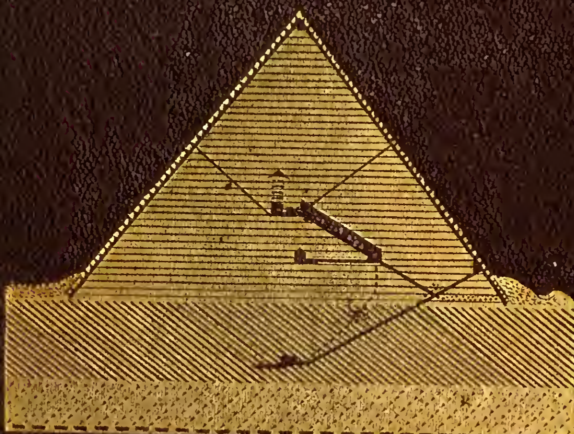

LIFE AND WORK
AT THE GREAT PYRAMID.

VOL. II.

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FOR

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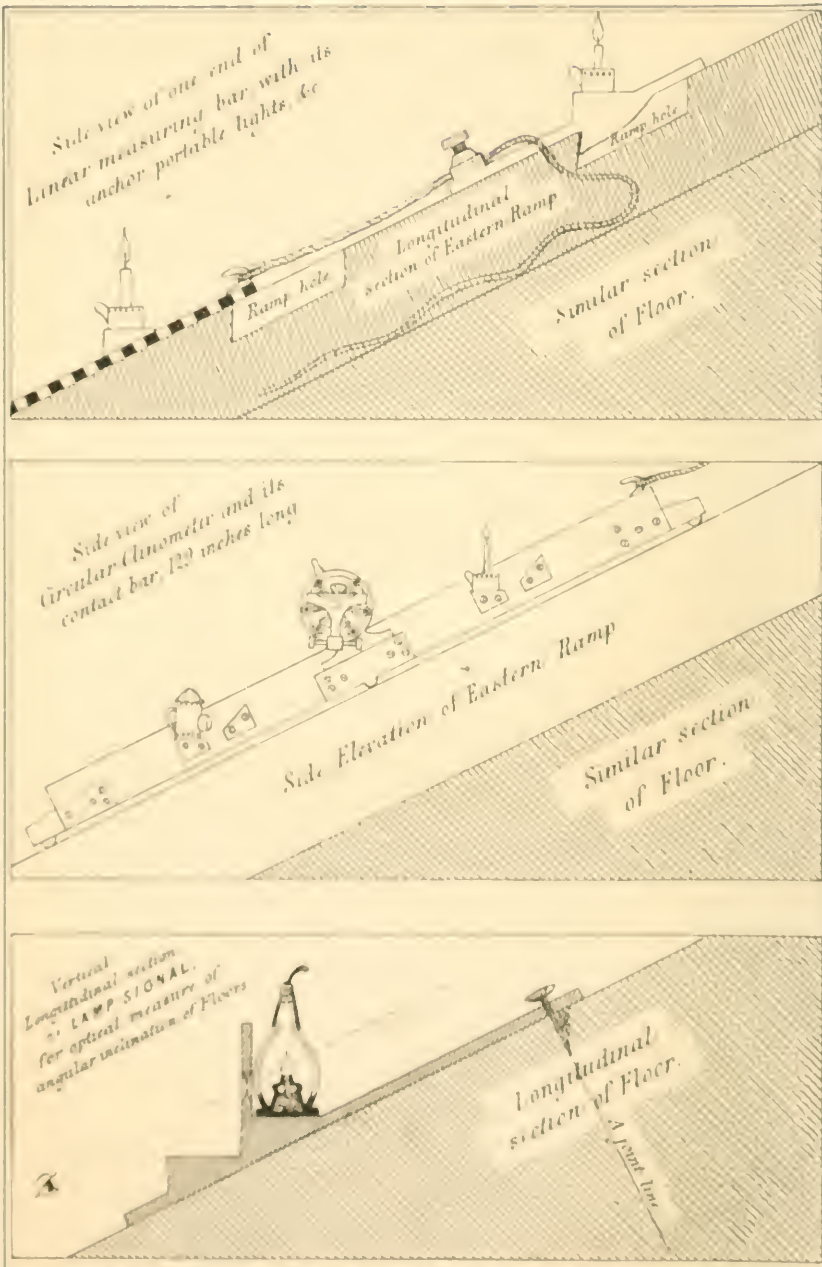

Special forms of apparatus, employed in measuring in the Grand Gallery.

LIFE AND WORK

AT THE GREAT PYRAMID

DURING THE MONTHS OF JANUARY, FEBRUARY, MARCH, AND APRIL, A.D. 1865;

WITH

A DISCUSSION OF THE FACTS ASCERTAINED.

BY C. PIAZZI SMYTH, F.R.SS.L. & E.

F R.A.S., F.R.S.S.A. ; HON. M. INST. ENGIN. SC., P.S. ED., AND R.A.A.S. MUNICH AND PALERMO;
PROFESSOR OF PRACTICAL ASTRONOMY IN THE UNIVERSITY OF EDINBURGH,
AND ASTRONOMER-ROYAL FOR SCOTLAND.

IN THREE VOLUMES;

WITH ILLUSTRATIONS ON STONE AND WOOD.

VOL. II.

EDINBURGH:
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VOL. II.

NUMERICAL

OBSERVATIONS.

‘*In God's work of Creation, amidst the rich profusion ‘and diversity which seem at first to defy all attempts at ‘arrangement and classification, an unexpected beauty of ‘order and regularity are discoverable on closer examina- ‘tion, and all things, from the lowest to the highest, are ‘found* “TO BE ORDERED IN MEASURE AND NUMBER AND ‘“WEIGHT.”’

‘SCRIPTURE PARALLELISM,’
by the Rev. John Forbes.

SECTION I.—LINEAR MEASURES.

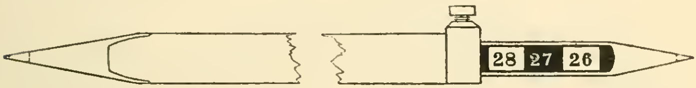
INTRODUCTION.

These linear measures are expressed throughout in terms of British inches and decimals of an inch: no other name of linear measure having been employed; and every measuring rod, bar, scale, or line having been specially prepared for this work, and graduated to show inches only, in numbers of either 5, or some multiple of 5. For coarse work, the rods had their inches painted alternately black and white, fractions being then read off by estimation, or by a portable inch-scale finely divided; while for closer work the bevelled edge of each scale was subdivided into tenths, and half-tenths, —which allowed a reading off with certainty to the merest hundredth of an inch, even under the necessarily imperfect candle illumination of the interior of the Pyramid; the readings being always taken in terms of decimal fractions of the whole inch, and never in tenths of the smallest divisional space on the scale, when that was other than a tenth, or hundredth of an inch. One of the five-inch scales, by Mr. T. Cooke and Sons of York, was subdivided, and with great neatness, to every hundredth of an inch; allowing readings to be taken with a hand-magnifier to ·001 or ·002 of an inch. But this was found to be beyond the requirements of the Pyramid in its present state, and was only employed in the operations for comparing the lengths of the several bars or scales, actually employed in the measuring,—with a standard of acknowledged authority; and deducing thence the corrections to be employed, to reduce whatever lengths had been observed in terms of inches of the rods,—into true British standard inches; which are accordingly the inches in which all the following observations are, or are intended to be, expressed, when not otherwise specially noted.

The rods or scales employed were as follows, for any outside work, or forms:—

Name of Scale.	Material—when of wood, tipped with brass at each end.	Nominal			Edges bevelled	Divided to, on			True length in British inches when in Egypt.
		Length.	Breadth.	Thickness.		Fine edge.	Middle.	Thick edge.	
		inches.	inches.	inches.		inches.	inches.	inches.	
Cooke, 5	Ivory, . .	5	1·6	·15	one	·01	1·	0	4·995
Adie, 5	Ivory, . .	5	1·2	·1	two	·05	1·	·05	4·994
,, 12	Box-wood,	12	1·8	·34	one	·05	1·	·1	11·964
,, 25	Box-wood,	25	...	...	one	·05	1·	·1	24·907
,, 50	Maple-wood.	50	...	...	one	·05	1·	·1	49·987
50 A	Fir, painted.	50	2·3	·7	one	1·	1·	1·	50·008
50 B	Fir, painted,	50	2·3	·7	one	1·	1·	1·	49·995
100 A	Fir, painted,	100	3·0	·9	one	1·	1·	1·	100·016
100 B	Fir, painted,	100	3·0	·9	one	1·	1·	1·	100·031
500 tape	Steel tape,	500	...	...	0	1·	1·	1·	......

For inside measures, as inside the coffer and inside the passages or rooms, for their breadth or height, a set of slider scales was employed; made of mahogany, ended with brass, and the brass tipped with steel, shaved or bevelled off on every side to an acute angle, so as to offer no impediment to measuring diagonals inside a cube; and appearing generally of this figure:—



The thicker part of the arrangement is a hollow square tube, 1·25 inch square outside in cross section; in which slides the thinner part,—which is a solid mahogany rod, ·75 inch square in cross section, and can be clamped at any point by an appropriate screw. The slider alone is divided, so that it measures only the excess beyond the closed length, whence the name of each slider is derived. The divisions merely consist of whole inches, painted alternately black and white, and numbered. The sliding rod was made in every case as long as the hollow trunk permitted; but if the subject allowed, no slider was used with its sliding rod projecting very far. The lengths, however, of each slider, were taken at many different inches of protrusion of its inside sliding rod, as thus:—

SLIDER 25.

(Used chiefly for internal breadths, and depths of coffer.)

Nominal Lengths, inches.		Real Lengths in British inches.	Nominal Lengths, inches.		Real Lengths in British inches.
25	=	24·965	34	=	33·993
26	=	25·949	35	=	34·993
27	=	26·981	36	=	35·988
31	=	30·975	41	=	41·003

SLIDER 35.

(Used chiefly for the breadths and heights of passages, doorways, and ramp intervals ; and its correction, for reducing a length given by its divisions to true British inches, has been considered = — ·152 inch.)

Nominal Length.		Real Length.	Nominal Length.		Real Length.
35	=	34·863	48	=	47·862
36	=	35·868	49	=	48·821
40	=	39·866	50	=	49·855
41	=	40·856	51	=	50·837
42	=	41·860	52	=	51·858
43	=	42·858	53	=	52·849
44	=	43·864	54	=	53·858
45	=	44·871	55	=	54·859
46	=	45·869	56	=	55·875
47	=	46·855	61	=	60·855

SLIDER 50.

(Correction to reduce a measure in its nominal inches to true British inches = + ·060 inch.)

Nominal Length.		True Length.	Nominal Length.		True Length.
50	=	50·044	61	=	61·060
51	=	51·068	66	=	66·055
52	=	52·067	71	=	71·066
53	=	53·072	76	=	76·055
54	=	54·048	81	=	81·055
55	=	55·077	86	=	86·045
56	=	56·060	91	=	91·068

SLIDER 70.

(Correction to reduce a measure in its nominal inches to true British inches = + ·130 inch, nearly.)

Nominal Length.		True Length.
70	=	70·057
71	=	71·107
76	=	76·121
77	=	77·135
78	=	78·127
81	=	81·123
86	=	86·129
91	=	91·123
96	=	96·121
And 60 inches of its slider alone	=	60·068

SLIDER 100.

Nominal Length.		True Length.
100	=	100·039
And 90 inches of its slider alone	=	90·068

SLIDER 400.

This was a variation on all the former sliders; and was composed of three hollow trunks of mahogany, sliding one within the other, and fixable at one point only by a stout brass pin; in the brass plate forming the base of the lower and thicker trunk, a strong steel peg was screwed (so that vertical heights might be measured truly on sloping floors); and from the top of the uppermost trunk there could be drawn forth,—by a string passing over a pulley, and capable of being either pulled from, or clamped, below,—a solid rod, marked with inches, and pointed at the end. After a particular measure on one occasion in the grand gallery, this rod was laid down on a level floor, and tested by 100 B, with the following result :—

Nominal Length of Slider 400 at a particular point of its Slider part.			Tested Length, in terms of 100 B.	Real Length in British inches.
		inches.		
Steel peg .	=	10·00	......	......
First trunk	=	100·00	......	......
Second ,,	=	99·92	......	......
Third ,,	=	99·95	......	......
Sliding part at	=	40·3	......	......
		350·17	350·2	350·3

This, and the other smaller sliding scales, were all made by Mr. T. Cooke and Sons of York, and gave great satisfaction ; if too, there is a large constant error about some of them, as slider 35, it had been intimated to Mr. Cooke, that these rods were only intended to carry a measured length from the thing measured to a certain reference scale of higher order, which was alone to be held answerable for the truth of its figures.

REFERENCE SCALE.

The reference scale was itself, however, only an intermediary between the practical bars employed in measuring, and the standard scale (of which presently), and was thus composed :—

A flat bar, 105 inches long, 5 broad, and 0·5 thick, laid flat on the shallow floor of a very stout box, 115 inches long, 8 inches square at the ends, and composed of wood 1·3 inch thick, with deep joist-like sides, to prevent gravity-flexure, and armed with thermometers at either end to show the temperature; the divisions were at every 5 inches; and there were gun-metal rectangles provided, one of which was fixed over the commencing division, and the other brought to touch one end of any rod, whose other end was touching the fixed metal surface; the excess of the place of the second rectangle beyond the last 5-inch division of the reference scale was then read off by means of the small ivory scale, divided to ·01 inch; and, by a magnifier, determined to ·001.

But the flat bar of the reference scale, which had been made out of an organ-pipe of the date of Queen Anne's reign, kindly procured for me by my friend Mr. Joseph Sidebotham, of Manchester, and reported by several of his friends to be almost matchless, when coated with copal varnish, for the construction of measuring-rods of invariable length, —had been unhappily treated to linseed-oil instead, by the optician into whose hands I had intrusted it; and this circumstance, joined perhaps to its having been cut out in the direction of a radial plane of the original tree, and to the heat and drought of Egypt,—set the bar twisting at such a rate in the plane of its breadth, great as that was, that in a short time it would no longer go into its box, and had to be discarded. In its place, however, I pencilled a scale on the inside bottom of the box, put in every fifth inch by means of a fine cut with a penknife, and used these divisions ever afterwards as the reference scale; employing for the time an estimated value of their proportion to British inches.

Now, the 5-inch spaces of the reference scale had been intended, in any case, to be compared with a 5-inch stone standard, by means of a micrometer-microscope beam-compass; which, together with the said standard, had been prepared for me before leaving England by an optician there. But when he brought the combined apparatus to me in Liverpool, only on the eve of embarking, and it appeared made quite contrary to instructions, and very ineffective,—I handed it back to him to alter; and he promised so to alter it and send it out after me to Egypt within one month, on pain of paying a penalty of 10s. per day for every day's delay beyond the month; but I have not seen it from that time to this, though he states that he sent it to Alexandria three months after the appointed time.

Being driven, therefore, to make some extempore apology for a length-carrier when engaged at the Pyramid, I prepared a piece of ancient basalt; scratched with a diamond ring an approximate 5-inch length thereon; and compared every 5-inch space of the reference scale with this basalt standard, through means of the ivory scale divided to ·01 of an inch. In this manner the lengths of all the measures used about the Pyramid became known, in terms of the basalt standard; and were so determined three times, on February 20, March 22, and March 28, at temperatures varying from 64° to 75°.

