. E., Ottawa, Canada; Jacob M. Clark, C. E., New York; Charles Latimer, C. E., Cleveland, Ohio; William H. Searles, C. E., Buck Creek, Pennsylvania; and Commodore William B. Whiting, United States Navy, Milwaukee, Wisconsin. Replies from these gentlemen have been received, which will be published in a short time.

It may, however, be well to state here some of the points made in the replies, both to show the nature of the difficulties to be overcome and to indicate the progress made. It is not necessary to give a complete digest of the several papers now contributed by the committee, but I may say, in general terms as an exhibit of the diversity of opinion that exists in the committee, that Professor Smyth, l'Abbe Moigno and Mr. Latimer favor the meridian of the Great Pyramid as the starting line for longitude reckoning; Mr. Fleming and Mr. Searles, the nether of Greenwich, which is Behring's strait; Mr. Clark, the nether of the Great Pyramid, which is Alaska, while Professor Stockwell is opposed to any agitation of the subject.

At first sight it would appear that such a committee could never come to an agreement. But an agreement may not have been the object, at least at present, in its appointment. It is well calculated to bring out the reasons for and against a change of longitude reckoning.

While the members of the committee thus differ in very important respects, they are of one voice in secondary matters. Thus they agree that for astronomical observations one meridian is as good as another; that the local uses of the people in time-reckoning should not be disturbed; and with one exception the committee are agreed that for the whole world there should be but one prime meridian. It is urged by some of them that a system of secondary meridians at intervals of 15° of longitude, that is one hour of time apart, be fixed for local standards, beginning to measure these hour meridians from the prime meridian. In case of the adoption of a prime meridian by the nations of the earth it is urged that governments respectively provide for opening and closing government offices and transacting government business by the local standard time, based on the nearest hour meridian. Devices are proposed to show on the dials of time pieces both the hour by local time and the hour according to the prime meridian. But these matters appear to be considered of minor importance, about which no one need to be anxious, even if an international agreement be reached recognizing some one meridian as the starting line for the world's reckoning of longitude.

Laying aside, then, the secondary details that may be safely left for subsequent adjustment, let us see how far the replies advance toward securing the object in view. To understand the positions taken in the several papers now contributed by the committee, some definitions will be in place here. A great circle is the equatorial line running east and west and girting the earth. A small circle is a parallel of latitude north or south of the great circle. A prime circle is the meridional circle which is taken as the starting line from which to reckon longitude; it girts the earth from pole to pole. Now let a prime circle be chosen, say the meridian of Greenwich. It is evident we may begin to reckon longitude from Greenwich east

or west, and the degree of longitude will increase till we reach the opposite side of the prime circle, when we shall be at Behring's strait, 180° west of Greenwich. That side of the prime circle which is in the greatest longitude from the starting line is called the great meridian, while the other or starting side of the prime circle is called the prime meridian, also the zero meridian. On the other hand, if we begin our longitude reckoning from the meridian of Behring's strait, Greenwich will be the great meridian, 180° east or west longitude, and Behring's strait will be the prime meridian. It is evident, therefore, that two persons may choose the same prime circle and begin their longitude reckoning from opposite sides of the earth. In such a case the two records made by such persons at any one place would show a difference of 180°. The mind of an observer readily apprehends this difference, and no difficulty is experienced in comparing the records and observations thus related to each other. We may therefore consider two advocates as not inconveniently differing if one urged Greenwich as a prime meridian and the other urged Behring's strait. Prof. Stockwell holds to Greenwich because it is already established. Mr. Fleming and Mr. Searles favor Behring's strait. The question may well be asked, why change to Behring's strait if for all purposes of longitude reckoning it is immaterial whether you begin at Greenwich or its great or nether meridian? Mr. Fleming and Mr. Searles have reasons for desiring a change; we shall give them directly. What we wish to observe here is that persons who agree in the choice of a prime circle may be regarded as disagreeing in matters of secondary importance if one begins longitude reckoning at one side of the circle and the other at the opposite side. In this view of the discussion, Professor Stockwell, Mr. Fleming, and Mr. Searles, are substantially one division of the committee; and Professor Smyth, l'Abbé Moigno, Mr. Latimer and Mr. Clark, who, for a prime meridian, urge Alaska, the nether of the Great Pyramid, constitute the other division. The contest is really, therefore, between Greenwich and the Pyramid; or, to put it in a little different form, between the two great astronomers, Professors Smyth and Stockwell, and between the canon of St. Denis,

assisted by the eminent engineers of New York and Mr. Latimer, on one side, and his brother engineers of Canada and Pennsylvania on the other.

But in its large and proper aspect the question is not at all a personal one. It is a cosmopolitan, a historical, a scientific question, and the men who are contributing to its solution are viewing it from their respective points of observation. Something is well said by all of them. Let us now see in a general way what is claimed for the two candidates, Greenwich and the Pyramid. For the details of the advocacy we must refer you to the several contributions of the committee, soon to be published. First is Greenwich, because she occupies the ground of custom. The prime circle of Greenwich has these advantages: It is accepted by all the English-speaking nations; we already have elaborate maps of almost the whole of the known world referred to the meridian of Greenwich. To change the starting point of reckoning longitude would involve a change in the lines of longitude crossing these maps at that interval; also of the tables of longitude indicating the distance from the Greenwich meridian of all the chief cities of the world. A change in the base of reckoning is a very radical change and ought not to be made without the gravest necessity. If Behring's strait be made the base line, no such changes in map lines or tables are required, for in all practical use of such tables the 180° can readily be added to the longitude given in the table, or subtracted, as the case may require.

A prime meridan located away from the habitable or civilized world is desirable, not so much on account of the reckoning of longitude east or west from zero, but chiefly on account of the confusion which would be likely to spring from the change of dates. If the observatory at Greenwich would begin its day the moment the sun crosses the meridian of Behring's strait, the astronomical and civil days would be identical, both beginning at midnight. These may not seem to be very substantial reasons for preferring a new base line of reckoning longitude, but they are the best, perhaps, that can be given. On the other hand, objection is made to Behring's strait and Alaska, for the location of a base line of longitude reckoning, on the

following grounds: First—The meridian of either lies almost wholly in the Pacific ocean; it cannot be located at any point save in the extreme northern part; nowhere but most remote from the center of civilization could an observatory be erected on it; it has never been used as a prime meridian; it is not a meridian with which astronomical observations in the various parts of the world could be compared; it is not a meridian from which to determine longitude; it is almost wholly unidentifiable; it has no historical association to commend it. Second—The positive advantages claimed for it are not weighty. An astronomical observatory begins its day at the instant the sun crosses its meridian. It is the only practical moment to take the time. If any other beginning be adopted for the astronomical day the observer must take his sun observation at noon and reckon backwards or forwards to find it. The danger of confusion of dates arising from the change of day belongs chiefly to sailors. They add or skip a day in their reckonings when they cross the nether meridian, not when they cross the prime meridian.

But if the prime meridian be in the midst of the civilized world, say at Greenwich, the crossing of the nether meridian will be in the midst of the Pacific ocean, and nobody will be affected by the addition or loss of a day but the vessel that makes the transit.

If a ship leaves London on Monday morning and sails westward 160° her solar days will number the same as London's days, and if she returns by the same way she counts for her voyage passage the same number of Mondays as the citizen of London counts. Or if she sails in the opposite direction 160° and returns again to her port the day reckonings agree.

It is only in the rare instance of crossing the nether meridian that the danger of mistaking Monday for Tuesday arises. The great mass of people are not affected by this. They begin their calendar at midnight. It is of no great importance to them to know just the moment of its beginning. The exact hour of the noon is of far greater interest. It is this that regulates the time of business and civil life; within six or eight hours of either side of this there is no change in the name of the day.