BASALT STANDARD.

The basalt standard having been safely brought home, was compared, at the Royal Observatory, Edinburgh, on September 7, 22, and 23,--at mean temperatures of 59° and 60°,—with a standard yard-measure, constructed by Captain Kater in the year 1824, and presented by the Imperial Government to the Magistrates of Edinburgh; who kindly lent it to me for the purpose of making so necessary a comparison. This yard-standard had hitherto apparently never been used, being kept only as a reserve, and consists of a bar of brass, 1 inch square in cross section, with raised steel ends, 0·5 inch thick, and 1 inch broad and high; the distance between the inner surfaces of these raised ends being the standard 36 inches required. For the purposes of comparison, the Kater standard was not taken out of its box; but as it lay there, the length inside its uprights was taken off by one of the Pyramid slider scales, and by that transferred to the reference scale; whose values were in that manner ascertained, in terms of the inches of the Kater standard yard; and immediately afterwards by another operation, in terms of the inches of the reputed 5-inch basalt standard.

The inches of the basalt standard being thus compared with those of the Kater standard, were found too short; or that the basalt reputed 5 inches were really only of the value of 4·994 inches of the Kater standard.

Now in the comparisons made at the Pyramid, I had suspected the basalt standard to be rather small, and had assumed its nominal length at 4·996; but after the above determination with the Kater yard, the values obtained at the Pyramid were all altered to a value of the basalt = 4·994; and these are the numbers which are given in preceding pages as the true length in British inches of the several scales employed at the Pyramid.

When all four sides of the base of the Pyramid shall be opened up at some future day, more accurate means of mensuration than the above, will have to be employed.

ENTRANCE PASSAGE OF GREAT PYRAMID.

JANUARY 28—FEBRUARY 11, 1865.

ENTRANCE PASSAGE.—(See Plates II. III. and IV.)

WEST *side of its* FLOOR; measures of the joints there, from beginning, or top, or north, end of said floor; and then from joint to joint.

Number of joint from top, or N.	Jan. 27, measured N. to S.	Jan. 27, measured S. to N.	Jan. 28, N. to S.	Jan. 29, N. to S.	Concluded Mean, from joint to joint.	Whole Distance from beginning of Passage-floor.	Character of Joint, etc.
	inches.	inches.	inches.	inches.	inches.	inches.	
0	0·0	0·0	0·0	...	0·0	0·0	Present beginning of basement sheet or floor is short of its original beginning.
1	54·2	54·0	54·2	...	54·1	54·1	Fair; *i.e.*, fairly close and fine.
2	47·9	48·0	48·0	...	48·0	102·1	Good.
3	58·9	59·0	58·9	...	58·9	161·0	Very good and close.
4	55·3	55·2	55·8	...	55·4	216·4	Very good and close.
5	65·7	65·8	65·7	...	65·7	282·1	Indifferent.
6	59·2	59·0	59·4	...	59·2	341·3	Long holes hereabout cut in middle of floor, and of a breadth to reach within six or eight inches of sides of passage.
7	66·0	66·3	66·2	...	66·2	407·5	Bad, and do. as to holes.
8	52·5	52·2	52·4	...	52·4	459·9	Bad, and do.
9	62·3	62·5	62·8	...	62·5	522·4	Bad, and do.
10	53·3	53·3	52·7	...	53·1	575·5	Bad, and do.
11	36·1	36·3	36·0	...	36·1	611·6	Bad, and do.
12	39·6	39·2	39·7	...	39·5	651·1	Bad, and do.
13	51·4	51·5	51·4	...	51·4	702·5	Bad, and do.
14	51·4	51·7	51·6	...	51·6	754·1	Bad, and do.
15	36·5	35·4	36·5	36·6	36·5	790·6	Hole 31 inches deep begins here, and shows floor-joints rectangularly transverse to axis of passage, through whole depth.
16	48·4	49·6	48·7	48·4	48·5	839·1	Bad.
17	40·2	39·8	40·0	40·0	40·0	879·1	Bad, as being broken.
18	24·7	...	24·8	24·8	24·8	903·9	Bad, and do.
19	35·1	60·0	35·2	35·2	35·2	939·1	Better.
20	...	...	63·7	63·5	63·6	1002·7	Diagonal! close, but with neighbouring cracks.
21	...	...	46·3	46·8	46·6	1049·3	Diagonal and close.
21′	133·3	...	22·±	20·±	21·±	1070·±	Sand-heap.
21″	44·±	...	48·±	50·±	49·±	1119·±	Al Mamoon's hole in west wall begins about this place.

ENTRANCE PASSAGE,

EAST *side of its* FLOOR ; measures of the joints there, from beginning, or top, or north end of said floor, and then from joint to joint.

No. of joint from Top or North.	Measured on January 28th.	January 29th.	Concluded Mean, from Joint to Joint.	Whole Distance from beginning of Passage Floor.	Character of Joint, etc.
0	0·0	0·0	0·0	0·0	
1	54·6	54·6	54·6	54·6	Indifferent.
2	47·7	47·6	47·6	102·2	Better.
3	57·8	58·1	58·0	160·2	Good and fine, *i.e.*, thin.
4	55·0	54·9	55·0	215·2	Thin and fine, but partly concealed in a hole.
5	68·5	68·4	68·4	283·6	Indifferent.
6	59·0	58·8	58·9	342·5	Bad.
7	66·2	66·3	66·2	408·7	Bad and broken.
8	51·7	51·8	51·8	460·5	Much broken.
9	59·5	59·0	59·2	519·7	Broken, and not square across floor.
10	53·2	52·8	53·0	572·7	Broken, and not square across floor.
11	38·8	38·9	38·8	611·5	Very bad and broken.
12	40·4	40·3	40·4	651·9	Bad and broken.
13	50·8	51·0	50·9	702·8	Bad and broken.
14	53·0	52·5	52·8	755·6	Very bad, broken, and wide.
15	36·3	36·6	36·4	792·0	Better.
16	48·5	48·7	48·6	840·6	Very much broken.
17	40·0	40·1	40·0	880·6	Very broken.
18	24·7	24·6	24·6	905·2	Good originally, but since broken at edges.
19	35·1	35·4	35·2	940·4	Good ; very hard stone between this and last joint.
20	57·0	57·0	57·0	997·4	*Diagonal* good, and in very hard stone, but with many neighbouring cracks.
21	36·0	36·4	36·2	1033·6	Diagonal, and do. do.
21′	35·±	30·	32·±	1066·±	Sand heap, adventitious, mixed with broken stones, blocks up entrance passage beyond and below this point.

ENTRANCE PASSAGE,

FLOOR OF.

West Side compared with *East* Side.

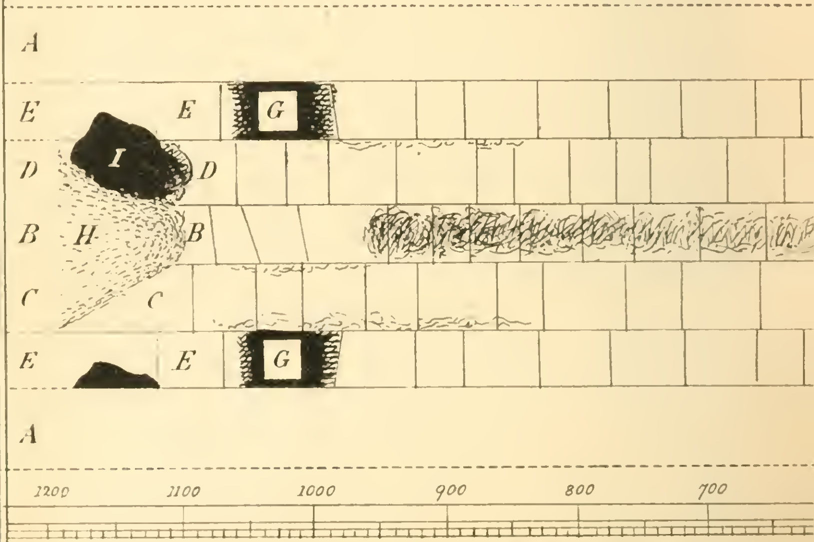
Number of joint from Top, or North.	Joint to joint on West side.	Do. on East side.	Whole distance from beginning of Passage Floor on West side.	Do. on East side.	Error of Rectangularity.
0	0·0	0·0	0·0	0·0	...
1	54·1	54·6	54·1	54·6	+ 0·5
2	48·0	47·6	102·1	102·2	+ 0·1
3	58·9	58·0	161·0	160·2	— 0·8
4	55·4	55·0	216·4	215·2	— 1·2
5	65·7	68·4	282·1	283·6	+ 1·5
6	59·2	58·9	341·3	342·5	+ 1·2
7	66·2	66·2	407·5	408·7	+ 1·2
8	52·4	51·8	459·9	460·5	+ 0·6
9	62·5	59·2	522·4	519·7	— 2·7
10	53·1	53·0	575·5	572·7	— 2·8
11	36·1	38·8	611·6	611·5	— 0·1
12	39·5	40·4	651·1	651·9	+ 0·8
13	51·4	50·9	702·5	702·8	+ 0·3
14	51·6	52·8	754·1	755·6	+ 1·5
15	36·5	36·4	790·6	792·0	+ 1·4
16	48·5	48·6	839·1	840·6	+ 1·5
17	40·0	40·0	879·1	880·6	+ 1·5
18	24·8	24·6	903·9	905·2	+ 1·3
19	35·2	35·2	939·1	940·4	+ 1·3
20	63·6	57·0	1002·7	997·4	— 5·3
21	46·6	36·2	1049·3	1033·6	—15·7
21′	21·±	32·±	1070·±	1066·±	— 4·±
21″	49·±	...	1119·±	......	...

NOTES ON FLOOR OF ENTRANCE PASSAGE, TO ACCOMPANY THE MEASURES.

This floor is all in a limestone, close, compact, more or less hard in places, abrading a fine white dust, which rises in smoke-like clouds under the feet from holes where it has accumulated. In parts *not* exposed to friction, this limestone has a tendency to decay into or acquire a rough, coarse surface, something like what granite might present, if coated over with thin, yellowish, lime-wash ; but where under friction, as from the feet of countless travellers, it has approached a smooth, glossy, and marble-like appearance. There has been a slight wearing down of the floor over its whole breadth, as evident by its present level compared with the side joints.

To assist men, apparently, to ascend and descend on the originally smooth, sloping surface, occasional shallow, transverse holes or notches have been rudely cut in the floor at moderate distances apart. But much more rudely still, has the operation been performed towards the middle and lower end (of the here measured portion) of the passage, where the floor-stone is not so hard as near the beginning. For in such parts, these transverse holes, usually about two-thirds the breadth of the passage, have been lengthened out, preserving their breadth, until they meet and join each other longitudinally ; and have then been deepened so as almost to form a sort of ditch, running along or through the central line of the passage floor ; very rough and broken, but yet enabling the ascent and descent to be made with only little stooping. These floor-holes have attained the following vertical depths at the given distances from the North beginning of floor, viz. :—

Joints of floor, walls, and roof (re
OF GREA
opened out on plane of t



Scale of British Inches for Size

A, A, A, A, the Basement sheet.

B, B, B, Line of floor, of passage.

C, C, C, East wall.

G, G, Granite portcullis, lower butt-end of, closing e

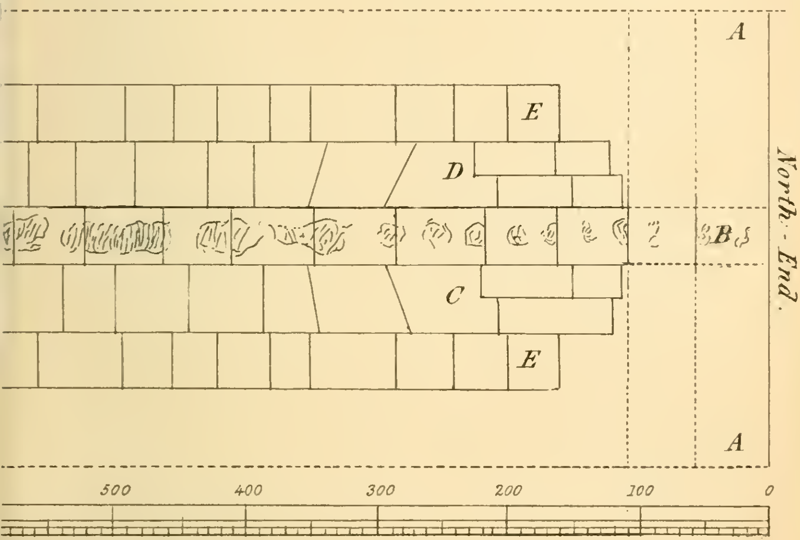
H, Heap of adventitious dust & rubbish brought in by

I, Caliph Al Mamoon's hole, where it broke into West-

of getting round the Portcullis blocks, & into the Ti ted twice) of Entrance Passage

PYRAMID

floor, or basement sheet.



Distance from North end of Floor.

D, D, D, West-wall of passage.

E, E, & E, E, Roof of passage, repeated twice.

ance to first ascending passage.

abs.

l of Entrance passage, and still serves travellers as a means

ascending Passage.

W. H. McFarlane Lith. Edin.

At and about	distance, 200,	depth of holes	= 4	more or less.
,,	300,		= 8	,,
,,	400,	,,	= 10	,,
,,	450,	,,	= 14	,,
,,	600,	,,	= 16	,,
,,	700,	,,	= 18	,,
,,	800,	,,	= 31	,,
,,	1000,	,,	= 0	,,

At the distance of about 1000 inches, the holes in the floor cease; and apparently because there, a very much harder stone is employed; so hard as to have defied both men and nature to injure it, and to have left for a short space the original floor surface almost unabraded and uninjured. Below, or beyond about 1100 inches of distance, the further floor is encumbered, and the whole passage down to the subterranean room of the Pyramid is stopped up by heaps of stones and sand, adventitiously or mischievously introduced by the Arabs in the course of the last few years; and effectively limiting now the amount of 'entrance passage' that can be carefully examined.

Only on the third occasion of measuring, did I perceive, that the piece of uninjured flooring, extending from 940· to 1065· of distance, is crossed by two joints. Rather obscured they are by neighbouring and parallel crackings, but true masonry joints nevertheless; very fine and thin, and placed notably diagonal to the axis of the passage. This position is such an anomaly to the other joints of the floor, and has been so very carefully and exactly performed,—made so close as not to catch a careless eye, and yet so certainly as not to escape a scrutinizing one,--and constructed in such excessively hard stone, that, whatever was intended, it *has* lasted to the present time untouched, and uninjured,—that something must have been purposed to have been marked thereby. What could it be ? By referring to the plan of the passage, Plate II. page 16, it will be seen that the lower butt-end of the granite portcullis leading to the upper parts of the Pyramid is just above the place ; or rather the hole belonging to said lower butt-end of it, is ; viz., that hole in the ceiling, out of which the so-called 'triangular' stone had dropped when Khaliph Al Mamoon was forcing his way into the Pyramid,—and disclosed to him, what Herodotus had never suspected, that there was an upper system of chambers and passages in this Pyramid, besides its subterranean ones.

The long and large holes in the entrance passage floor, though passed over by many describers, are thought by Perring and others,—to have been effected at a very early day, in order to let men get under the blocks of stone—with which they suppose the passage to have been filled up to its mouth by the original builders,—and so by getting under them, to be able to break them up and then drag them out piecemeal.

ENTRANCE PASSAGE,

Roof of.

West Side.

No. of joint.	First measure, joint to joint.	Second measure, do.	Mean.	Whole distance from beginning of *floor*, produced up to roof-level—*continued.*	Character of joint, etc., January 30, 1865.
0	0·0	0·0	0·0	162·2	Front surface of first roof stone is rather wavy and uncertain to measure.
1	38·2	38·2	38·2	200·4	Indifferently good.
2	40·7	40·8	40·8	241·2	Do. } Roof stones have a dusty, pulverulent surface, and are 0·3 higher than joint of top of walls.
3	42·7	42·8	42·8	284·0	Bad. }
4	66·5	66·4	66·4	350·4	Bad.
5	30·6	30·8	30·7	381·1	Bad.
6	39·0	39·2	39·1	420·2	Good.
7	35·3	35·3	35·3	455·5	Indifferent.
8	35·4	35·4	35·4	490·9	Bad, stone showing a honey-comb surface-roughness.
9	61·8	62·0	61·9	552·8	Indifferent.
10	36·6	36·6	36·6	589·4	Fair.
11	36·6	36·5	36·6	626·0	Much broken on under side.
12	36·7	37·0	36·8	662·8	Bad.
13	55·4	55·4	55·4	718·2	Indifferent, stones rough-surfaced.
14	55·4	55·3	55·4	773·6	Fair and do.
15	54·6	54·7	54·6	828·2	Broken at under side.
16	55·6	55·6	55·6	883·8	
17	34·3	34·3	34·3	918·1	
18	59·0	59·1	59·0	977·1	Visible only in a hole in roof, in continuation of portcullis blocks of first ascending passage.
19	46·7	46·6	46·6	1023·7	At 5·7 preceding is a parallel crack. This, the nineteenth joint produced upwards, hits lower end of granite portcullis.
20	40·3	40·0	40·2	1063·9	Indifferent and broken.
21	48·0	48·0	48·0	1111·9	At beginning of Al Mamoon's hole on west side of passage.

ENTRANCE PASSAGE,

Roof of.

East Side.

No. of joint.	First measure from joint to joint.	Second measure do.	Mean.	Whole distance from beginning of *floor*, produced upwards to roof-level—*continued*.	Character of joint, etc., January 30, 1865.
0	0·0	0·0	0·0	162·3	Wavy and uneven cut off to roof stone.
1	38·6	38·8	38·7	201·0	Indifferent.
2	40·9	40·9	40·9	241·9	Bad and broken.
3	43·3	43·3	43·3	285·2	Indifferent.
4	66·2	65·8	66·0	351·2	Bad and wide.
5	30·3	30·5	30·4	381·6	Bad and wide; powdery, passing into a rough eaten-in surface.
6	39·3	39·6	39·4	421·0	Close.
7	35·4	35·3	35·4	456·4	Indifferent.
8	35·6	35·6	35·6	492·0	Bad.
9	61·8	61·9	61·8	553·8	Bad; stone very rough.
10	36·6	36·4	36·5	590·3	Good and close.
11	37·8	37·8	37·8	628·1	Indifferent.
12	36·7	36·7	36·7	664·8	Bad.
13	55·4	55·3	55·4	720·2	Wide.
14	53·1	53·0	53·0	773·2	Stone very rough and broken.
15	54·4	54·6	54·5	827·7	Much broken at lower edge.
16	58·5	58·6	58·6	886·3	
17	35·5	35·4	35·4	921·7	
18	60·0	60·3	60·2	981·9	Situated up in a hole, which is in continuation of portcullis blocks of first ascending passages, and in their inclined line.
19	46·0	46·4	46·2	1028·1	At 6·5 before this, a parallel crack. This joint produced in its own plane upwards, hits end of granite portcullis, three inches above its bottom.
20	38·5	38·8	38·6	1066·7	Beyond this point the ceiling is much broken in continuation of Al Mamoon's forced hole from the west.

ENTRANCE PASSAGE,

ROOF OF.

East and *West Sides* compared together.

Number of joint from Top, or North End.	Joint to joint on West side.	Do. on East side.	Whole distance from beginning of *Floor*, produced upwards to roof level, continued on West side.	Do. do. on East side.	Error of rectangularity.
0	0·0	0·0	162·2	162·3	+ 0·1
1	38·2	38·7	200·4	201·0	+ 0·6
2	40·8	40·9	241·2	241·9	+ 0·7
3	42·8	43·3	284·0	285·2	+ 1·2
4	66·4	66·0	350·4	351·2	+ 0·8
5	30·7	30·4	381·1	381·6	+ 0·5
6	39·1	39·4	420·2	421·0	+ 0·8
7	35·3	35·4	455·5	456·4	+ 0·9
8	35·4	35·6	490·9	492·0	+ 1·1
9	61·9	61·8	552·8	553·8	+ 1·0
10	36·6	36·5	589·4	590·3	+ 0·9
11	36·6	37·8	626·0	628·1	+ 2·1
12	36·8	36·7	662·8	664·8	+ 2·0
13	55·4	55·4	718·2	720·2	+ 2·0
14	55·4	53·0	773·6	773·2	— 0·4
15	54·6	54·5	828·2	827·7	— 0·5
16	55·6	58·6	883·8	886·3	+ 2·5
17	34·3	35·4	918·1	921·7	+ 3·6
18	59·0	60·2	977·1	981·9	+ 4·8
19	46·6	46·2	1023·7	1028·1	+ 4·4
20	40·2	38·6	1063·9	1066·7	+ 2·8
21	48·0	...	1111·9	......	...

NOTES ON THE GENERAL CHARACTER OF ROOF OF ENTRANCE PASSAGE IN GREAT PYRAMID.

These blocks of stone do not seem of so hard and dense a quality as those of the side walls; and these again are inferior to the floor stones; which floor, therefore, seems to have been meant to stand work. The roof stones near upper end of passage have a pulverulent surface, as from dry oxidation; lower down the passage they show the same rough decayed surface as the wall stones. Water sometimes runs down both the roof and side walls, as shown by dark stains.

The roof is first notably broken in upon, or broken out of, at, about, and in continuation of, the butt-end of granite portcullis of first ascending passage; and next it is broken in upon, and even more extensively and irregularly, lower down, partly opposite to, but more in continuation of, Khaliph Al Mamoon's hole in the west.

The parts broken out of the roof, under the portcullis, are rather more than would supply the now missing 'triangular' stone,—which, according to Sir Gardner Wilkinson and others, once completed the roof at that spot, and kept the portcullis out of sight; but they quite include the reasonableness of its once having existed.

The greater distances of nearly all the roof joints east, over west, as measured from commencement of basal sheet at its upper or north end, is probably due to the north escarpment of said basal sheet, in its present broken state, being rather difficult to trace; in fact, rather to error in point where measures were begun, than to all the roof joints being out of cross-level: the *differences* among them will, however, still serve to indicate the degree of closeness and accuracy aimed at, or attained, by the builders in that particular element.

ENTRANCE PASSAGE,

Walls of.

West Wall, *Lower* ends of Joints.

No. of wall-joint from top or North end.	Measured January 27. Joint to joint.		January 27. Joint to joint.		January 30. Joint to joint.		Mean concluded.		Total distance from outside of basement.		Character of Joint, etc.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	123·4	110·0		
1	...	42·6	...	42·7	42·6	42·6	42·6	42·6	166·0	152·6	This first upperjoint so fine as to have escaped observation on the two first measurements.	Good.
2	100·5	55·0	100·0	55·0	58·0	55·2	58·0	55·0	224·0	207·6	Good.	Good.
3	82·4		82·1		......		82·2		289·8		Vertical approximately.	
4	59·7		59·6		......		59·6		349·4		Do.	
5	42·1		42·5		......		42·3		391·7			
6	35·5		35·3		......		35·4		427·1		Good.	
7	55·0		55·1		......		55·0		482·1		Bad.	
8	45·0		45·1		......		45·0		527·1		Indifferent.	
9	35·1		34·9		......		35·0		562·1		Good.	
10	77·0		77·0		......		77·0		639·1		Bad.	
11	42·1		42·2		......		42·2		681·3		Bad.	
12	59·1		59·1		......		59·1		740·4		Bad.	
13	26·6		26·4		......		26·5		766·9		Bad.	
14	34·5		34·8		......		34·6		801·5		Bad or indifferent.	
15	40·6		40·4		......		40·5		842·0		Bad.	
16	29·1		29·1		......		29·1		871·1		Indifferent	
17	60·4		60·4		......		60·4		931·5		Good.	
18	49·5		49·6		49·6		49·6		981·1		Good.	
19	29·7		......		29.8		29·8		1010·9		Good, when produced upwards hits centre of lower end of granite portcullis.	
20	41·3		41·5		41·3		41·4		1052·3		Good.	
21	......		54·5		56·0±		55·±		1107·±		Touched on by Khaliph Al Mamoon's hole.	
21′	......		......		70·±		70·±		1177·±		End of Al Mamoon's hole.	

ENTRANCE PASSAGE,

WALLS OF.

West Wall, *Upper* ends of Joints.

No. of wall-joint from top or North end.	First measure, joint to joint.		Second measure, joint to joint.		Mean, joint to joint.		Total distance from outside of basement, North end.		Character of Joint, etc. January 31, 1865.
	Whole course.		Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	0·0	0·0	0·0	0·0	0·0	0·0	122·4	110·0	
1	42·8	42·6	42·7	42·7	42·8	42·6	165·2	152·6	
2	58·2	55·3	58·3	54·9	58·2	55·1	223·4	207·7	
3	50·4		50·2		50·2		273·6		Vertical joint approximately.
4	65·7		65·2		65·4		339·0		Vertical do.
5	52·7		52·7		52·7		391·7		
6	35·3		35·3		35·3		427·0		
7	55·1		55·2		55·2		482·2		
8	45·3		45·2		45·2		527·4		
9	35·0		35·0		35·0		562·4		
10	77·0		77·1		77·0		639·4		
11	41·9		41·8		41·8		681·2		
12	59·4		59·4		59·4		740·6		
13	26·5		26·3		26·4		767·0		
14	34·8		34·8		34·8		801·8		
15	40·2		40·5		40·4		842·2		
16	29·3		29·4		29·4		871·6		
17	59·7 ?		60·3		60·2		931·8		In a fracture.
18	49·5		49·4		49·4		981·2		
19	30·3		......		30·3		1011·5		This joint produced in its own line hits portcullis end.
20	40·8		......		40·8		1052·3		Past, or to south of portcullis butt-end.

ENTRANCE PASSAGE,

WALLS OF.

West Wall, *Lower* and *Upper* ends of Joints compared together.

No. of wall-joint from top or North end.	Lower end: joint to joint.		Upper end: joint to joint.		Lower end: total distance from beginning of floor, North.		Upper end: total distance from beginning of floor, North.		Correction required to *upper* end.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	123·4	111·0	122·4	110·0	...	...
1	42·6	42·6	42·8	42·6	166·0	152·6	165·2	152·6	+ 0·8	0·0
2	58·0	55·0	58·2	55·1	224·0	207·6	223·4	207·7	+ 0·6	— 0·1
3	82·2		50·2		289·8		273·6		+ 16·2	
4	59·6		65·4		349·4		339·0		+ 10·4	
5	42·3		52·7		391·7		391·7		0·0	
6	35·4		35·3		427·1		427·0		+ 0·1	
7	55·0		55·2		482·1		482·2		— 0·1	
8	45·0		45·2		527·1		527·4		— 0·3	
9	35·0		35·0		562·1		562·4		— 0·3	
10	77·0		77·0		639·1		639·4		— 0·3	
11	42·2		41·8		681·3		681·2		+ 0·1	
12	59·1		59·4		740·4		740·6		— 0·2	
13	26·5		26·4		766·9		767·0		— 0·1	
14	34·6		34·8		801·5		801·8		— 0·3	
15	40·5		40·4		842·0		842·2		— 0·2	
16	29·1		29·4		871·1		871·6		— 0·5	
17	60·4		60·2		931·5		931·8		— 0·3	
18	49·6		49·4		981·1		981·2		— 0·1	
19	29·8		30·3		1010·9		1011·5		— 0·6	
20	41·4		40·8		1052·3		1052·3		0·0	
21	55·		......		1107·3		......		......	
21′	70· ±		......		1177·3		......		......	

ENTRANCE PASSAGE,—Walls of.

East Wall, *Lower* ends of Joints.

No. of wall-joint from top or North end.	First measure, joint to joint.		Second measure, joint to joint.		Mean of joint to joint.		Total distance from outside of basement, North end.		January 30, 1865.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	0·0	0·0	124·8	110·2		
1	83·3	40·1	83·2	40·3	83·2	40·2	208·0	150·4	Fine and thin	Exquisitely fine; more remarkably still the longitudinal joint between the two courses.
2	...	68·9	...	68·8	...	68·8	...	219·2	...	Exquisitely fine.
3	70·8		70·9		70·8		290·0		True, but injured; vertical approximately.	
4	64·0		63·8		63·9		353·9		Bad and open; vertical approximately.	
5	33·6		33·3		33·4		387·3		Bad and open; wall-surface is rather glazy over an uneven grain, and is not of so hard a stone as the floor.	
6	54·9		54·9		54·9		442·2		Close.	
7	58·8		58·8		58·8		501·0		Bad and open.	
8	36·1		36·1		36·1		537·1		Close; wall-stone more injured and decayed.	
9	68·0		68·1		68·0		605·1		Close at top, open at bottom.	
10	53·7		53·8		53·8		658·9		Moderately close; stone surface very rough and decayed.	
11	58·1		58·3		58·2		717·1		Open; two big cracks between this and last joint.	
12	44·1		44·2		44·2		761·3		Closer at top than bottom.	
13	60·0		60·0		60·0		821·3		Indifferent.	
14	32·8		33·0		32·9		854·2		Indifferent; wall stones very rough.	
15	62·7		62·8		62·8		917·0		Close; from last joint to this one and the next two or three, there are extensive chips or fractures in the upper part of the wall stone.	
16	40·8		40·7		40·8		957·8		Close.	
17	42·4		42·7		42·6		1000·4		Indifferent.	
18	38·9		39·3		39·1		1039.5		Indifferent; stone much chipped both below and above.	
19	44·0		44·0		44·0		1083·5		Exceedingly broken.	
20	57·0		57·0		57·0		1140·5		Close, but exceedingly broken and opposite to Al Mamoon's hole on West side, *i.e.*, past its beginning by about 28 inches.	

ENTRANCE PASSAGE,

WALLS OF.

East Wall, *Upper* ends of joints.