But Pekin's time is less than eight hours faster than London, and St. Louis, is but six hours slower. By the Greenwich and London time the change of date between these extreme points takes place outside of business hours, therefore, there is no substantial change to be apprehended from a possible mistake of dates. When it is midnight in London it is 6 P. M. in St. Louis and 7:45 A. M. at Pekin. Practically, the working day of St. Louis ends before the working day of Pekin begins. A telegram dated at Pekin, Tuesday, 9 A. M., would be received at St. Louis Monday night, but its delivery would be Tuesday morning.

A real danger, however, does arise from the use of these prime meridians. It is highly important that one be agreed upon, and the more important as the commercial and scientific relations of the world become more active.

If we admit that the foregoing objections are so far worthy of respect that a change of the prime meridian from Greenwich to Behring's strait or Alaska, cannot be recommended, the question is narrowed down to a choice between Greenwich and the Great Pyramid. The reasons for holding fast to Greenwich have already been given. What can now be said of the Pyramid? The great advocate of the Pyramid is Piazzi Smyth. Let us hear his reasons:

"The advantage for Ghizeh as a base line meridian for reckoning longitude are: First—Its line is capable of being laid out by trigonometrical measurement a distance covering the whole breadth of the habitable earth from north to south; it can be marked by masonried station signals at convenient intervals for nearly 100° of latitude; such signal stations are the only accurate, permanent and visible method of setting forth the one base of longitude measuring. Second—The Great Pyramid is the best built surveying station-mark ever erected. Third—It is historically associated with the past records of the world; it is geographically central to the civilized world. Fourth—It is rapidly becoming easily accessible to all nations."

In so far as it relates to Professor Smyth's advocacy of a surveyable line for a prime meridian, it is well to observe that the late Lieutenant M. F. Maury was fully persuaded that this at

least should be its character, and he, in an interview with Commodore William B. Whiting, United States Navy, at one time took down a map and pointed out in the Pacific ocean about 6° east of the Hawaiian Group, where he thought the nether meridian should be, that is 148° 51′ west from Greenwich. The prime of that nether meridian is Ghizeh.

Professor John N. Stockwell and Commodore Whiting agree with Professor Smyth and Lieutenant Maury in the opinion that a prime meridian should by no means be in mid-ocean, but on solid land, from which observations and measurements can be referred.

With these considerations the question is narrowed more closely. The meridian of the Pyramid has all the advantages that can be claimed for Greenwich. Greenwich has the advantage of established usage. Objection is made against changing from Greenwich to Behring's strait or Alaska, on the ground of the great inconvenience involved without a corresponding gain. It may be well asked what practical gain will be realized by changing from Greenwich to Ghizeh? Scientifically the chief gain would be in securing a base line 5,000 miles long that can be identified and marked by station signals at convenient intervals. But inasmuch as all observatories must reduce their observations to a common reference point for comparison, the scientific advantages that are derivable from a line of observatories on a single meridian, could be had by erecting station signals on the meridian of Ghizeh, and reducing their several observations to the meridian of Greenwich, or *vice versa*. Greenwich and other observatories could reduce their observations to the meridian of Ghizeh for any special object. Such matters would chiefly concern the astronomers. It may be noted here that if an observatory were established at Ghizeh it would occupy one of the 24-hour meridians proposed by Mr. Fleming in his exhaustive paper on time-reckoning. There is now no observatory on the parallel of latitude 30° N., nor is there one within 400 miles of it. Important as that latitude is in its geodetic relations it has long been neglected. The region of the Great Pyramid is no doubt admirably suited to such an object. It is a point that ought not to be overlooked in the

selection of sites for the increase of astronomical stations. Its meridian is close to that of Cairo, Suez, Alexandria, Odessa, Cronstadt and St. Petersburg, especially the last, from which it differs by only three or four miles. An observatory already exists at St. Petersburg. Could one be established at Ghizeh, some important results might be obtained from instantaneous observations at the two points. If one also were established at Odessa, which is midway between the two, it might still be better.

If at last an agreement be reached in the adoption of a prime meridian or base line from which to reckon longitude, whether it be at Greenwich or Ghizeh, or the nether of one of these, the question is yet open, where shall we begin the day's reckoning? Shall it coincide with the longitude reckoning? Or shall it be referred to some other base? If we agree upon a cosmic base line for reckoning longitude, is it possible to have also a *cosmic* beginning for reckoning days? Astronomers begin their day at noon; it is determined by the sun crossing the meridian of the locality where the observation is taken; it is a definite, reliable starting point; each observatory, therefore, has its own day beginning and ending; it does not coincide with any other observatory's day. Whenever the astronomers desire, for any special purpose, to take observations from different parts of the world at the same moment; they make accurate allowance for the difference of time, and thus do their work at the same instant. There is no real difficulty in telling just what hour it is in any part of the known world when a particular astronomical event occurs.

But suppose that provision be made to take the time-reckoning from the prime meridian; suppose we make the sun's crossing of the meridian of Behring's strait the beginning of the cosmic day. It is then midnight in London, 8 A. M. in Pekin and 4 P. M. in San Francisco; but the people of the Pacific coast will not change their dates at 4 o'clock in the afternoon; the custom of the people will naturally follow the course of the sun, and they will reckon their day from local midnight, not from any prime meridian. Whatever can be done, therefore, to bring the diverse systems of time-reckoning to some degree

of uniformity, the natural division of day and night must hold its place. The middle point of daylight is the only practicable moment to depend upon for the accurate adjustment of time-pieces. A cosmic day belongs to observatories, a natural day belongs to the people. Allowing then that a prime meridian be adopted for longitude reckoning and that the noon-tide of nature's light continued to be recognized as the daily index of time, may not something be done to put an end to some of the arbitrary systems of time-reckoning now maintained?

We have school time, church time, meridian time, shop time, railroad time, observatory time, and who can tell what next? Nothing is gained by having a shop clock set ten minutes faster than other clocks. There must be some adjustment of these conflicting systems or we shall continue to waste time and miss appointments from the confusion of time-pieces. Now it is evident to any one who takes thought of this subject that only one class of activities is under restraint in the adoption of a time basis. The railway business cannot be carried on safely without time-tables that to some extent disregard meridian time. These time-tables must have a standard clock. That clock must be corrected daily. The test should be nothing less than an astronomical observation. A possible error of five seconds should not be tolerated. There is no practical difficulty in having school time, church time, shop time, and business time conform to railroad time. Railroad necessities will keep railroad time practically correct. A difference of half an hour between railroad and meridian time is no real inconvenience. And even if it were necessary that school close at 12 meridian time, allowance for the difference between this and railroad time could be made. The advantage of uniformity in local time is greater than we can now appreciate. Let this be once established and the people could not be persuaded to return to the confusion that now exists. Let the time-pieces be all set to railroad time, let railroad time be fixed by the nearest observatory, and let business and other hours be changed to suit the convenience or necessities of the case.

If, according to Mr. Fleming's plan, twenty-four-hour meridians be established, beginning to count such from the meridian

of Greenwich as a prime meridian, Halifax, Washington, New Orleans, Santa Fé and Sacramento would occupy within a few seconds or minutes, the proposed meridians of this continent; while Venice, St. Petersburg and the Great Pyramid, Madagascar, Singapore, Manilla, Yeddo and Ovolan, Feejee Islands, principally the meridians of the eastern world. Within five minutes of many of these meridians, well equipped observatories now exist. While hour meridians would meet all practical needs in so vast a territory as the United States, secondary time standards of less difference might be demanded for the nationalities of Europe. The suggestion of Professor Gylden, who was appointed by the Royal Swedish Geographical Society, to report on the question of an international meridian and common time, cannot be too warmly commended, both for its practical grasp of the subject and its true cosmopolitan spirit. It is that, if the Greenwich meridian is fixed on as the common one, the meridian 90° or six hours west would give New Orleans for the central meridian of the Western Hemisphere, and the meridian 90° or six hours east would be within a few minutes of Calcutta for the Asiatic standard, while the nether of Greenwich would touch the Feejee group and run a little east of New Zealand. Subdivisions of these quadrants might then be made to meet local time-reckonings, according to the wishes of the people occupying them. Professor Gylden has well mentioned New Orleans as one of the quadrant meridians, for it is not only a central meridian of the United States, but it is in latitude 29° 57′ 46″, almost exactly the latitude of the Great Pyramid.