No. of joint from top or North end.	First measure, joint to joint.		Second measure, joint to joint.		Mean, joint to joint.		Total distance from beginning of floor, North.		February 1st, 1865.
	Whole course.		Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	0·0	0·0	0·0	0·0	0·0	0·0	124·8	110·2	Front, or North surface of the upper of these two courses, begins 15 to 20 inches behind or to south of lower one; but neither have good and regular fronts, being greatly broken and injured.
1	82·9	40·0	82·8	40·0	82·8	40·0	207·6	150·2	
2	...	68·8	...	68·9	...	68·8	...	219·0	
3	70·7		70·6		70·6		278·2		Bad joint and difficult reading.
4	66·6		66·6		66·6		344·8		Do. do.
5	42·7		42·6		42·6		387·4		
6	54·8		54·8		54·8		442·2		
7	58·8		58·7		58·8		501·0		
8	36·6		36·4		36·5		537·5		
9	67·6		67·5		67·6		605·1		
10	53·8		53·7		53·8		658·9		
11	58·0		58·0		58·0		716·9		
12	44·2		44·2		44·2		761·1		
13	60·1		60·1		60·1		821·2		
14	32·8		32·9		32·8		854·0		
15	62·8		62·8		62·8		916·8		Close joint.
16	40·5		40·6		40·6		957·4		
17	42·5		42·5		42·5		999·9		This joint produced upwards hits top, or north side of lower butt-end of granite portcullis.
18	39·3		39·1		39·2		1039·1		
19	43·3		43·7		43·6		1082·7		Grievously broken, and lower part ending in sand.
20	......		......		......		......		

ENTRANCE PASSAGE,

WALLS OF.

East wall, *Lower* and *Upper* ends of joints compared.

No. of joint from top or North end.	*Lower* ends, joint to joint.		*Upper* ends, joint to joint.		*Lower* ends, total distance from beginning of floor, North.		*Upper* ends, total distance from beginning of floor, North.		Correction required to upper ends.	
	Whole course.		Whole course.		Whole course.		Whole course.		Whole course.	
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.
0	0·0	0·0	0·0	0·0	124·8	110·2	124·8	110·2	...	...
1	83·2	40·2	82·8	40·0	208·0	150·4	207·6	150·2	+0·4	+0·2
2	...	68·8	...	68·8	...	219·2	...	219·0	...	+0·2
3	70·8		70·6		290·0		278·2		+11·8	
4	63·9		66·6		353·9		344·8		+ 9·1	
5	33·4		42·6		387·3		387·4		— 0·1	
6	54·9		54·8		442·2		442·2		0·0	
7	58·8		58·8		501·0		501·0		0·0	
8	36·1		36·5		537·1		537·5		— 0·4	
9	68·0		67·6		605·1		605·1		0·0	
10	53·8		53·8		658·9		658·9		0·0	
11	58·2		58·0		717·1		716·9		+ 0·2	
12	44·2		44·2		761·3		761·1		+ 0·2	
13	60·0		60·1		821·3		821·2		+ 0·1	
14	32·9		32·8		854·2		854·0		+ 0·2	
15	62·8		62·8		917·0		916·8		+ 0·2	
16	40·8		40·6		957·8		957·4		+ 0·4	
17	42·6		42·5		1000·4		999·9		+ 0·5	
18	39·1		39·2		1039·5		1039·1		+ 0·4	
19	44·0		43·6		1083·5		1082·7		+ 0·8	
20	57·0		......		1140·5		......		......	
21	......		......		......		......		......	

NOTES ON THE CHARACTER OF THE STONE SURFACE OF THE WEST AND EAST WALLS.

These walls of the entrance passage begin at the north or upper end in two courses to form its height; but after 100 inches or more of distance southward, they are formed of larger blocks of the full height of the passage, and therefore in a single course only. All the joints between these stones are transverse or *perpendicular* to the axis of the passage, excepting only the third and fourth joints, which approximate to a *vertical* position.

A few inches below, or south of the fourth joint, and nearly similarly on either side of the passage, is still to be seen a line about ·08 broad and ·02 deep, drawn by a powerful hand, and with a hard tool, upon the stones, and in direction of a perpendicular to the line of the passage. The line finds itself on that particular stone, whose lower or southern end is perpendicular to the passage, while its upper and northern end is approaching to the vertical; and from its (the line's) position, would enable a set-off to be obtained for the unusual angle of the northern face more accurately than from the farther end of the stone, to which the line may be considered parallel,—but it is in fact rather truer in rectangularity than that, to the passage axis. The Pyramid guides had not noticed these lines on either side; and quite believed, on having them pointed out, that they might have been made by the original builders; while we ourselves afterwards found traces of similar lines on the junction surfaces of fragments of casing stones, and more notably on the south-west socket of the Pyramid excavated and exposed to view by Mr. Aiton in April.

The joints of the stones near the beginning of the passage are fine, thin, and true almost past belief; towards the middle of the passage they become coarse and wide, say 0·2 in breadth; but are closer again on approaching the neighbourhood of the portcullis block of the first ascending passage.

The surface of the walls is nowhere absolutely smooth: it shows indications, indeed, of having been once worked to a true plane, and then having, ages afterwards, suffered a corroding effect, which has partially honeycombed the surface; and this effect is chiefly visible far down inside the passage, where mechanical violence is most slightly felt. Wherever, on the contrary, the stone has been exposed to friction, it seems to harden under it, become smooth and marble-like, and resist the corroding and rough honeycombing influence seen elsewhere. Wherever, too, the stone has been fresh chipped or fractured, as it has been abundantly near the portcullis, the chipped surfaces are smooth, dense, and uniform.

ENTRANCE PASSAGE,

WALLS OF.

West Wall Joints, tested for rectangularity by a large Square.

No. of joint from top or North end.	Tail of square to South.		Tail of square to North.		Mean freed from error of square.		Notes, January 31, 1865.
	Whole course.		Whole course.		Whole course.		
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	...	...	...	...	...	...	Measures in first column made with tail of square to south, and going down passage; those, in second column, with tail to north.
1	+ 0·10	+ 0·30	—0·20	—0·09	—0·05	+ 0·10	
2	+ 0·20	0·00	—0·25	—0·02	—0·02	—0·01	
3	+ 14·±		+ 13·±		+ 14·±		
4	+ 9·±		+ 8·±		+ 9·±		Bad joint; the rectilineal line drawn and engraved in the stone behind this joint, or at about 355 inches or more from beginning of basement sheet (for it was not measured for distance) reads on the square +0·12 by a forward observation, and —0·12 by a backward observation, whence the mean shows no error of perpendicularity.
5	0·00		— 0·18		— 0·09		
6	0·00		— 0·03		— 0·02		
7	+ 0·12		— 0·05		+ 0·03		
8	+ 0·07		— 0·35		— 0·14		
9	+ 0·10		— 0·27		— 0·14		
10	0·00		— 0·20		— 0·10		
11	0·00		— 0·10		— 0·05		Joint open below.
12	0·00		— 0·30		— 0·15		Joint open at top.
13	— 0·03		— 0·25		— 0·14		
14	0·00		— 0·2±		— 0·10		Bad joint.
15	0·00		— 0·12		— 0·06		
16	— 0·10		— 0·20		— 0·15		Passage grows dark about and below this point.
17	+ 0·12		— 0·15		— 0·02		
18	+ 0·10		— 0·10		0·00		
19	0·00		— 0·1±		— 0·05		This joint produced upwards hits nearly on middle of lower butt-end of granite portcullis.
20	Sand heap.		— 0·2±		...		

ENTRANCE PASSAGE,

Walls of.

East Wall Joints, tested for rectangularity by a large Square.

Number of joint from top or North end.	Tail of square to North. Whole course.		Tail of square to South. Whole course.		Mean, freed from error of square. Whole course.		Notes, January 31, 1865.
	Upper course.	Lower course.	Upper course.	Lower course.	Upper course.	Lower course.	
0	...	...	...	...	...	...	
1	00·0	—0·07	—0·05	+0·10	—0·02	+0·02	
2	...	—0·10	...	+0·10	...	0·00	
3	+10·±		+10·±		+10·±		Bad joint, and measure at top in a hole.
4	+ 7·±		+ 8·±		+ 8·±		Bad joint; line on stone behind or south of this joint reads one way of the square +0·15, and the other way —0·22; giving for mean a —0·04.
5	— 0·45		— 0·08		— 0·26		
6	— 0·25		0·00		— 0·12		
7	— 0·25		+ 0·07		— 0·14		
8	— 0·30		— 0·12		— 0·21		
9	— 0·25		+ 0·10		— 0·12		
10	— 0·17		+ 0·01		— 0·08		
11	— 0·25		+ 0·03		— 0·12		Ends in a hole at top, and by a crack leads to a joint in roof.
12	— 0·20		+ 0·05		— 0·08		
13	— 0·22		+ 0·05		— 0·14		
14	— 0·25		+ 0·12		— 0·06		
15	— 0·10		+ 0·05		— 0·02		Best joint for many preceding ones. Upper edge of wall is chipped more than half way down.
16	— 0·25		+ 0·10		— 0·08		Getting rather dark for measuring.
17	— 0·20		+ 0·22		+ 0·01		This line produced hits near upper part of butt-end of portcullis.
18	— 0·25		Sand heap interferes.		......		This line produced hits a little past, or to the south of butt-end of granite portcullis.
19	......		......		......		

NOTES ON THE ABOVE OBSERVATIONS.

The square employed was made by myself at the Pyramid for the occasion, out of some of the well-planed flat deal bars contained as packing in the 100-inch linear box. The height of upright was 41·, and length of bar, 50 inches. The base was all on one side of the upright, in the L manner ; hence, when testing any particular joint, and reversing the square upon it, the tail-piece stood on different portions of the passage floor on each occasion, which might introduce some error from want of perfect straightness of floor surface ; the shape, moreover, of the pieces of wood forming the base was such, as to prevent the upright applying quite so close to the wall in one way of using it as the other,—when the making of the observations accurately, became therefore rather more difficult.

I had hoped, on examining the square when first made up in the instrument-tomb, that it was true at the top of its upright to much less than 0·1, but by the time it had been carried up to the Pyramid, the observations show that it must have increased its error to 0·1 full, each way ; making a difference between two sets of readings, with tail-piece reversed, of 0·20, which is probably a greater error than most of the joints themselves are really affected by, —always excepting the two *quasi*-vertical joints, whatever the reason of their being so made, may have been. The large differences between the corrections for the said two joints, as measured with the square and as deduced from the linear measures, pages 16 and 19, are believed to be due to the measure of the square being taken at the top of its upright, or 41 inches from floor, while the linear measures were taken at the very top of the wall, or 47·3 inches above the same.

After making due note of those two anomalies, it will be perceived that there is a remarkably increased accuracy in the parallelism of the wall joints, as well as in their perpendicularity to the axis of the passage,—than what obtains with those of either floor, or roof; where errors, or variations exist as often to whole inches, as in the walls they do to tenths. This species of accuracy, too, is preserved throughout the whole measured length of both walls, notwithstanding that there is no effort apparent to make the blocks composing the walls either all of equal size, or to make them correspond in large and small on the two opposite sides.

ENTRANCE PASSAGE,

Relative lengths of stones in floor, walls, and roof, beginning with the highest or Northernmost.—(See Plate II.)

Floor, West side of.	West wall.				Roof.		East wall.				Floor, East side of.
	Bottom of.		Top of.				Top of.		Bottom of.		
	Whole course.		Whole course.				Whole course.		Whole course.		
	Bottom of lower course.	Top of lower course.	Bottom of upper course.	Top of upper course.	West side of.	East side of.	Top of upper course.	Bottom of upper course.	Top of lower course.	Bottom of lower course.	
54·1	...	...	...	...	...	...	...	...	...	...	54·6
48·0	...	...	...	...	...	...	...	...	...	...	47·6
58·9	42·6	42·6	42·6	42·8	38·2	38·7	82·8	83·2	40·0	40·2	58·0
55·4	55·0	55·1	58·0	58·2	40·8	40·9	...	...	68·8	68·8	55·0
65·7	82·2		50·2		42·8	43·3	70·6		70·8		68·4
59·2	59·6		65·4		66·4	66·0	66·6		63·9		58·9
66·2	42·3		52·7		30·9	30·4	42·6		33·4		66·2
52·4	35·4		35·3		39·1	39·4	54·8		54·9		51·8
62·5	55·0		55·2		35·3	35·4	58·8		58·8		59·2
53·1	45·0		45·2		35·4	35·6	36·5		36·1		53·0
36·1	35·0		35·0		61·9	61·8	67·6		68·0		38·8
39·5	77·0		77·0		36·6	36·5	53·8		53·8		40·4
51·4	42·2		41·8		36·6	37·8	58·0		58·2		50·9
51·6	59·1		59·4		36·8	36·7	44·2		44·2		52·8
36·5	26·5		26·4		55·4	55·4	60·1		60·0		36·4
48·5	34·6		34·8		55·4	53·0	32·8		32·9		48·6
40·0	40·5		40·4		54·6	54·5	62·8		62·8		40·0
24·8	29·1		29·4		55·6	58·6	40·6		40·8		24·6
35·2	60·4		60·2		34·3	35·4	42·5		42·6		35·2
63·6	49·6		49·4		59·0	60·2	39·2		39·1		57·0
46·6	29·8		30·3		46·6	46·2	43·6		44·0		36·2
21·±	41·4		40·8		40·2	38·6	......		57·0		32·±
49·±	55·±		......		48·0	...	......		......		...
...	70·±		......		...	...	......		......		...

ENTRANCE PASSAGE.

Relative positions of joints in floor, walls, and roof, as indicated by their distance from beginning of basement sheet at its North end.—(See Plate II.)

Floor, West side of.	West wall. Bottom of. Whole course.		West wall. Top of. Whole course.		Roof.		East wall. Top of. Whole course.		East wall. Bottom of. Whole course.		Floor, East side of.
	Bottom of lower course.	Top of lower course.	Bottom of upper course	Top of upper course.	West side of.	East side of.	Top of upper course.	Bottom of upper course.	Top of lower course.	Bottom of lower course.	
0·0	...	...	...	...	...	...	...	...	...	...	0·0
54·1	...	...	...	...	...	...	...	...	...	...	54·6
102·1	111·0	110·0	123·4	122·4	...	...	124·8	124·8	110·2	110·2	102·2
161·0	152·6	152·6	166·0	165·2	162·2	162·3	207·6	208·0	150·2	150·4	160·2
216·4	207·6	207·7	224·0	223·4	200·4	201·0	...	...	219·0	219·2	215·2
282·1	289·8		273·6		241·2	241·9	278·2		290·0		283·6
341·3	349·4		339·0		284·0	285·2	344·8		353·9		342·5
407·5	391·7		391·7		350·4	351·2	387·4		387·3		408·7
459·9	427·1		427·0		381·1	381·6	442·2		442·2		460·5
522·4	482·1		482·2		420·2	421·0	501·0		501·0		519·7
575·5	527·1		527·4		455·5	456·4	537·5		537·1		572·7
611·6	562·1		562·4		490·9	492·0	605·1		605·1		611·5
651·1	639·1		639·4		552·8	553·8	658·9		658·9		651·9
702·5	681·3		681·2		589·4	590·3	716·9		717·1		702·8
754·1	740·4		740·6		626·0	628·1	761·1		761·3		755·6
790·6	766·9		767·0		662·8	664·8	821·5		821·3		792·0
839·1	801·5		801·8		718·2	720·2	854·0		854·2		840·6
879·1	842·0		842·2		773·6	773·2	916·8		917·0		880·6
903·9	871·1		871·6		828·2	827·7	957·4		957·8		905·2
939·1	931·5		931·8		883·8	886·3	999·9		1000·4		940·4
1002·7	981·1		981·2		918·1	921·7	1039·1		1039·5		997·4
1049·3	1010·9		1011·5		977·1	981·9	1082·7		1083·5		1033·6
1070·±	1052·3		1052·3		1023·7	1028·1	......		1140·5		1066·±
1119·±	1107·3		......		1063·9	1066·7	......		......		...
...	1177·3		......		1111·9	...	......		......		...

ENTRANCE PASSAGE.

Relative view of errors of perpendicularity to axis of passage in the joints of floor, walls, and roof; the measures by the square being corrected for the less height of its upright, than the walls of the passage.

Floor.	West wall.				Roof.	East wall.				Notes.
	By linear measure.		By square.			By linear measure.		By square.		
	Whole course.		Whole course.			Whole course.		Whole course.		
	Lower course.	Upper course.	Lower course.	Upper course.		Upper course	Lower course.	Upper course.	Lower course.	
+ 0·5	...	...	...	...	...	...	...	...	...	Of the two methods by which the wall joints have been tested, that by the square is considered the more accurate of the two, and capable of the more accuracy; as top and bottom of the joints were compared at the same instant, and noted to ·01 of an inch; while with the other method the readings for the top of the joints were taken one day, and for the bottom perhaps on another day, and they were only read off at any time to tenths of an inch; with a certain amount always of risk as to the measuring-rod slipping on the inclined floor, whose angle is greater than that of frictional repose. Yet it was important to exhibit the results of this method against the square on the *walls*, as it is the only method that was employed to test the joints of both roof and floor.
+ 0·1	...	...	...	...	...	...	...	...	...	
− 0·8	0·0	+ 0·8	+ 0·11	− 0·06	+ 0·1	+ 0·4	+ 0·2	− 0·02	+ 0·02	
− 1·2	− 0·1	+ 0·6	− 0·01	− 0·02	+ 0·6	...	+ 0·2	...	0·00	
+ 1·5	+ 16·2		+ 16· ±		+ 0·7	+ 11·8		+ 11·3±		
+ 1·2	+ 10·4		+ 10·3±		+ 1·2	+ 9·1		+ 9· ±		
+ 1·2	0·0		− 0·10		+ 0·8	− 0·1		− 0·30		
+ 0·6	+ 0·1		− 0·02		+ 0·5	0·0		− 0·14		
− 2·7	− 0·1		+ 0·03		+ 0·8	0·0		− 0·16		
− 2·8	− 0·3		− 0·16		+ 0·9	− 0·4		− 0·24		
− 0·1	− 0·3		− 0·16		+ 1·1	0·0		− 0·14		
+ 0·8	− 0·3		− 0·11		+ 1·0	0·0		− 0·09		
+ 0·3	+ 0·1		− 0·06		+ 0·9	+ 0·2		− 0·14		
+ 1·5	− 0·2		− 0·17		+ 2·1	+ 0·2		− 0·09		
+ 1·4	− 0·1		− 0·16		+ 2·0	+ 0·1		− 0·16		
+ 1·5	− 0·3		− 0·11		+ 2·0	+ 0·2		− 0·07		
+ 1·5	− 0·2		− 0·07		− 0·4	+ 0·2		− 0·02		
+ 1·3	− 0·5		− 0·17		− 0·5	+ 0·4		− 0·09		
+ 1·3	− 0·3		− 0·02		+ 2·5	+ 0·5		+ 0·01		
− 5·3	− 0·1		0·00		+ 3·6	+ 0·4		......		
− 15·7	− 0·6		− 0·06		+ 4·8	+ 0·8		......		
− 4·±	0·0		......		+ 4·4	......		......		
...	......		......		+ 2·8	......		......		

ENTRANCE PASSAGE,

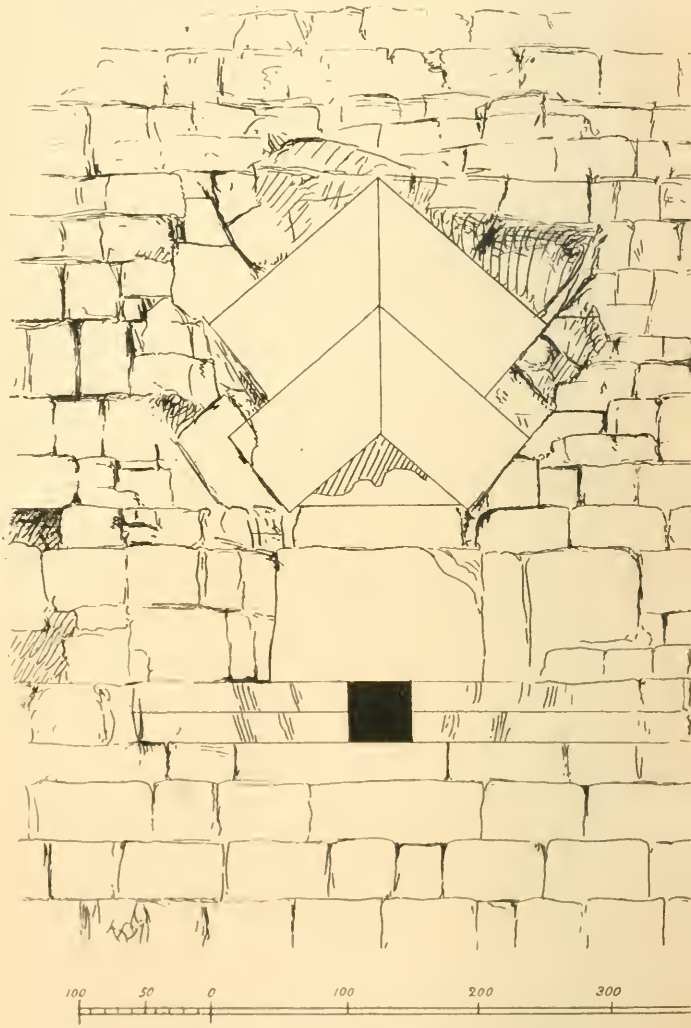
Breadth and Height of, measured with Slider 35·, and therefore corrected by—·14 to make it show British inches.

At or near floor joint, on West side.	*Breadth*, perpendicular to axis of passage. Near bottom of walls.	*Breadth*, perpendicular to axis of passage. Near top of walls.	Mean, or breadth near middle of walls.	*Height*, perpendicular to axis of passage. West side of floor.	*Height*, perpendicular to axis of passage. East side of floor.	Mean height.	Notes, February 1, 1865.
1	...	...	...	...	...	...	
2	...	...	...	...	...	...	
3	...	...	...	...	...	...	
4	41·61	41·63	41·62	47·24	47·27	47·26	The peculiar little holes of the rough decayed surface, always avoided. Passage has a *vertical* height here = 52·68.
5	...	...	...	...	...	...	
6	...	...	...	...	...	...	
7	41·51	41·41	41·46	47·23	47·30	47·26	
8	41·59	41·41	41·50	...	...	...	Supposed to be Professor Greaves' place of measure; the fifth joint might also answer his description of being 'opposite to a joint in the roof,' but there are wall joints on either side there, which would render the place inappropriate for his purpose.
9	...	...	...	...	...	...	
10	...	...	...	...	...	...	
11	41·59	41·51	41·55	47·30	47·32	47·31	Depth from roof, perpendicular to axis of passage, down to bottom of the broken holes in floor = 55·0, about.
12	...	...	...	...	...	...	
13	...	...	...	...	...	...	
14	...	...	...	...	...	...	Breadth measured purposely from hollow to hollow of the surface roughnesses on either wall = 41·91.
15	41·59	41·46	41·52	47·16	47·18	47·17	*Vertical* height of passage = 52·36; depth from roof, as before, to bottom of holes in floor, from 61· to 71· about this part.
16	...	...	...	...	...	...	
17	...	...	...	...	...	...	
18	...	...	...	...	...	...	
19	...	...	...	...	...	...	
20	...	...	...	...	...	...	
21	41·46	(chipped)	...	47·28	47·14	47·21	Top defined for height by plane of side roof joint.
	Mean of all,		41·53			47·24	

Elevation, looking South,

of North-end of Entrance passage of Great Pyra

slightly modified in perspective of lower parts.

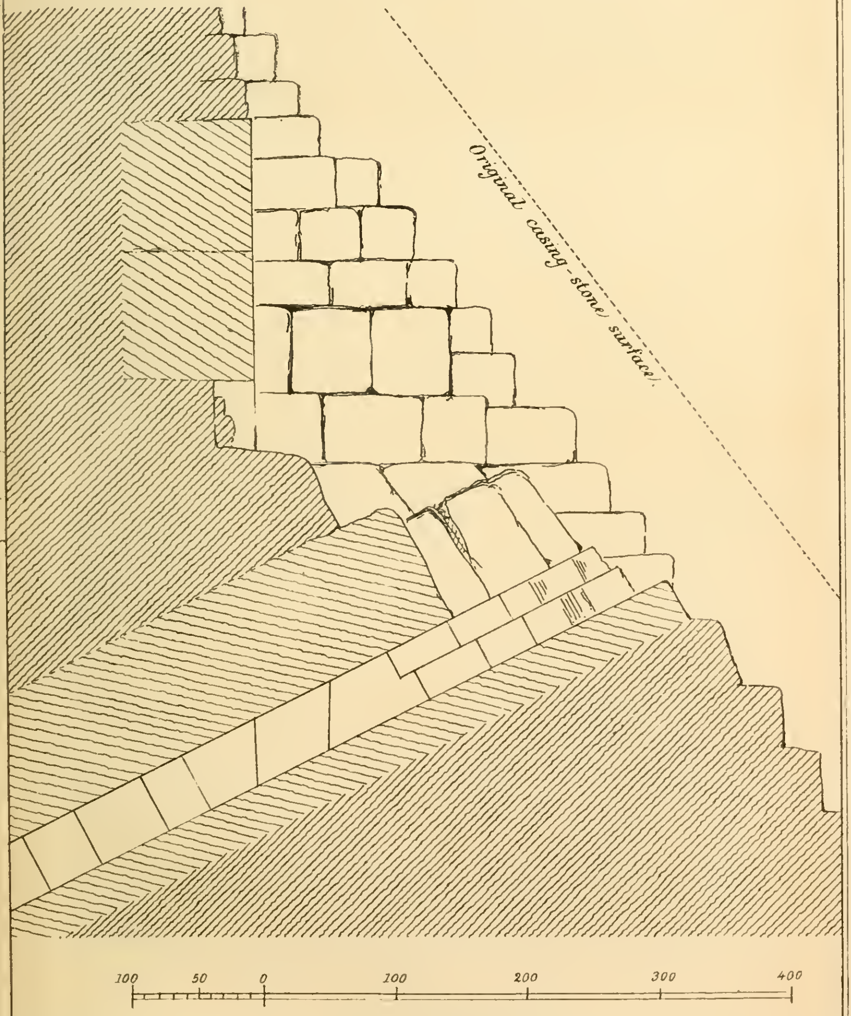


Scale of British Inches.

Vertical Section, looking West,

of North end of Entrance passage of Great Pyramid,

chiefly to show joints of West wall.



Scale of British Inches.

W. H. Mc Farlane, Lith^r Edin^r

ENTRANCE PASSAGE,

Beginning of.

The present beginning of the entrance passage is an accident of dilapidation, and mischievous destruction ; hence, the roof ends northward at one distance, the walls extend a little farther out in the same direction, and the floor a good deal farther out still ; the latter, moreover, bears evident markings on its surface, of the walls, and therefore the passage, having once extended along its whole length to its extreme upper or northern end. But that upper or northern end of the floor, at present, is probably short by more than 100· inches of the original surface of the Pyramid at that place.

There is nothing, therefore, of great theoretical importance derivable from the measured length of the whole passage, as at present ; though much may be deduced from attention to different parts : and no one with an ability to appreciate good work, can look, unmoved with admiration, at the extraordinarily truthful straight lines, and close fittings of the wall joints near and about the present entrance. This feeling, too, increases on examining further the proximate means by which permanence and solidity were given to that special masonry : for instance, though the passage itself is but 41·5 inches wide,—the flooring forming it, is close upon 400 inches wide, so that if that broad sheet, composed, too, of the hardest and whitest stone in all this part of the building, was cross-levelled only tolerably at its own sides, the error on the sides of the passage must have been, to linear measure, microscopically small. And when the truth of the floor had been thus secured, the firmness of the rest of the passage was obtained by a manner of building, best represented by drawings, as below; where the front view dispenses with the very difficult representation of the characteristic dip of the passage southward at an angle of 26·3° nearly; but the side view, or longitudinal section, supplies that deficiency.—(See Plate III.)

The measurements on which the above sketches have been founded, are, in addition to those already detailed :—

Thickness of basement sheet, . .	=	29 to 30 inches.
,, roof-stone, . . .	=	100
,, stone above roof-stone, .	=	60 at outer end.
Height of triangular hollow under arch-stones,	=	55 inches.
Length of roof sides of said hollow, . .	=	84 ,,
Height of vertical line of the two lower arch-stones, ...	=	96 ,,
Depth of hollow from outer face of arch-stones,	=	33 ,,
Projection of stone above roof-stone, horizontally, or nearly so, beyond, or north of, face of arched stones, . . .	=	46 ,,
Projection of roof-stone beyond, or north of, stone above it, ...	=	39 ,,
Breadth of floor-base, . . .	=	398 ,,
,, roof-stone, . . .	=	147 ,,
,, base of triangular hollow, .	=	128 ,,

These measures about the so-called false portal are very rough; and the sketches have been partly filled in by reference to photographs. One or more pair of arched stones formerly existed northward of the present set, as testified to by masonry below, in the form of abutments; but there is no visible indication that there are any more sets behind the present ones, going farther into the Pyramid; and, if there should be such, they go in upon a horizontal line, and therefore rapidly leave the neighbourhood of the entrance passage,—which descends, as it enters, at an angle 26·3°, nearly, below the horizon.

ENTRANCE PASSAGE,

SHAFT OF.

This was not examined farther than the heap of sand and stones fixed in it by the Arabs, at about 1200 inches from the north commencement.

This obstruction occurs just below Khaliph Al Mamoon's hole, which is to the west; the forced front entrance to said hole being from a point outside the Pyramid, about 300 (?) inches below the proper entrance, and 250 (?) inches west of it; very nearly, therefore, in the vertical central line of north face. On windy days a certain amount of ventilation goes on, between this forced passage and the entrance passage,—the incline of the latter giving it a certain amount of chimney power,—and their point of connexion being, where the bulbous inner end of the forced passage, or the Khaliph's hole, breaks into the western side of entrance passage. Shortly below that point, it is believed that the masonry of the entrance passage ceases, all the lower part being excavated in the live rock of the hill.