How much the consideration of subjects that concern international relations will serve to unify and harmonize the deeper interests of human industry and life we cannot forsee. It is becoming a fact that, notwithstanding local conflicts and jealousies, the nations of the earth are members one of another; that they are drifting, or being led, into a vast brotherhood, wherein if one suffer, all suffer. To this divine result, we trust, will tend all efforts to unite in taking our reckonings for time and for life from one certain, fixed and accurately defined base line.

The following are the first meridians in use by the different nations of the world:

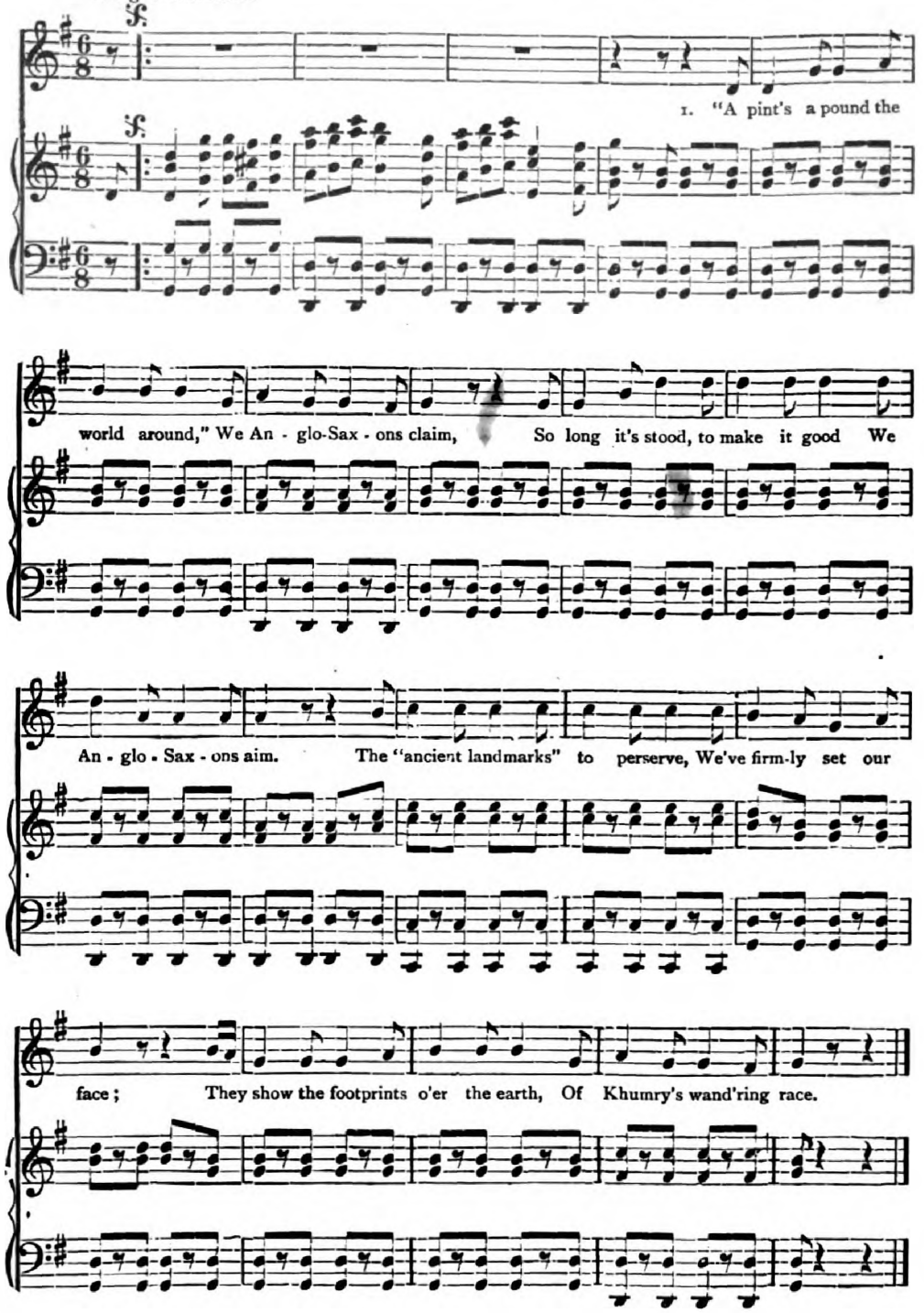
COUNTRY.	FIRST MERIDIANS USED.
Great Britain and the British Colonies,	Greenwich.
United States,	Greenwich and Washington.
Norway,	Christiania and Greenwich.
Italy,	Naples and Greenwich.
Germany,	Ferro, Greenwich and Paris.
France	Paris.
Spain	Cadiz.
Russia	Pulkova, Greenwich and Ferro.
Sweden	Stockholm, Greenwich and Paris.
Holland	Greenwich.
Greece	
Austria	Greenwich and Ferro.
Denmark	Copenhagen, Paris and Greenwich.
Portugal	Lisbon.
Turkey	
Brazil, &c., S. America	Rio de Janeiro and Greenwich.
Belgium	Greenwich.
Japan, &c., Asia	Greenwich.

"A PINT'S A POUND THE WORLD AROUND."

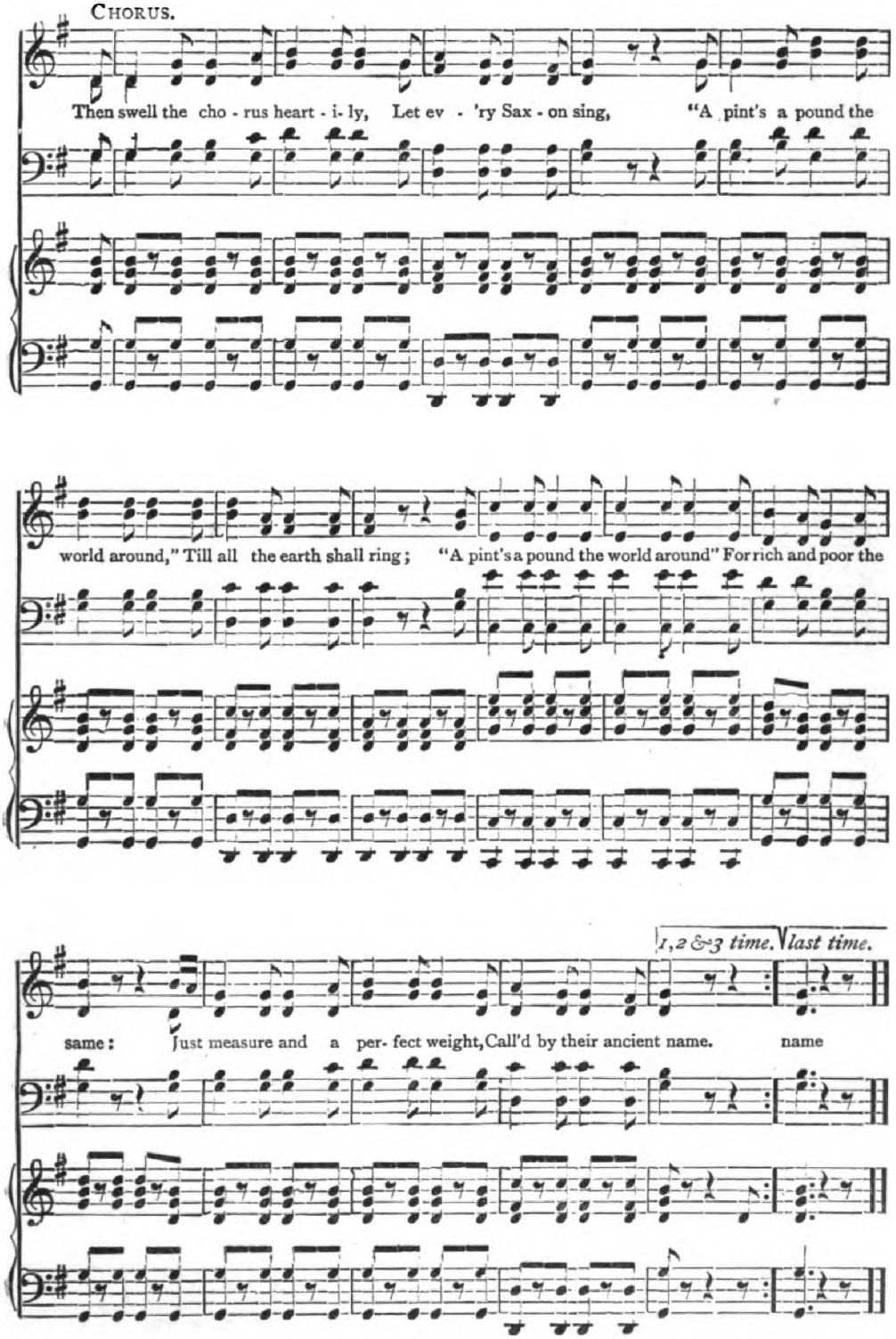
"Remove not the ancient landmarks."