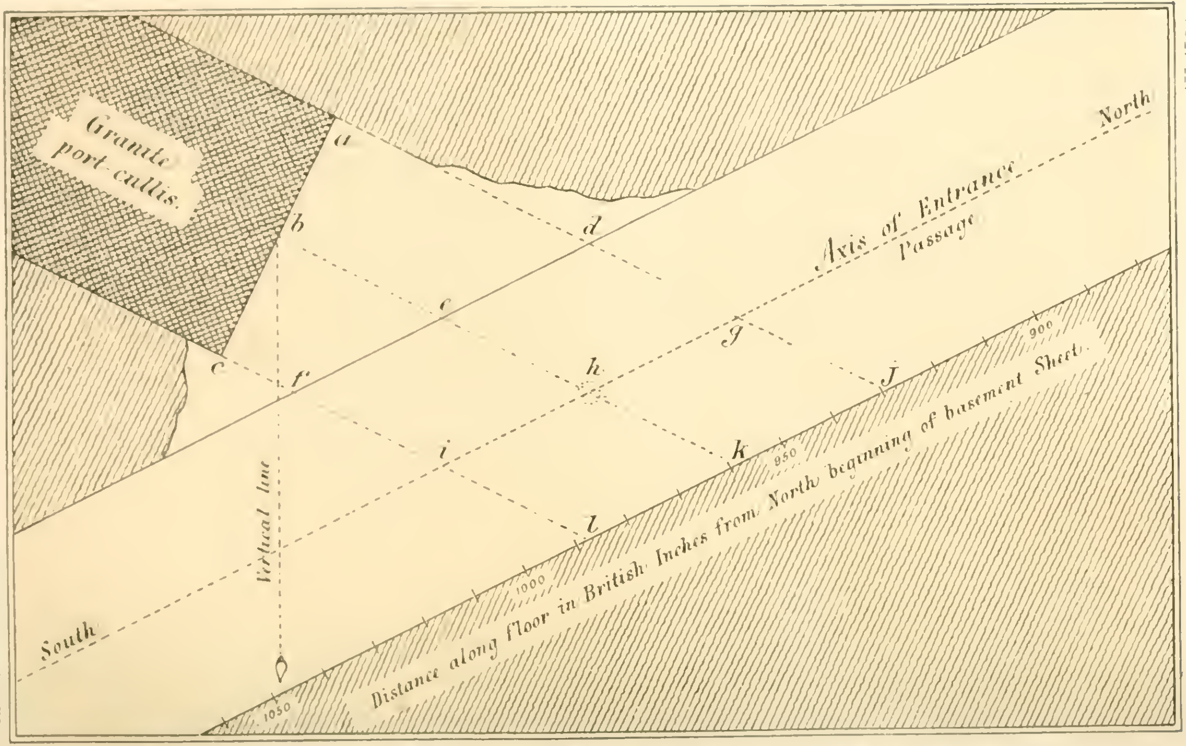
The lower butt-end of granite portcullis of first ascending passage, as it appears in roof of entrance passage, is most noteworthy. It is visible now by a stone having fallen out of the roof at that part; the 'triangular stone' of Pyramid historians.

The shape of this stone, judging by the hole it has left, was underneath, or in plane of roof, about 100 inches long, and 41·5 inches broad, and rectangular; but in side elevation it must have been triangular, having the northern side about 60 in. long,
and the southern, ... 70 „
with the base, as before, about . . 100 „

The position of said granite portcullis or block, with regard to entrance passage, is also important, and requires more accurate measures.

If the position of its butt-end be demanded as referred to the floor of entrance passage, by lines transverse to the axis of that, then—

On Western side—		
Northern edge of butt-end of granite portcullis, from beginning of basement sheet, . .	=	992·9
Southern edge, do., do., ...	=	1031·5
Mean,	=	1012·2
On Eastern side—		
Northern edge, do., do., ...	=	995·4
Southern edge, do., do., ...	=	1033·3
Mean,	=	1014·4
Mean of both, or centre of portcullis's lower butt-end, distant by transverse line to axis of entrance passage, from beginning of floor of same, ...	=	1013·3



Vertical section (from North to South) shewing Junction of Entrance Passage and First Ascending Passage, looking West.

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But if the distance on floor at which the axial line of the portcullis block, or, which is the same thing, of the first ascending passage, if produced, will strike,—be demanded, the distance will be very much less; viz.:—

For the mean, ...	=	958·0
And distance at which said axial line strikes *axis* of entrance passage, measured transversely on floor, .	=	975·5
And distance at which roof of entrance passage is similarly struck, ...	=	993·3

These quantities were obtained for the means, by small special calculations of the following measures; but where the roughness of many of the broken surfaces prevented accuracy, and where a constant difference was found between the measures east and measures west.—(See Plate IV.)

The letters refer to the diagram following.

MEASURES CONNECTING PORTCULLIS BLOCK WITH ENTRANCE PASSAGE.

		Measures West.	Measures East.
a d, . . .	=	50·3	50·2
b e, . . .	=	32·8	32·3
c f, . . .	=	14·1	14·2
d g, . . .	=	29·8	29·7
e h, . . .	=	30·0	29·5
f i, . . .	=	30·0	29·8
g j, . . .	=	29·8	29·7
h k, . . .	=	28·7	28·9
i l, . . .	=	30·0	29·8

DISTANCES OF CERTAIN POINTS FROM BASEMENT BEGINNING.

		Measures West.	Measures East.
j, ...	=	927·3	928·2
k, first method, .	=	957·9	959·4
k, second ,, .	=	956·4	957·7
l, ...	=	985·6	987·2
h, first method, .	=	974·6	976·4
h, second ,, .	=	974·9	976·2
d, ...	=	963·0	964·8
e, ...	=	992·6	993·9
f, ...	=	1022·2	1023·0

SIZE OF LOWER END SURFACE OF PORTCULLIS BLOCK.

Breadth from east to west, across upper or north edge, ...	= 38·35 — ·15 = 38·20
Do. do. middle, . .	= 38·30 — ·15 = 38·15
Do. do. across lower or south edge, ...	= 38·22 — ·15 = 38·07
Mean,	38·14

Height or length on eastern side, February 9,	= 46·8 — ·20 = 46·6
,, ,, ,, 11,	= 47·1 — ·20 = 46·9
,, western side, ,, 9,	= 46·8 — ·20 = 46·6
,, ,, ,, 11,	= 47·0 — ·20 = 46·8
Mean,	46·72

Diagonal, east top to west bottom, .	= 59·8
,, west top to east bottom, .	= 59·6

The longitudinal surfaces of portcullis extending southwards and upwards from the above butt-end surface,—are partly visible on all four sides; and indicate, that the so-called granite portcullis is not a large sheet of granite sliding transversely to the axis of passage, but is in form like a cork or stopper, rammed in along the axis, from above, and filling up all the bore of the passage.

The breadths and heights of butt-end being measured with the scale 'Adie 25,' have been corrected accordingly. They still show a small excess of length over the diagonals, measured with '50 A,' but that may be due to my having been misled by the rounding of the corners of the granite block. All the other and larger linear measures were taken with rod '100 A,' considered not to require any correction for such purposes as those which are here being inquired into.

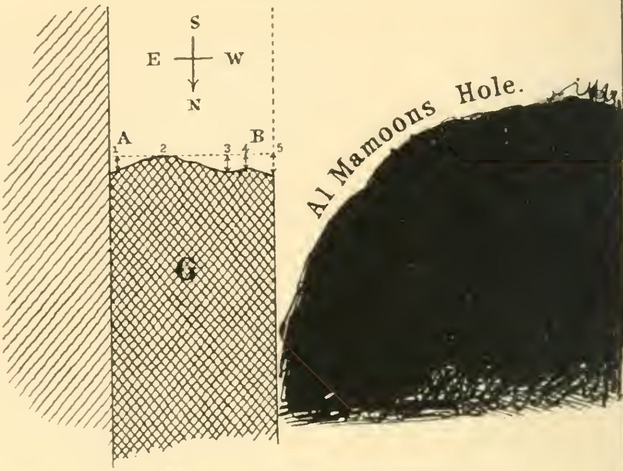
FIRST ASCENDING PASSAGE.

FEBRUARY 13-17, 1865.

COMMENCEMENT OF MEASURES FOR LENGTH AT ITS PRESENT PRACTICAL LOWER END, OR JUST ABOVE THE UPPER END OF GRANITE PORTCULLIS.

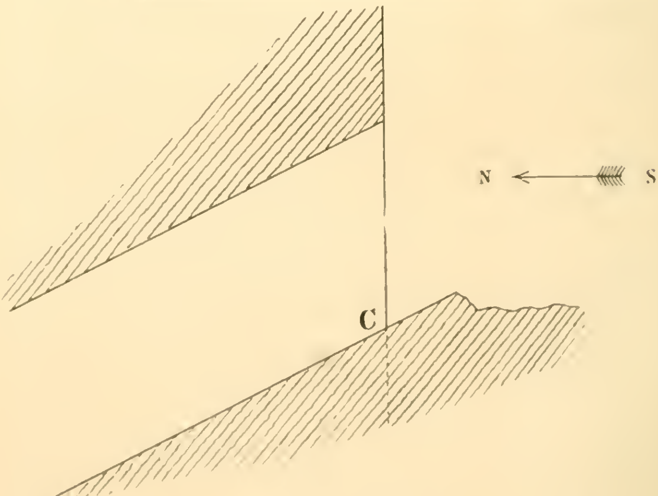
THE floor of this passage is, if traced underneath its walls, much broader than passage itself; as is most easily to be seen on western side, where several feet in length, from portcullis upwards, of western wall have been broken away to admit of entrance into the passage by any one climbing upwards from Al Mamoon's hole: the original position of the removed wall is, however, still to be traced on the floor surface, and is conformable to the passage itself above or south, and to the breadth of the granite portcullis below, or north of, that place. (Plate v.)

The upper, or southern, face of the granite portcullis is very broken and uneven; it is, in fact, altogether a surface of fracture, and not the original end of the portcullis, which may have extended much farther upwards and southwards; while certain large fragments of granite, occasionally with parts of worked surfaces, still to be seen at the bottom of



Plan on Floor-plane of lower or North end
of 1st Ascending Passage,
G = Granite portcullis.

0 10 20 30 40 50 60 70 80 90 100 *Scale of British Inches.*



Vertical longitudinal section of upper or South end
of 1st Ascending Passage,
looking East.

0 10 20 30 40 50 60 70 8 90 100 *Scale of British Inches.*

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Al Mamoon's hole just underneath,—may have been derived from some former breaking up of the southern end of portcullis.

The base of the present upper or southern end of portcullis terminates in the uneven manner represented in the sketch (Plate v.); where the corrections required to reduce actual surface to a straight line A B, drawn at right angles to axis of passage, and touching the most prominent part of the portcullis block, are, at the places marked

1	=	1·3 inch.
2	=	0·0 ,,
3	=	1·8 ,,
4	=	2·0 ,,
and 5	=	3·3 ,,

This line A B will be the reference for linear measures at the lower or northern end of first ascending passage.

TERMINATION OF MEASURES FOR LENGTH AT UPPER OR SOUTHERN END OF FIRST ASCENDING PASSAGE.

At upper or southern end, first ascending passage enters the Grand Gallery, *i.e.*, the *second* ascending passage,—by passing through a vertical wall which makes north end of said Gallery. Roof and walls of first ascending passage terminate flush with said north wall of Gallery, but the floor passes in, and extends into Gallery to a distance of from twenty to twenty-three inches, preserving its steep ascending angle; so that a vertical section of upper end of first ascending passage, appears thus, when looking east.—(See Plate v.)

The floor of first ascending passage is, however, marked by a joint in continuation of vertical plane forming roof and walls, say at c, which will therefore be made the upper reference line for linear measures of the length of this passage.

SHAFT OF THE FIRST ASCENDING PASSAGE.

The stone of which the *floor* of this passage has been composed, is excessively hard, and has acquired, under friction of feet, a species of half-marble, half-flinty sort of polished surface; on which, a screw-driver would not make any visible line, when tried, to mark the end of the measuring-rod,—obliging a black-lead pencil to be used for that purpose. There are abundant cross notches cut in the floor, to keep feet from slipping; but the joints themselves are not very good, as a rule; though occasionally there were some so excessively close and fine through parts of their course, as to be quite invisible on either their western or eastern sides, as will be perceived in the columns of measures.

The *walls* and *roof* of the passage are composed of a very much softer stone, as Professor Greaves remarked in his day; and they are decayed and exfoliated away to a lamentable degree, chiefly towards the lower end, so as quite to give all that part of the passage a rounded and cavernous character, which was not clearly mentioned by Professor Greaves, and is serious if it has occurred since his visit. Towards the upper end of the passage, the original surfaces of roof and walls begin to appear again ; but a considerable portion of the roof is cracked longitudinally along the middle.

The walls show sometimes vertical, and sometimes perpendicular-to-passage, joints, and these are now and then confusedly interfered with by parts of horizontal courses of masonry. Altogether, there is smaller and less perfect masonry employed in the first ascending passage than in the entrance passage ; giving the practical impression of the former being a mere necessary mean of communicating between the entrance passage and Grand Gallery, and having little or no symbolic importance in itself.

The measures were more troublesome than in entrance passage ; for there, daylight generally served ; but here, in first ascending passage, there is not a particle of daylight ; candles had to be employed, and as they will not stand, but slip, and slide right away on the steep floor,—small angular brackets were fitted to the measuring-rod ; so that when that was duly held fast by an attendant Arab, the candles and their illumination were preserved about us.

FIRST ASCENDING PASSAGE,

Floor of, on *West* Side; Measures for Length.

Numbers of joints from line A B at lower end.	Measures from joint to joint. Feb. 13.	Whole distance from line A B.	Measured by lengths of rod 100 A.	Notes on Characters of Joints, etc.
Line A B	0·0	0·0	...	
1	49·1	49·1	...	Bad joint.
2	42·2	91·3	...	
3	38·5	129·8	...	Very bad.
4	36·8	166·6	...	
5	37·0	203·6	...	Very bad, passage cavernous.
6	51·0	254·6	...	Bad.
7	55·0	309·6	...	Bad.
8	50·0	359·6	...	Passage very cavernous.
9	41·5	401·1	...	
10	62·0	463·1	...	
11	32·8	495·9	...	
12	49·4	545·3	...	
13	56·4	601·7	...	All the joints in this passage very difficult to identify and measure.
14	29·3	631·0	...	
15	38·0	669·0	...	
16	32·8	701·8	...	
17	52·2	754·0	...	
18	37·0	791·0	...	
19	36·5	827·5	...	Extremely close.
20	50·0	877·5	...	Extremely close.
21	30·2	907·7	...	
22	41·5	949·2	...	Extremely close.
23	...	...	...	No joint perceivable on this side; see east side.
24	86·2	1035·4	...	
25	48·3	1083·7	...	Bad.
26	30·8	1114·5	...	
27	...	...	...	No joint perceivable on this side; nor east side.
28	119·0	1233·5	...	Good.
29	57·5	1291·0	1291·2	This measure really taken on the *east* side.

FIRST ASCENDING PASSAGE,

Floor of, on *East* side ; Measures for Length.

Numbers of joints from line A B at lower end.	Measures from joint to joint. Feb. 16.	Whole distance from line A B.	Measured by lengths of 100 inch rod, A.	Notes on Characters of Joints, etc.
Line A B	0·0	0·0	...	On a second examination, a joint was noticed at 5·5.
1	45·2	45·2	...	
2	36·4	81·6	...	
3	40·9	122·5	...	Very bad joint.
4	...	...	...	No joint perceivable on this side ; see west side.
5	74·0	196·5	...	Bad ; passage cavernous.
6	50·0	246·5	...	Bad.
7	53·3	299·8	...	Bad.
8	49·7	349·5	...	Bad.
9	50·0	399·5	...	Floor uneven and hollow to a degree.
10	62·5	462·0	...	
11	32·3	494·3	...	
12	50·2	544·5	...	
13	55·3	599·8	...	
14	...	...	...	No joint perceivable on this side ; see west side. All these measures made by candlelight, as otherwise the passage is perfectly dark.
15	67·7	667·5	...	
16	33·0	700·5	...	
17	53·1	753·6	...	Good.
18	34·7	788·3	...	
19	37·4	825·7	...	
20	49·0	874·7	...	
21	31·7	906·4	...	
22	41·0	947·4	...	
23	53·0	1000·4	...	
24	33·5	1033·9	...	
25	48·8	1082·7	...	
26	30·7	1113·4	...	
27	58·5	1171·9	...	All the joints in this passage very difficult to identify and measure.
28	61·3	1233·2	...	
Line C = 29	57·8	1291·0	1291·4	

FIRST ASCENDING PASSAGE.