Words by C. A. L. TOTTEN. Arranged by H. A. SPRINGETT.

Allegro marziale.



"A PINT'S A POUND THE WORLD AROUND."—Concluded.



2.

They bid us change the ancient "names,
The "seasons" and the "times;"
And for our measures go abroad
To strange and distant climes.
But we'll abide by things long dear,
And cling to things of yore,
For the Anglo-Saxon race shall rule
The earth from shore to shore.

CHORUS.

3.

So rally round your "Standards" all,
Come Saxons tried and true;
Aloud your "old traditions" call,
For time throughout they'll do.
Preserved and sacred evermore
The inch, and pint, and pound
Shall mete out justice to mankind
The rolling earth around.

CHORUS.

4.

Then down with every "metric" scheme
Taught by the foreign school,
We'll worship still our *Father's* God!
And keep our Father's "*rule*"!
A perfect inch, a perfect pint,
The Anglo's honest pound,
Shall hold their place upon the earth,
Till Time's last trump shall sound!

CHORUS:

Then swell the chorus heartily,
Let every Saxon sing:
"A pint's a pound the world around,"
Till all the earth shall ring,
"A pint's a pound the world around"
For rich and poor the same;
Just measure and a perfect weight
Called by their ancient name!

LETTERS.

SAN FRANCISCO, July 24th, 1883.

CHARLES LATIMER, ESQ.—

My dear Sir:—I feel like congratulating you upon the increasing interest of the articles in THE INTERNATIONAL STANDARD, and of saying at the same time that it seems to me Lt. Totten's letter admirably indicates the only safe and wise course for the Institute to pursue in finally determining upon what the perfected standards shall be.

His questions are excellent, and should be fully and unquestionably answered before final or permanent action is taken.

I am surprised and disappointed that more interest is not felt by intelligent people in these subjects, and I feel the need of a very brief yet complete enumeration of the disadvantages of the French metric system and the corresponding advantages of the perfected Anglo-Saxon system for ordinary use in fixing the attention upon this subject of people who neither know nor seem to care about the Great Pyramid.

Yours truly, L. F. HASKELL.

[We would be pleased to receive short communications on this subject.—ED.]

BOSTON, 271 Tremont St., Aug. 3d, 1883.

MY DEAR MR. LATIMER—

I am so occupied in the model of the Great Pyramid that I have delayed writing you.

A few weeks since I sent Mrs. Libby to see Gen. Norton to obtain permission for a little more room for the pyramid, which he kindly granted, and in the course of her interview he laughingly said "he didn't know he was a member" of the Institute—adding remarks indicating his interest in our work. The scale of the model pyramid is one-tenth of an inch to a foot The dimensions of the model: Base $6\frac{5}{12}$ feet; height (less 2 in. for absent capstone), $3\frac{10}{12}$ feet. The margin (which includes "pavement" not forgotten) one foot; thus occupying $8\frac{5}{12}$ feet square

space of the floor of the Exhibition of Egyptian Department. To raise the model to view, above the heads of the audience, the model is to stand on a frame $8\frac{5}{12}$ feet square and 6 feet high. The frame of the whole is made of hard southern pine wood, and so arranged as to be separated into two parts and folded so compactly that a man can carry it under his arm—except the interior chambers and passages. The pyramid is to be covered nicely with white, strong muslin sewed together to fit the pyramid and removable to fold up. The foot margin space around the pyramid is to be light brown muslin—the six foot elevation curtained with brown or reddish muslin. The interior chambers and passages are to be made of tin and firm pasteboard, suspended by small black wire from the frame of the pyramid.

A highly cultured gentleman has called at this office two or three times, who has visited and explored the Pyramid, from whom I have obtained valued information. He claims there are yet to be found two other chambers below the King's chamber, which, when opened, will give startling revelations. I was soon reminded of our esteemed member, Mr. Bidwell, at Cleveland, who is so zealous in his description of the pyramid yet unrevealed, my friend here, Dr. Johnson, having taken the thirty-second degree in Masonry.

The packages from the Astronomer Royal for Scotland arrived here last week, containing three fragments— some fifteen pounds—of limestone from the first and second Pyramids, also seven whole negatives of views taken by him in 1865. I regret that the remaining four or five of the negatives were broken into hundreds of pieces. This present to the Institute from Prof. Smyth was in response to my application to him for their exhibition at the Grand Foreign Exhibition in Boston, and in accordance with his directions I am preparing standards for their support in positions best adapted to show their respective angles. This is all I have from the Great Pyramid except the small fragment deposited with me by Rev. Mr. French.

LUCIAN I. BISBEE.

R. A. PROCTOR AND THE "PYRAMIDISTS."

To the Editor of the International Standard:

SIR:—The Gentleman's Magazine for October last contains an article from the pen of Richard A. Proctor, Esq., attacking "Pyramidists" in general and Professor C. Piazzi Smyth in particular, ridiculing the results obtained and published by the professor and his co-students, as mere accidental coincidents frequently occurring in calculations. R. A. Proctor proceeds to give the following as illustrating his argument:

"If the number of days in a year be multiplied by 25, and the number so obtained be squared, and the square doubled, the resulting number is (*quam proxime*) the square of the number of years in the Precessional Period, in which the earth accomplishes her mighty reeling movement, as, like a gigantic top, she 'spinning, sleeps on her soft axis as she paces even,'" etc., etc.

Unfortunately for Mr. Proctor, "the resulting number is" NOT "the square of the number of years in the Great Precessional Period"—it is only the square of *half* that period.

To put the proposition in the form of an equation, let D be the number of days in a year (365¼), and P the number of years in the Great Precessional Period. Then, according to Mr. R. A. Proctor, $(D\times25)^2\times2$, or $2(D\times25)^2$, or $2(25D)^2 = P^2$ and therefore $\sqrt{2(25)^2}=P$ the Precessional Period; but the fact is that $\sqrt{2(25D)^2} = \frac{P}{2}$ or one-half the above. Hence the proper equation for the square of the Great Precessional Period, expressed in terms of D and P, is $8(25D)^2=P^2$ instead of $2(25D)^2 = P^2$ as stated by Mr. Proctor. Ere a critic becomes censor and satirist he ought at least to prove his weapons.

C. E. P. G.

[The value of P by this formula is 25,827 years, whence the annual rate of mean precession is 50″.179.—ED.]

POLLERTON CASTLE, CARLOW, IRELAND, July 10, 1883.

DEAR MR. LATIMER:

Your Remington type-writer letter of the 27th ult. came this

morning to hand, showing that you are abreast of the time in its applied discoveries. It strikes me that a day will come when by combining the telephone with the type-writer, one will be able to dictate to his machine and an infallible amanuensis be thereby secured.