Floor of.

West and *East* sides compared.

Numbers of joints from line A B, at lower or Northern end.	Sizes of the stones.		Whole distances from line A B.		Error of rectangularity.	Notes.
	On West side of floor.	On East side of floor.	On West side.	On East side.		
Line A B	0·0	0·0	0·0	0·0	...	
1	49·1	45·2	49·1	45·2	+ 3·9	
2	42·2	36·4	91·3	81·6	+ 9·7	
3	38·5	40·9	129·8	122·5	+ 7·3	
4	36·8	...	166·6	...	...	Joint so close as to be invisible on East side.
5	37·0	74·0	203·6	196·5	+ 7·1	
6	51·0	50·0	254·6	246·5	+ 8·1	
7	55·0	53·3	309·6	299·8	+ 9·8	
8	50·0	49·7	359·6	349·5	+10·1	
9	41·5	50·0	401·1	399·5	+ 1·6	
10	62·0	62·5	463·1	462·0	+ 1·1	
11	32·8	32·3	495·9	494·3	+ 1·6	
12	49·4	50·2	545·3	544·5	+ 0·8	
13	56·4	55·3	601·7	599·8	+ 1·9	
14	29·3	...	631·0	...	...	Joint invisible on East side.
15	38·0	67·7	669·0	667·5	+ 1·5	
16	32·8	33·0	701·8	700·5	+ 1·3	
17	52·2	53·1	754·0	753·6	+ 0·4	
18	37·0	34·7	791·0	788·3	+ 2·7	
19	36·5	37·4	827·5	825·7	+ 1·8	
20	50·0	49·0	877·5	874·7	+ 2·8	
21	30·2	31·7	907·7	906·4	+ 1·3	
22	41·5	41·0	949·2	947·4	+ 1·8	
23	...	53·0	...	1000·4	...	Joint invisible on West side.
24	86·2	33·5	1035·4	1033·9	+ 1·5	
25	48·3	48·8	1083·7	1082·7	+ 1·0	
26	30·8	30·7	1114·5	1113·4	+ 1·1	
27	...	58·5	...	1171·9	...	Joint invisible on West side.
28	119·0	61·3	1233·5	1233·2	+ 0·3	
29	57·5	57·8	1291·0	1291·0	0·0	

FIRST ASCENDING PASSAGE,

BREADTH AND HEIGHT OF.

Observed with Slider 35, and therefore corrected by — 0·1.

At or near joints on floor, numbered from line A B upwards and southwards to line C.	Breadth.	Height perpendicular to axis of passage.	Notes, February 13, and February 16, 1865.
Line A B	41·6	47·3	These measures are rather of the portcullis block, close-fitting into the original passage at this point: and showing what that must have been.
Between line A B and joint 1	41·4	47·5	By old markings on floor and walls.
2	...	...	
3	...	50· ?	These excessive breadths and heights are caused by the extraordinary cavernous exfoliations of the stone; which have enlarged all the lower end and much of the middle of the passage, above its original size.
4	55· ?	53· ?	
5	60· ?	56· ?	
6	61· ?	59· ?	
7	60· ?	55· ?	
8	...	...	
9	58· ?	56· ?	
10	...	...	
11	55· ?	55· ?	
12	...	...	
13	...	...	
14	...	...	
15	...	...	
16	...	...	
17	...	...	
18	...	...	
19	...	...	
20	...	...	
21	...	...	Hereabouts the original surfaces of roof and walls begin to reappear; and with them the true measures; but roughly only by reason of cracks, and holes, and wear.
22	...	...	
23	...	...	
24	...	...	
25	...	47·7	Vertical height = 53·0 ±.
26	...	...	
27	...	47·7	All sorts of larger heights and breadths are possible by measuring in holes in the surfaces caused by wear and tear, but these have been carefully avoided.
28	42·2	47·5	
29	42·1	47·5	

PORTCULLIS.

This is composed of a series of blocks of red granite of shape of the passage, viz., 47·3 high (transverse to axis of passage), and 41·6 broad, and have been pushed down the passage from above; the lowest block being made with a 'taper,' and the lowest part of the passage similarly, to prevent the blocks going right through and into the entrance passage below. This tapered shape is proved by comparing the above measures for height and breadth of the top or south end of the portcullis with the similar measures for the lower end, see page 42 of entrance passage linear measures, viz.:—

Lower butt-end of portcullis, height (transverse to its passage)	=46·7
Do. do. breadth, ...	=38·1

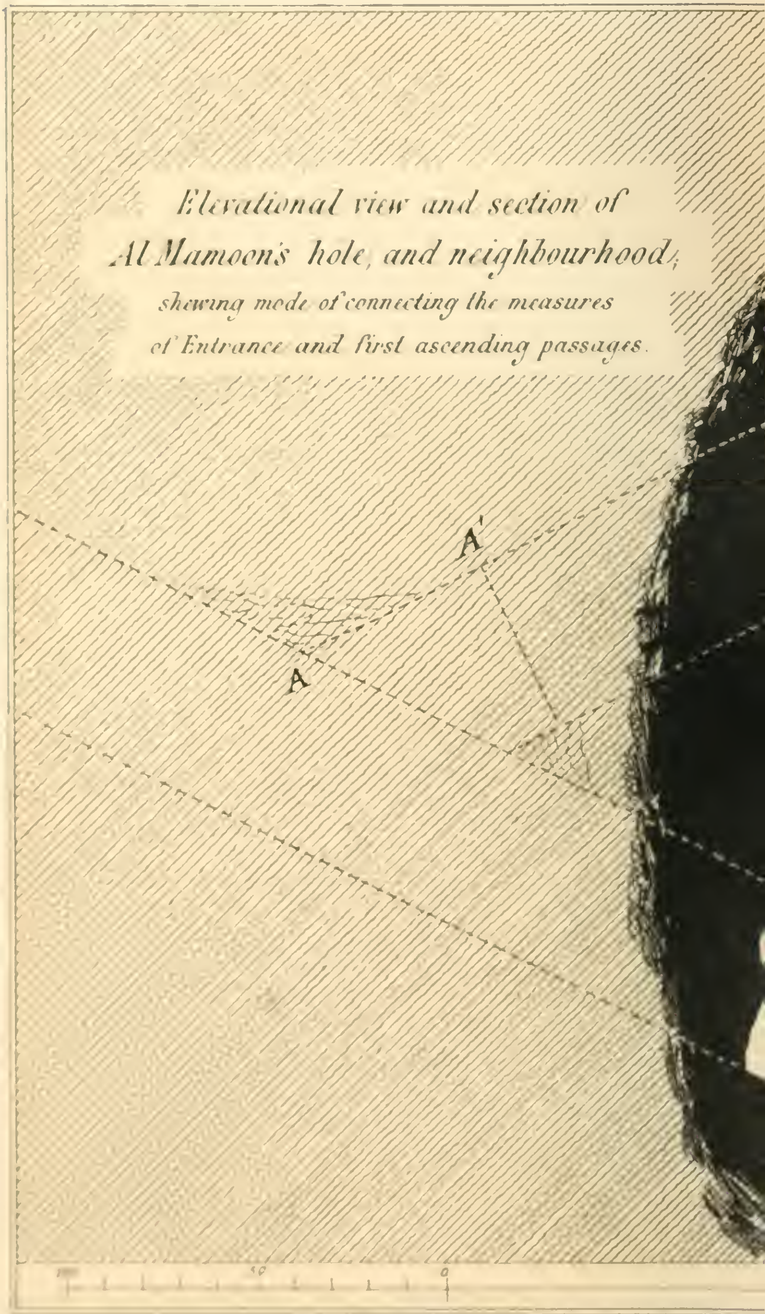
The length of the portcullis from lower butt-end up to the line A B, marking its upper or southern end on the floor = 178·8. See next section.

TOTAL LENGTH OF FIRST ASCENDING PASSAGE.

This may be considered as made up thus,—

1st, Shaft, or from line A B to line C, . .	= 1291·2
2d, Portcullis; or from line A B to lower butt-end,	= 178·8
and 3d, From middle of lower butt-end to axis of entrance passage in *h* (p. 41 and Plate IV.),	= 62·5
See also Plate VI.	1532·5

Of these three quantities, the second has not yet been proved; and it was so very difficult and roundabout to measure, that I do not attach much


Elevational view and section of
Al Mamoon's hole, and neighbourhood;
shewing mode of connecting the measures
of Entrance and first ascending passages.
A'
A

W. H. Mc Farlane, Lith. Edin.

value to the numbers; but, such as they are, they were obtained as follows.

Standing in Al Mamoon's hole, towards its western side, you can see, looking eastward, a part of the upper or southern end of the portcullis; and also part of the entrance passage vertically under it; but you cannot drop a plumb-line from one to the other, for there is much projecting masonry between: neither can you see the whole length of portcullis, for the lower part thereof is buried still in solid surrounding masonry: and this state of things is shown in our large Plate VI., in elevation; and partly in plan, in the upper figure of Plate V.

The difficulty of the plumb-line was overcome, by making use of two,—one hung upon the portcullis itself, and the other from the end of a square, whose base was on the portcullis surface, and whose rectangular arm was so long, horizontally, as to carry the plumb-line clear of the obstructing matter below. It was then tolerably easy to bring the eye into the plane of the two plumb-lines, and see where that, being produced optically, would cut on the roof line of the entrance passage below, or at the point C.

Now, that point C, was measurable by rods from the point A, or at where the roof surface of the upper passage met the roof of the lower one; and such length A C, must be geometrically equal to A B, the angles of the passages being assumed equal and opposite. But A B being thus obtained, and found = 180·5; we must evidently, in order to get the portcullis itself, subtract A A′ = 50·2, or the distance of top of lower butt-end of portcullis from roof of entrance passage; and we must add on thereto at the other end, the length B B′, = 48·5, so as to reach on roof, a line transversely opposite that other line (A B) on the floor, of first ascending passage, which formed the origin there for measures of length.

We have then, finally, for the length of the portcullis, or A′ B′, 180·5 − 50·2 + 48·5 = 178·8.

Hence the length of first ascending passage, on its *floor*, from back of portcullis to line C (page 46) at top or south end of said passage,

$$= 1291{\cdot}2 + 178{\cdot}8 = 1470{\cdot}0,$$

but from roof of entrance passage (see page 41),

$$= 1291{\cdot}2 + 178{\cdot}8 + 14{\cdot}2 = 1484{\cdot}2,$$

and from axis of entrance passage (see page 41),

$$= 1291{\cdot}2 + 178{\cdot}8 + 14{\cdot}2 + 29{\cdot}9 = 1514{\cdot}1.$$

While from axis of entrance passage, as cut by *axis-line* of upper passage (see page 41 and Plate IV.),

$$= 1291{\cdot}2 + 178{\cdot}8 + 32{\cdot}6 + 29{\cdot}8 = 1532{\cdot}4.$$

But, if *axis* of passage be thus adopted, there must be a further addition at the upper end; for a line produced upwards from the old line C (there on the floor), and perpendicularly to arm of passage, —will fall inwards or north of the doorway there; and by a quantity of about 12 inches, making thus, for full *axial length* of first ascending passage, from axis of entrance passage, to middle of doorway at south end of said first ascending passage,

$$= 1291{\cdot}2 + 178{\cdot}8 + 32{\cdot}6 + 29{\cdot}8 + 12{\cdot}0 = 1544{\cdot}4 \text{ inches.}$$

HORIZONTAL PASSAGE TO QUEEN'S CHAMBER.

This horizontal passage may be considered to begin at the north wall of the Grand Gallery; and, trending thence due south, has its first portion coincident with, or hidden in, said large Gallery; it then passes under the elevated floor of that Gallery, and, continuing on still horizontal (approximately) and southward, reaches the room called the Queen's chamber, entering it on its floor-level, and at the eastern side of its northern wall. But, in order that such coincidence of floors may take place at the entrance, the floor of the passage experiences a notable depression of nearly half the whole height of the passage, at about 1-7th of its whole length from the southern end. It is also to be noted, that the horizontal passage only begins *visibly* to be a passage, and of about the height and breadth of the 'entrance passage,' when it passes under floor of Grand Gallery; and this place occurs also at about 1-7th of the whole length, but from the north end, reference being had to the mean of the *two* northern ends or cut-offs of the Grand Gallery floor.

Further, it is particularly noteworthy, that in going from north to south in the horizontal passage, saline incrustations are observable on walls and floor, beginning at about 150 to 200 of distance from north end, and increasing in amount farther southward; until at last both roof, walls, and floor are covered with a coating of them near an inch thick, brown outside, white inside, and of almost stony hardness, and they are termed by some authors, 'sparry excrescences.'

These saline incrustations are alluded to elsewhere in this volume, as well as in vols. i. and iii., for their chemical nature, mode of formation, and probable origin; here, they are merely mentioned as being impediments to applying linear measures direct to the original worked surface of the stone.

For the shape of this passage, near its commencement at north end, see Plate x.; also Plate vi. vol. i.; and for southern end, see Plate viii. For the whole passage, on a very small scale, see Plate iii. vol. i.

HORIZONTAL PASSAGE TO QUEEN'S CHAMBER,—WALLS OF.

Floor Joints on *East* side, measured from North to South.

Number of joint.	Length from joint to joint.	Total length from North wall of Grand Gallery.	Notes, February 18, 1865.
North wall of Grand Gallery	0·0	0·0	
1	27·3	27·3	This joint about 4·5 in front, or to south of the cut-off of inclined floor of first ascending passage.
2	40·4	67·7	Bad joint.
3	45·0	112·7	Concluded from west side; east side being covered by hardened dirt.
4	58·2	170·9	Bad joint.
5	43·4	214·3	This is under roof; roof having begun at 199·4, where is the last or total cut-off of Grand Gallery floor.
6	16·9	231·2	At 236·0, is the first or southernmost, but only partial cut-off of Grand Gallery floor.
7	39·3	270·5	Wall joints at and beyond this part are all close, good, and true; vertical and horizontal, for they are in two layers or courses.
8	40·0	310·5	
9	44·1	354·6	From about 200· to this distance, and thence right on into the Queen's chamber, walls and roof are all composed of a species of limestone, hard, but having a species of saline incrustation on its surface, in sheets hard and brownish on the surface.
10	36·7	391·3	
11	18·4	409·7	
12	29·3	439·0	
13	31·5	470·5	
14	62·2	532·7	
15	44·2	576·9	
16	43·8	620·7	All these floor joints are more or less wide and bad; the stones, too, are small, and so narrow as to require two, sometimes three, to cross the passage
17	42·0	662·7	
18	48·0	710·7	
19	33·3	744·0	At 765 in centre of floor a cylindrical hole, 8·0 in diameter, and 3·0 deep.
20	39·7	783·7	Hereabouts begins a better floor, in large blocks all across.
21	83·8	867·5	
22	80·4	947·9	At 945·3 a hole in centre of floor, 4·0 diameter, and 4·5 deep.
23	79·3	1027·2	
24	68·3	1095·5	Wide joint.
25	79·0	1174·5	At 1122·5 a hole in middle of floor, 3·0 diameter, and filled with dirt.
26	49·4	1223·9	Stone broken longitudinally.
27	79·4	1303·3	At 1288·0 a hole in middle of floor, 2·5 diameter, and chipped about edges.
28	42·0	1345·3	At and from 1303·3 begins the lower level of passage floor.
29	50·0	1395·3	Wall joints hid by the excessive amount of hard, brown, stone-like, yet saline incrustation.
30	127·3	1522·6	This joint is 3·2 inches *inside* the Queen's chamber.
		— 3·2	
		1519·4	

The above measures for length being the mean of two sets, nowhere differing more than 0·3, and having been further tested for the whole length by a third measuring carried on by rod lengths of 100 inches, may be pretty safely depended on.