Menzies was he to whom was given the revelation of the chronological feature of the Pyramid measurements; to Casey, working in Menzies's lines, the Christology of the "Pillar of Witness;" to Smyth, the consolidation, symmetrical finishing and apostolic zeal, in literally preaching to civilized mankind the irrefragable testimony of the monument to the absolute truth of the Holy Scriptures, which testify from the beginning that Jesus the Prophet of Nazareth of Gallilee was the promised Shiloh, the incarnate Mercy, and Christ of God.

I hold that Piazzi Smyth has been and is, to the Pyramid's truth, what Paul was and is to the doctrine and Church of Christ. I must here confess to you that the Divine portion of the Pyramid teaching—*i. e.* that portion which records the fulfillment of the promises of a Saviour of Men, who should come upon the earth and amongst men, in the fullness of the appointed time, is the only portion in which I am deeply concerned. Not that I undervalue the importance of its testimony as to weight and measure, but to me the subjective truth is more important than the objective, in the record of the monument in its revelation to mankind.

With fervent wishes that you may be strengthened to victory in your battle with the Prince of this world, and those who are his servants, by the spirit of Christ, the Paracletos; *Dominus vobiscum,*

CHARLES CASEY.

REVIEWS.

THE BIBLE IN STONE, OR THE GREAT PYRAMID THE FOUNDATION OF FREE MASONRY. By Rowland Allan Brangwin, pp. 69, octavo, London.

A copy of this interesting book has been received from the author. He treats his subject in a most fair and candid way, and evinces everywhere a reverent and Christian spirit. He regards the pyramid as an inspired monument for a sign and symbol of the typified chronology of the history of mankind for "Time"—seven thousand years—or "the ages," and that it has an especial teaching for the present day. After a clear and concise description of the structure in its several parts, he proceeds to develop the chronology of the passages from creation to the millenium, and in so doing he includes every passage and chamber now known, combining all in one consistent scheme. He does no needless hair-splitting whether for good or bad, but goes grandly to gather the testimony of the whole in all its breadth and depth. He has less to say of Free Masonry than would be inferred from the title. He argues that it is reasonable to suppose that the knowledge of this building as an inspired monument and religious symbol would have been entrusted by its architect to the keeping of a society pledged to preserve through the darkest ages its meaning, object, and aim, in the light of a pure and spiritual worship, until the time should come, in the latter days, for the pyramid to be known as a "sign and a witness unto the Lord of hosts." He inquires, "Is it only in the highest of the thirty-three degrees of Free Masonry that the full knowledge of the Pyramid has been handed down?"

Mr. Brangwin is a young workingman of the people, and an experienced South African colonist. His book is a valuable contribution to our literature of the Pyramid on the religious side.

UNITS OF MEASUREMENT FOR SCIENTIFIC AND PROFESSIONAL MEN. By Lowis D'A. Jackson, pp. 12, quarto. W. H. Allen & Co., London, 1883.

We have here a practical essay on the subject of weights and

measures, and a calm and impartial examination into the merits and demerits of both the British and French system.

The author acknowledges the defects of the complicated British system for the needs of science, although commerce may be amply satisfied with the present large assortment of units. One objection to the use of English standards for scientific work is the double temperature reference; thus standards of length are compared at a temperature of 62° Fahr., while those of weight and capacity are compared at 39°.1 Fahr., the temperature of maximum density of water. "Besides the introduction of air-pressure, there is the further complication of air displacement. The amount of computation enforced by these conditions on the scientific man, whenever extreme accuracy is necessary, is large, even when dealing with comparatively simple quantities." The author further deprecates the lack of a simple and definite correlation between weight and cubic measure. It is doubtful if the pound is represented *in fact*, as it is nominally and legally, by 27.7274 cubic inches of water at its utmost density. A redetermination by actual observation is required.

Another difficulty among so many units is, that different scientific men will adapt different units and decimalize, each upon his own, requiring a reduction before a direct comparison can be made in their results. "Such is the result of unguided freedom of choice."

The Metric system, he shows, is not free from technical defects, either; "the principal of which are, that it is not a single temperature system, that the correlation between cubic measure and weight is inaccurate, that the values of all the small units are practically inconvenient from accruing at the very points where they are least wanted, and that there is a total absence of all correlation with natural measures of any sort."

After a discussion of the difficulties inherent in the present systems Mr. Jackson proceeds to consider what may be done to produce a more perfect system. In seeking for a base he discards both the polar axis and the Parisian quadrant, for the reason that neither are as yet definitely ascertained, and are not soon likely to be. He remarks: "The metre is particularly unfortu-

nate as a geodic unit and takes its place as a simple arbitrary unit of French derivation, with the peculiarity that it is both based on error and independent of historic tradition." He also objects to the geodetic mile derived from one degree of any great circle of the earth, because of the insufficient determination of its value, but admits that "the minute of equatorial longitude offers the best mode of utilizing results not likely to err much, after they have been once observed and thoroughly investigated." The method of deducing standard units of length through seconds pendulum observation is shown to be an untrustworthy process, being indirect and dependent on computed allowances.

"Besides these there have been also proposed modes of deriving systems of measurement from historic, ancient and nominally sacred units. Such matters are frequently very interesting; but the merits and demerits of a system depend on an intrinsic value in the first place, and on suitability to given conditions in the next; the claims of either novelty or antiquity, strangeness or familiarity, wickedness or sanctity, are mere modes of enlisting prejudice, by which no rational man should be guided in opposition to sound principle."

The author therefore concludes that the best that can be done under the circumstances is to make use of such English measures as we have, and since four basic simple correlated units are required, viz.: of length, of surface, of capacity and of weight, he finds that the only four units in the whole English series suited to the purpose are *the foot, the square foot, the cubic foot and the foot-weight.*

"The foot-weight is still a legal standard, made by Miller in 1859, still existing in the Standards Department, and supposed to represent the weight of one cubic foot of water; its nominal value in pounds avoirdupois is 62.32106." This, however, is fallacious, since Miller had two temperatures to deal with, and could not construct his weight direct from the cubic foot of water, but depended upon a computation that it might be 62.32106 pounds. With the four basic units named, therefore, the author proposes the very ingenious scheme of establishing a decimal system for all scientific purposes, leaving the present

conglomerate system still to exist for those who prefer it, or to die a natural death in yielding to the new system, as the case may be. He would make the new system a single temperature system, adopting 39.1 degrees; a vacuum system, to avoid both air pressure and air displacements; and would determine the correlation between cubicity and weight through water at its maximum density, since that is the commonly accepted base of reference for specific gravities. This correlation remains to be determined, and naturally should be accomplished at the expense and by the sanction of the government. Nothing after that need prevent its early adoption by all scientific men.

He complains of the lethargy of the English government in failing to procure a direct determination of the foot-weight. It would seem that a general demand on the part of the scientific men of the country for this most reasonable and necessary experiment would not be denied on the part of the government, either in Great Britain or the United States.

In order to make the matter as simple and easy as possible for the average legislator, Mr. Jackson reduces his demands upon his government to the three following points:

"1. The adoption of a single temperature and of a vacuum for the construction of standards without interfering with the present legal conditions of trade employment.

"2. The redetermination of the foot-weight by direct construction under those conditions.

"3. The adjustment of a millesimal ounce to the 1-1000th of the corrected foot-weight by a very slight reduction of the ounce avoirdupois, not exceeding 0.5 per cent. under the same conditions."

He adds: "One of the conveniences of adopting a single English ounce of systematic derivation will be the future possibility of discarding the terms Avoirdupois and Troy, borrowed from the French after Creçy and Poitiers, but not returned after our collapse at Châtillon."

"When the above mentioned three points shall have been most graciously conceded and carried out, we shall, it is true, not have a complete scientific system, but we shall possess correctly correlated basic units." The volume closes with exten-

sive tables, first, of English commercial units (temp. 62° and 39° Fahr. and bar. 30″) expressed in English and French scientific units (temp. 32° and 39° Fahr. *in vacuo*); and second, of French and English decimal scientific systems compared at 32° and 39° Fahr. *in vacuo*. Under each of these heads are given not only the single units of measure and weight, but also an extensive list of compound units, which seem to have been worked out with great care.

We have been thus elaborate in describing the features of this work that our readers may the better estimate its value, not only for the information contained, but for the happy suggestions therein made as to a possible way of escape for the scientific Anglo-Saxon from the labyrinth of our present anomalous system, without forsaking the time honored units of our race inherited from a remote antiquity.

EDITORIAL NOTES.

GENERAL HOWARD VYSE.

We very much regret that we have to go to press without the biography of Gen. Howard Vyse, whose portrait graces this number of the Magazine. We are indebted to the indefatigable efforts of Mrs. Piazzi Smyth for this portrait and for others which we now have in our possession, and which will appear in due time; but since the biography of Gen. Howard Vyse has in some unaccountable manner miscarried, we are only able at this issue to make brief mention of his work, hoping in the next number to give a full biographical notice of him.

The work of Gen. Vyse in Egypt is distinguished for the great earnestness with which he pursued his object; for the great liberality with which he carried it out; he having furnished large sums of money from his own purse in the pursuit of this knowledge; for several extremely important discoveries touching the Great Pyramid which were peculiarly essential to

the understanding of its form and proportion; and also for certain, though few, valuable measures which seem to settle some disputes in relation to the dimensions of the Pyramid.

In the winter of 1836 he obtained a "firmaun" from the Pasha, to make extensive explorations and excavations at the pyramids and in the tombs in their vicinity. He associated with him M. Caviglia, an Italian, and employed a young English civil engineer who happened to be there, Mr. Petrie, and also a Mr. Marsh, who made examinations and measurements with him.

The most important feature of this whole work of Gen. Vyse was the discovery of two casing stones in place on the north side of the Pyramid directly in the centre of the same. So perfectly were they jointed and cemented together that although the cement which joined them, as he distinctly states, was not thicker than silver paper,yet in dissevering the stones they broke before the cement in some places. The slope-angle of these stones prove the π proportion of the Pyramid structure. Without this discovery we should have been in doubt whether the Great Pyramid had ever been covered, or not, with casing stones.

The measure of the base, 764 feet at the bottom of the casing stones, outside measurement, agrees with that of the French, but here we are met with a difficulty. The interior measure evolves a lesser base by about 28 inches.

Gen. Vyse went up the Nile to the interior of Egypt, leaving his assistants with M. Caviglia to make explorations during his absence. On his return he finished the work with them. One of his principal works was to bore into the shoulder of the Sphinx 27 feet, proving it to be a solid body. When this distance was reached the drill broke and was never recovered, and the boring was stopped.

One of the most remarkable of Gen. Vyse's discoveries was the Temple of Isis or Latona between the fore-paws of the Sphinx—a temple which may have had a particular office with reference to the Great Pyramid itself, yet to be understood.

We shall hope to give a full account of the life of this remarkable explorer in our next issue.

The Institute is indebted to Professor C. Piazzi Smyth for a number of copies of his pamphlet, On an Equal-Surface Projection (of the world) and its Anthropological Applications, published in 1870. It contains a number of handsomely executed maps, illustrating the method, and also the importance of the geographical position of the Great Pyramid. There is also a map of the Delta of the Nile from the Pyramid to the coast, "adapted chiefly from the maps of Henry Mitchell, U. S. Coast Survey, and those of the French Commission in 1798 under General Bonaparte."

From Professor Smyth's remarks on this map, we quote:

The most interesting portions of the Delta's Mediterranean coast-line for our present enquiry, are the points where it is cut by the Great Pyramid's meridian line, and its N.E. and N.W. diagonal lines.

The meridian line cuts at the northernmost point, or the true Cape Bourlos; for the practice of some modern map-makers in giving the name, not to the northernmost point of the whole country, but to one side of the entrance into Lake Bourlos several miles westward thereof, is not borne out by the older maps. Outside that present mouth, the French charts note "Ruins of a castle and village under the water," and there are other proofs of Cape Bourlos itself having suffered degradation within the historic period; so that even if there had been once a monument there to connect it with the Great Pyramid, it would probably have been submerged before this. The locality is however peculiarly distinguished in the old French charts by the large amount of date-trees and villages "with some ruins"—compared with the bareness of the sand-dunes on either side, and it might be worth while to have the region well explored for its extreme antiquities.

Still more probably would it repay to explore where the Great Pyramid's N.E. and N. W. diagonals cut the coast; for while they in a manner define the limits of the Delta on either side all the way along, they go on to cut the coast, the former near the site of the ancient Pelusium, and the latter to the west of Alexandria.

Pelusium itself is indeed only a Greek city, and though according to some, Kadesh Barnea of the Bible, was of no great antiquity,—but then it had been built, according to W. Osburn, on the site of *Chatash*, a memorable Egyptian city under the 18th dynasty, and was distinguished in the hieroglyphic pictures of that time by an eminent mound in its neighborhood, of apparently higher antiquity still,—or possibly coeval with the foundation of the Great Pyramid.

Similarly Alexandria, near the N.W. diagonal line of the Great Pyramid produced, is not old enough to be of importance from its Greek foundation; but to the west of it have been discovered, according to W. Osburn, columns of temples marked with the name of a king of the 18th dynasty, and some still older obelisks. The region therefore eminently requires exploration anew, with men's wits sharpened to recognise—not the decorated architecture, and granite statues or animal-headed idols and gilded mummies of the New Empire, which they are usually looking for in modern Egyptological researches,—but the more modest, as well as pure, unidolatrous and exact geometrical workings of that period of the Old Empire, when its one grandest and most eternally interesting monument was erected.

It occurs to us in this connection, that if we recognize the Great Pyramid as the "Altar unto the Lord in the land of

Egypt" referred to by Isaiah XIX, 19, we may very properly look for the "Pillar in the border thereof" on the coast line near either Cape Bourlos, or Alexandria, or the ancient Chatash.

TRANSACTIONS OF THE OHIO AUXILIARY SOCIETY OF THE INTERNATIONAL INSTITUTE.

JULY 4, 1883.

This being the National holiday, the meeting was adjourned for two weeks.

JULY 18, 1883.

The Society met at 8 A. M., President Latimer in the chair. The following were elected members:

Joseph Baxendell, F. R. A. S.,	Southport, England.
Samuel McElroy, C. E.,	Brooklyn, New York.
Ernest L. Meyer, C. E.,	Elizabeth, New Jersey.
Gustave Lehlbach,	Newark, New Jersey.
Charles Gardner,	Chicago, Illinois.
Dr. C. R. Morgan,	Philadelphia, Pennsylvania.
Clark W. Russell,	Avondale, Illinois.
Miss Elizabeth Burr,	New York, New York.

Letters were read from Joseph Baxendell, F. R. A. S.; Lowis d'A. Jackson, Theodore Gribi, and a number of other students and scientific gentlemen. A communication was read from Samuel Beswick in which he declares that the British mile of 5,280 feet is exactly equal to one minute of arc measured on the parallel of latitude at the Great Pyramid, thus making the radius of that circle 3,437.7 miles, or the number of minutes in the analytical unit. The President showed the predominance of this unit in the Pyramid, instancing the depth of the coffer in the King's chamber, which is 34.37 inches, the height of the coffer, which is 41.25 inches or twelve times the unit divided by one thousand, and the thickness of the coffer, which is 6.87 inches or the one-five-hundredth of that unit.

A short paper on the British mile by Rev. H. G. Wood was then read.

Extracts were read from a book just received entitled "Units of Measure for Scientific Men," by Lowis d'A. Jackson, of London, England. A discussion followed.

Joseph Baxendell's paper upon the Russian measures in the Pyramid was read and excited remarkable interest. After further discussion the meeting adjourned.

AUGUST 1, 1883.

The Society met at 8 P. M., and in the absence of the President, A. M. Searles, Esq., was called to the chair. The following gentlemen were elected members:

William Hart,	Elgin, Illinois.
John Bliss,	New York, New York.
Col. Stephen Chester,	New York, New York.
Robert C. Bacot,	Jersey City, New Jersey.
Peter Witsel, C. E.,	Newark, New Jersey.
Samuel H. Doty,	Chicago, Illinois.
John E. Kelley,	Elizabeth, New Jersey.
Thomas Moore,	Elizabeth, New Jersey.
Adolph Phillippi, C. E.,	Elizabeth, New Jersey.
Capt. John N. Frazee,	Cleveland, Ohio.
C. Cone,	Toledo, Ohio.
Dr. R. A. Vance,	———, Indiana.

Reference was made to letters received from Charles Casey, C. E., Professor Gribi, Dr. Watson F. Quinby, and others.

After the reading of a paper on the "Earth's Elliptic Ratio" received from Samuel Beswick, of Canada, the chairman referred to a copy of *Cosmos Les Mondes* recently received from Paris, containing a French translation of Mr. Latimer's paper on the "Parallax of the Sun," which appeared in the first number of THE INTERNATIONAL STANDARD.

A pamphlet on "Equal Surface Projection and Anthropological Application," by Professor C. Piazzi Smyth, was presented to the Society on behalf of the author.

An interesting discussion on the "Merits of the Metric System," published in the *Detroit Clinic*, was read; Prof. R. A. Witthaus, A. M., M. D., of New York, writing in favor, and Lorenzo Hale, M. D., of Albany, N. Y., in opposition to the French metric system. The subject was then discussed by the Society.

Prof. N. B. Wood was then called on to report upon an analysis of a specimen of limestone taken from the Great Pyramid. He gave a description of the character of the stone and the results of his analysis.

The meeting then adjourned.

AUGUST 15, 1883.

The regular meeting of the Society was held at 8 P. M., President Latimer in the chair. After the usual opening exercises, the following ladies and gentlemen were elected:

Mrs. N. S. Baldwin,	Buffalo, New York.
Mrs. Rebecca N. Hazard,	Kirkwood, Missouri.
William H. Frohon,	Elizabeth, New Jersey.
A. V. Benoit,	New York, New York.
Colonel Hiram Van Buskirk,	Hudson, New Jersey.
H. L. Weston,	Bayonne, New Jersey.
W. T. Eddy,	Bayonne, New Jersey.
William F. Robertson,	New Brighton, New York.
Clark Fisher, C. E.,	Trenton, New Jersey.
Mrs. S. R. Prentiss,	Oakland, California.

A number of interesting letters were then read, from Rev. E. P. Ingersoll, of Rosevale, Kansas; L. F. Haskell, Esq., of San Francisco, California; Rev. H. G. Wood, Sharon, Pennsylvania; Commodore Whiting, and others. A short extract sent by General Du-Puy, of New York, on Chinese measures and coin, was read.

The paper of the evening was from Professor John L. Stockwell, of the Case school of Applied Science, Cleveland, Ohio, upon the "Lunations of the Moon." This contribution to science was made in response to the request of Professor Piazzi Smyth for an investigation of the length of a lunation 4000 years ago. A short discussion followed the reading, but owing to the absence of Professor Stockwell the further discussion was postponed to the next meeting.

A resolution was passed, tendering the thanks of the Society to Professor Stockwell for his valuable paper, and their heartfelt sympathy in his late bereavement, which prevented his attendance.

Professor N. B. Wood, of Cleveland, read a short paper on the geological characteristics of the Pyramid limestone. Adjourned for two weeks.

AUGUST 29, 1883.

The regular meeting of the Society was held at their rooms, there being a good attendance, the President in the chair. The session was opened with a brief prayer, invoking the blessing of God upon the work of the Society.

The following names were presented for election to membership, all being favorably received:

LIFE MEMBERS.

Rev. H. G. Wood,	Sharon, Pennsylvania.
P. L. Kimberly,	Sharon, Pennsylvania.
Samuel Kimberly,	Sharon, Pennsylvania.
Dr. E. M. Epstein,	Vermillion, D. T.
Dr. J. W. Redfield,	Cleveland, Ohio.
Rev. James A. Bolles, D. D.,	Cleveland, Ohio.

MEMBERS OF THE INTERNATIONAL INSTITUTE.

Rev. James A. Upjohn,	Meenah, Wisconsin.
John H. Stilling,	New York.
Cook Talcott, C. E.,	New York.
William H. Peddle, C. E.,	Roselle, New Jersey.
Edward Fussell,	Elizabeth New Jersey.
Emmett Smith, C. E.,	Bayonne, New Jersey.
William V. Clark,	Red Bank, New Jersey.
L. D. Bruyn,	Red Bank, New Jersey.
Samuel Beswick, C. E.,	Strathroy, Ontario, Canada.
Mrs. E. Beddell Benjamine,	Brooklyn.

MEMBERS OF THE OHIO AUXILIARY SOCIETY.

A. P. Baldwin,	Akron, Ohio.
Alex. Vance,	Gallipolis, Ohio.
John H. Walsh,	Galion, Ohio.

The minutes of the last meeting were read and approved, after which several letters were read offering papers and discussions which were deferred until future meetings, owing to the paper which was to be read by the Rev. H. G. Wood, of Sharon, Pa.

INQUIRERS' CLUB.

No. 2. The querist says:

In the INTERNATIONAL STANDARD for March I observe the following paragraph:

"The same stars which looked upon the last moments of George Washington, the patriarch of liberty, shone upon the moment of the birth of James A. Garfield; and the constellation whose type he was, with sword uplifted, was the one claimed by Nimrod and Napoleon Bonaparte. Orion, the constellation of the measuring rod, and of just weights and measures, which shone in meridian splendor, in the place of honor, at his advent, appeared in the east at his birth into the heavenly mansions."

Does the International Institute, as a corporate body, profess a belief in astrology; or is this an individual expression of opinion? ASTER."

The Institute as a society is only responsible for its action taken in convention or at a regular meeting. Each member is responsible for his own utterances. I, as the author of the paper on General Garfield, am responsible, and wish to state here my belief in the truth of astrology as a science; a belief, the foundation for which will be shown in my paper on the Unveiling of Isis. Let me be judged by the facts I have to offer, not from theories propounded.

The question is pertinent, although I cannot see why in our Magazine we should confine ourselves strictly to the subject of weights and measures, for we need the widest latitude so that we may not only study how to obtain their origin, and to perfect them, but also show their relation to races, religions, and chronology.

Proctor tells us that the Great Pyramid was probably above all things else constructed for astrological purposes, and after telling us of the wonderful scientific knowledge of its builders, he says that the Egyptians were all addicted to this kind of study, and indeed universally believed in astrology, or the art of foretelling events by the heavenly bodies; and he calls these wonderful people, whom he acknowledged knew at least as much of the science of astronomy as we know, the victims of a great superstition. Now does it look well that men so scientific as they were should be so superstitious? If it be true that they were scientific, and learned, and also believed in astrology, does it not rather teach us to examine astrology and see if there be not some science there too?

Mr. Proctor gives us to understand that the Great Pyramid of Egypt was erected to give a horoscope of Cheops. Now suppose that instead of Cheops it was constructed to give the horoscope of Jesus of Nazareth, the Messiah; and also to give the history and chronology of his race and kingdom; and that the prophecies of the coming of the Messiah and his kingdom were not only written in the Holy Scriptures, and in the stars, but were also written in the stones composing this monument in the proportion of one year for each inch of measurement of certain parts, and that the measure which unlocks the whole secret is found with the Anglo-Saxon people to-day. I say suppose this to be the truth, then I presume that all the world would acknowledge that the subject of measure was related to that of astrology.

Now this we have good reason to believe to be true, and it behooves all men to examine for themselves, and to disprove, if possible, what we shall attempt to show from time to time upon this grand subject. Not only do I believe in the science of astrology, but that it has a special reference to measures. Were I to trust the evidences of my own knowledge and sense alone, I should be forced to the conviction of the truth of the subject as a science, but when we see the long list of great men who have not only believed in this science, but have practiced it, among whom are: Ptolemy, Placidus, Partridge, Kepler, John Cooper, Ashmond, Dr. Sibley, Lilly, Bacon, and a host of others, our attention should be arrested, and the subject examined.

It may be thought by some who see no possibility of a revelation outside of the Holy Scriptures, that these men were an undevout, a superstitious, or credulous set of fanatics, or otherwise mountebanks, trying to gull their fellow men, but understand that they are represented by one (Kepler) who said: "I have stolen the golden vases of the Egyptians to build up a Tabernacle for my God, far away from the borders of Egypt."

Let not prejudice or ridicule warp our judgment.†

CHARLES LATIMER.

†NOTE.—The following is the horoscope given of the moment of the birth and death of our late noble President, by the late Astrologer Griggs. It was the custom in Egypt to give the horoscope of the kings and place it on their tombs:

THE NATIVITY OF JAMES A. GARFIELD. BORN IN OHIO, 1831, NOV. 19, SATURDAY, AT 2 A. M.

The horoscope of this illustrious person affords a remarkable example of the correctness of the fundamental principles of celestial science. From his birth all along the years of toil and vicissitudes even to the culminating events of his decease, his path of life was singularly in unison with the configurations and aspects of the planets. We are fortunate in having his correct birth to be able to compare the actual facts with the already historical life.

I insert below the planets' places in degrees and minutes as they were in the signs according to White's Celestial Atlas for the time above :—

Herschel,	12°, in Aquarius.	Venus,	13°, 44′ " Libra.
Saturn,	13°, 55′ " Virgo.	Mercury	29°, 15′ " Scorpio.
Jupiter,	15°, 12′ " Aquarius.	Moon,	19°, 12′ " Taurus.
Mars,	7°, 32′ " Scorpio.	Moon's nodes,	16°, 37′ in Leo.
Sun,	26°, 13′ " Scorpio.		

28° of the commanding sign of Virgo was ascending with Gemini, culminating at the mid heaven. He was born under the rule and dominion of the planet of Mercury. This planet is the astrological

source of ingenuity, discovery, eminent skill in science, art, and almost every important branch of human knowledge; he tempers the rational mind with a retentive memory, a natural thirst for knowledge, and delights in philosophy or classic learning; he produces the most eloquent orators, the most skilful students, and such as live in history from their deeds in life. Saturn was rising in the east in semi-sextile to Venus; this gave a caution and deliberation unusual, and was the key to his prudence and sagacity. Jupiter and Herschel were close in conjunction in the fifth celestial house, orientally posited, and marked the man with extraordinary religious tendencies, the soul of submission and faithfulness in a higher power. Mercury was within 3° of the sun in Scorpio occidentally placed, was the incentive to experiment in chemistry, fondness for medicine, and would have excelled as a physician; this planetary aspect increased the already marked liability to gain knowledge. Mars sparkled from 7°, 31′, of Scorpio, and was the killing influence in his nativity. The moon was going down 19° in Taurus and was full moon 11 hours and 14 minutes after his birth; she was close to a quartile (90° from her own nodes).

The ascending degree—the Moon and Sun were the actual givers of life; this is proved by the fact that at his death the moon was at her own quartile, Mars in zodiacal square to the ascendant and the Sun and Saturn and Mars in semi-quartile. To measure the period of life we calculate by primary direction, Mars to a quartile of the ascendant and we have 50°, 44′, and this in time is equal to 50 years, 172 days. At first we would think he would have reached this period, and upon this fact a large degree of hope rested, but every transit of Mars would be particularly evil, especially as he approached near to this time, and had he regained partially his health it is not likely he would have passed the above years, still it will always be a matter of conjecture among students of astrology whether or not he would have reached that point if decisive steps were taken immediately after the shooting, and a removal made to a locality designated by Jupiter in Aquarius, or even inland *via* Ohio. However, over and above it all, remains the positive indication that his nativity showed him to be a short lived man and that he was near to the end.

. . . The sextile aspect of the Sun and Mercury to the ascendant added to the remarkable constitution at birth and gave him the wonderful clinging on to life which he displayed.

The good aspect of Venus to Jupiter and Saturn are significant of strong attachment to family and relations, evincing particular interest in and affection for his children—who will be fortunate in the world.

The first 29 years of his life was a steady struggle, so many of the planets below the earth made it a labor to rise; from 30 upwards it became easier, but even in middle life the labor and studiousness and gravity of Saturn were stamped upon his daily life; even when at the zenith of his fame, when honor and the exaltation of position laureled his brow, his pathway was beset by labor, troubles, and grave obstacles, culminating in his violent death.

ERRATA.

NO. 2.—MAY, 1883.

Page 78—24th line from top, for Kibrath-arctz, *read* Kibrath-aretz; 27th and 28th lines from top, *strike out* "and the post-meile of Saxony and Weimar;" *and correct the sentence to read* "The dain of Rangoon, the roëneng of Siam and the lieue-de-poste of France have the same aspect;" 36th line, for "An-naver' *read* An-nam; 27th line, for "liene" *read* lieue.

Page 79—3d line, for "liene" *read* lieue; 1st line, for "leuza" *read* leuga; 6th line, for "one-eighth" *read* one-sixteenth; 16, 17, 18, 19, and 20th lines, for "Anne" *read* Aune; 27th and 28th lines, for "Terrara" *read* Ferrara; 36th line, for "Modenna" *read* Modena.

Page 80—17th line, for "Gronigen" *read* Groningen; 20th line, for "Aaran" *read* Aarau; 23d line, for "Anhalt-cæthen" *read* Anhalt-Cœthen.

Page 81—29th line, for "Thurgan" *read* Thurgau; 42d line, for "Hatebi" *read* Halēbi.

Page 82—21st line, for "Alleppo" *read* Aleppo; 39th line, for "Petersburgh" *read* Peterborough.

Page 85—7th line, for "10.972" *read* 10.729; 11th and 12th lines, for "Braca" *read* Braça; 13th line, for "Cana" *read* Caña; three lines at bottom, for "Toisc" *read* Toise.

Page 86—first two lines, for "Toisc" *read* Toise; 37th line, for "0.9095" *read* 0.9059.

Page 87—23d line, for "Arancada" *read* Arançāda; 35th line, for "Journeè" *read* Journé; 44th line, for "Meytercè" *read* Meytĕrée; 45th line, for "0.0790" *read* 0.9790.

Page 88—6th line, for "Seterce" *read* Setĕré; 19, 20, 21, and 22d lines for "Cana" *read* Caña; 24th line, for "Toalouse" *read* Toulouse; 26th line, for "Estado" *read* Estādo.

Page 89—18th line, for "Tessiva" *read* Tessina; 44th (at bottom), for "mannale" *read* manuale.

NO. 3.—JULY, 1883.

Page 189—5th line, for "2046" *read* 2146.

Page 190—5th line from bottom, for "4—" *read* 4-10——

Page 191—17th line from top, for "3-10" *read* 8-10—.

Page 192—28th line from top, for "0.0921 yards" *read* 0.0921 miles.

NO. 4.—SEPTEMBER, 1883.

Page 229—7th line from bottom *read* "past two hundred" instead of past hundred.

Page 231—9th line, 2nd paragraph, *read* "attraction" for attractions.

Page 235—2nd line from bottom, for alunation *read* "a lunation;" and on same page following the last paragraph *read*, "The present length of a lunation being 29.530588572 days, the lunation of 2000 and 4000 years ago will be 29,530594053 and 29.530598959 days respectively."

ADDENDUM.

To "Analogues, Metric Perch" (p. 87) may be added the

Duōng	. An-nam	. Alexander	. 1.0221