Hence whole length of horizontal passage, from north wall of Grand Gallery to north wall of Queen's chamber, ...	=	1519·4
One-seventh of the above, ...	=	217·1
South length of passage with low level, . .	=	216·1
North length without roof, measuring to *mean place* of the two cuts-off in Grand Gallery floor, .	=	217·8

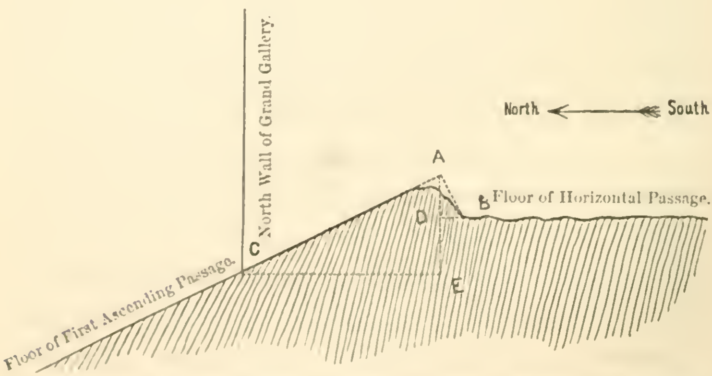
BREADTH AND HEIGHT OF HORIZONTAL PASSAGE.

These measures, when below 50 inches, were taken with the '35 Slider' scale, and have had 0·14 subtracted from them for its correction; but when above that width, with the '50 Slider,' in which case the readings have not been corrected. Both roof, sides, and floor of this passage were so uniformly coated with more or less of the saline incrustation, that the measures are probably always less than the original truth by the thickness of such adventitious crust.

Place in passage, by distance from North wall of Grand Gallery.	Breadth, near the			Height, vertical, and also in this case perpendicular to axis of passage.			Notes, February 20.
	Bottom.	Middle.	Top.	East side.	Middle.	West side.	
220·	40·61	40·84	41·16	46·58	...	46·64	
760·	...	40·96	...	46·16	...	46·16	
1270·	41·06	...	41·16	46·36	...	46·26	
1310·	...	41·36	...	69·0	...	68·5	Lower level of floor here; stones much broken and badly placed over an excavated hole.
1516·	...	41·46	...	67·3	67·2	66·5	Roof stone is cracked over the entrance into Queen's chamber.

The original height of northern portion of above passage was not improbably 47·0 at least; the difference between 47·0 and the numbers above being due to the saline incrustations. But that height is what is measured off the floor of the passage; and that floor, although the saline matter were to be removed, is rough to a degree, and has even been assumed by Mr. Perring to be the casual surface of the mere course of core masonry of the whole Pyramid, which is nakedly exposed both here and in the floor of the Queen's chamber; and he alludes to the round holes (p. 57), as pivot-holes of the machines used in lifting the stones at the building. The present apparent floor is therefore not in a manner an *intended* feature; it was never worked true as a floor; and even if masons were to cut it down now to the depth of six inches all along (a quantity by which it is in a manner too high, as presently to be shown) and polish it, the material would not be the finer and more precious Mokattam stone, which forms the floor of all the other passages. The bringing in, indeed, of layers of that species of stone to the thickness seen in some other parts, would nearly fill this horizontal passage up to its roof or ceiling, in fact, destroy it as a passage ; and yet there is every appearance of roof, and walls perhaps also, being constructed in the fine stone, intended to be durable and be seen, or made some use of.

The floor is therefore eminently an anomaly in the horizontal passage ; and if measured at its commencement, is shown to be six inches above the level of the line C, formerly referred to in measurements, on the floor of the first ascending passage ; *i.e.*, that part of its floor which is in the plane of the north wall of the Grand Gallery.



Connexion of Floors of First Ascending, and the Horizontal, Passages.

The measurements were not very accurate, on account of the broken state of the upper corner of the protruding portion of ascending floor; but, slightly assisting the present forms, as shown by the dotted lines in the above diagram, the following measures were taken:—

A C, or inclined length, ...	=	23·2
A B, ...	=	4·7(?)
C E, or horizontal length, ...	=	21·5
D E, or vertical height of floor of horizontal passage above C on floor of first ascending passage, .	=	6·0

If this 6·0 be now added to vertical height of horizontal passage, formerly given, or 47·0, we have 53·0, or the same as the *vertical* measured height of south end of first ascending passage; and both top and bottom of horizontal passage will *then* be on the same levels as top and bottom of the other passage, or, which is the same thing, as the north doorway of Grand Gallery.

But southern, or depressed, end of floor of horizontal passage, together with the whole floor of Queen's chamber, is still 14·0 *below* the bottom of said north doorway of Grand Gallery.

QUEEN'S CHAMBER.

The chamber known under this name, at the south end of the horizontal passage, has been long, and entirely, an enigma as to its objects or purposes: it is nearly square on the floor, with an angular roof; and the eastern wall has a large and sumptuously-constructed niche, of the Grand-Gallery walls description, but with a less number of overlappings (four only in place of seven), and it is not in the centre of its wall by a very notable distance. The material of walls, roof, and niche, is a fine white limestone; the floor is ragged and uneven, and apparently merely the general masonry of the Pyramid, so that the room is in fact without a floor-proper, and we are left to speculate where, in height, the upper surface of that would have reached. This peculiar condition of the chamber becomes all the more manifest on examining the structure of the walls; for they are not only not of the general masonry of the whole building, but are in advance both as to whiteness, beauty of the material, and closeness of the joints to the lining of any of the passages yet inspected. The joints are so close, that the edges of the two surfaces of worked stone, and the filling of cement between, are comprisable often within the thickness of a hair. This fact was noted chiefly on the west wall, where, too, the presence of cement in the vertical as well as horizontal joints was duly noted. Elsewhere there is a difficulty in recognising the joints, on account of the half-glazy coating of saline matter. This substance must be regarded as a modern exudation of the stone, for some letters scratched on the north wall, with date 1824, have now a raised outline in the salty matter around and upon them. The saline matter was also seen filling a fissure apparently formed by injurious pressure in the west wall. In one or two places small portions of the original surface of the wall-stones appeared, and bore traces of having been once exquisitely smoothed and finished. The inclined roof-stones appear of a similar order, and extend 100 inches, more or less, into the wall or substance of the Pyramid, to give a firm bearing, as shown by two holes, just under the ceiling, worked by Colonel Howard Vyse and Mr. Perring. A large excavation hole has been made in the floor under the niche, and another at the back of it, by various parties, in former years; while on the south side of the room is a trifling nick recently cut into the wall, apparently for holding visitors' candles.

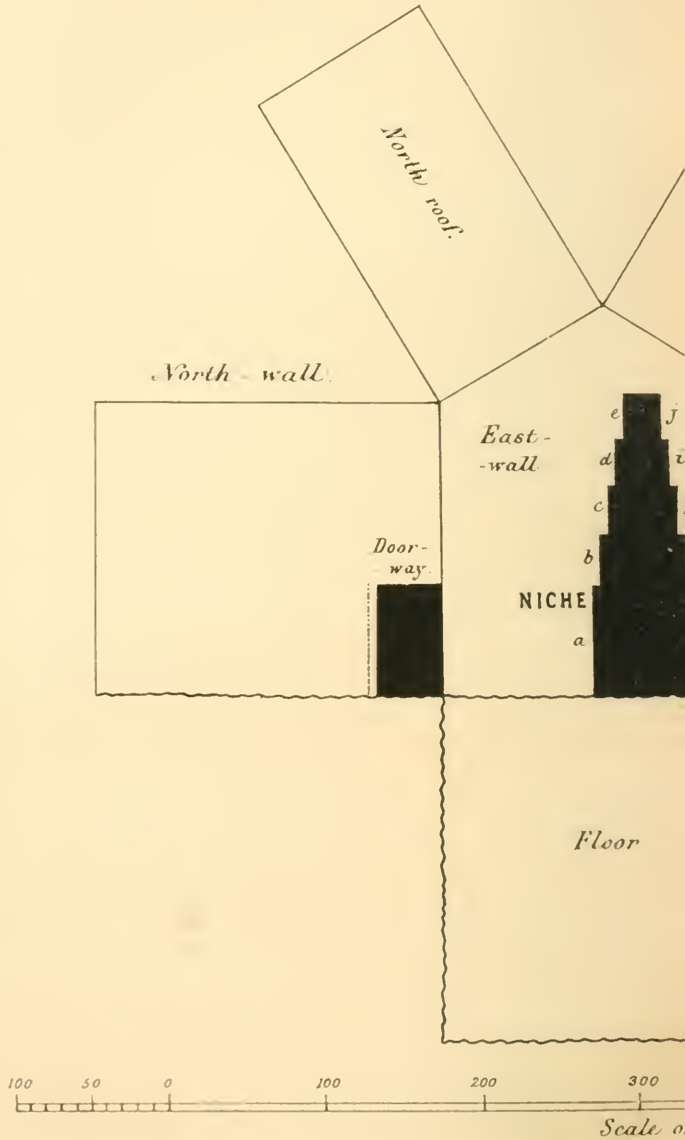
The following are the measures taken in this room, partly with the 100-inch rod, and partly with the great 400-inch slider, tested by the others, and not requiring greater corrections than theirs.

QUEEN'S CHAMBER,

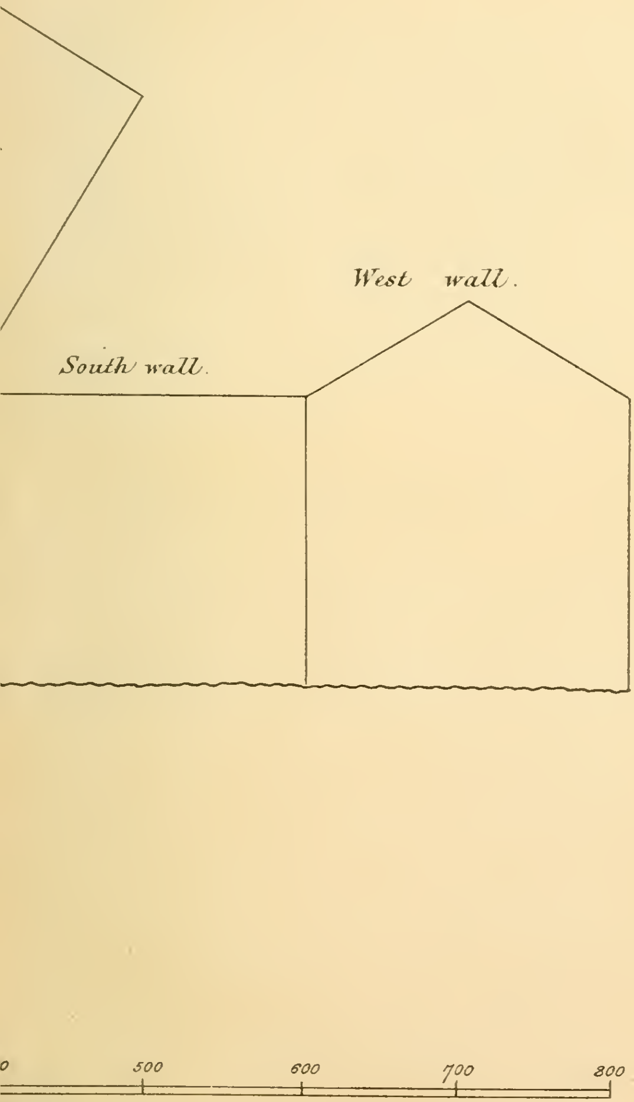
FLOOR OF.

		First Measure.	Second Measure.	Mean.
East side, LENGTH of, . .	=	204·7	206·5	205·6
South ,, ,, . .	=	227·0	227·4	227·2
West ,, ,, . .	=	206·3	205·6	206·0
North ,, ,, . .	=	226·5	226·5	226·5
Mean of sides, E. and W., .	=	...	...	205·8
,, N. and S., .	=	...	...	226·7
East gable end, HEIGHT from floor,	=	245.4	244·9	245·2
West, ,, ,, .	=	244·2	...	244·2
Gable ridge, in middle of room,	=	243·9	...	243·9
Mean, . .		...	...	244·4
North wall at E. end, height, .	=	182· (?)	...	183·2
,, W. ,, .	=	184·5		
South wall at E. end, ,, .	=	181· (?)	...	181·5
,, W. ,, .	=	182· (?)		
Mean, . .		...	...	182·4

Diagonals, LENGTH of measured.			Mean.
Floor, N.E. corner to S.W. corner, ...	=	302·9	303·2
,, N.W. ,, S.E. ,, ...	=	303·6	
North wall, low N.E. corner to high N.W. corner,	=	293·5	292·2
,, ,, N.W. ,, N.E. ,,	=	291·0	
South wall, low S.E. ,, S.W. ,,	=	291·8	291·0
,, ,, S.W. ,, S.E. ,,	=	290·1	
East wall, low S.E. ,, N.E. ,,	=	275·5	275·4
,, ,, N.E. ,, S.E. ,,	=	275·2	
West wall, low S.W. ,, N.W. ,,	=	273·8	275·6
,, ,, N.W. ,, S.W. ,,	=	277·3	



Sides of Queen's Chamber



...en on plane of East-wall.

W.H.M^c Farlane, Lith^r Edin^r

The notes to the above measures, state the floor to be in a very disorganized state; some of the slabs being higher, or lower, than others, and all very rough and much broken: base of walls also much injured, and corners rendered uncertain by hardened dirt, with saline incrustations.

This room may be considered to have seven sides, viz., one floor, four walls, and two inclined roof-sides: these I was not able to measure directly, but they may be deduced from the above measures, and stated as follows, viz. :—

Inclined roof sides—

Length from East to West (same as floor), . .	=	226·7
Breadth on the incline, ...	=	120·1

The latter is computed as the hypothenuse of the right-angled triangle, where the vertical = 62·0 (or the difference between 182·4, the mean height of walls at outer side of gable end, and 244·4, the mean observed height in centre of same), and the base = 102·9 (or half 205·8, which is the mean breadth of the floor). But tenths of inches are a needless refinement with the lower part of this room, especially in connexion with its uneven floor; and, having due regard to diagonals computed from the rectangular measures, as compared with the diagonals observed, I am inclined to take the following as the most probable rough approximations to the real size of this room, viz. :—

QUEEN'S CHAMBER.

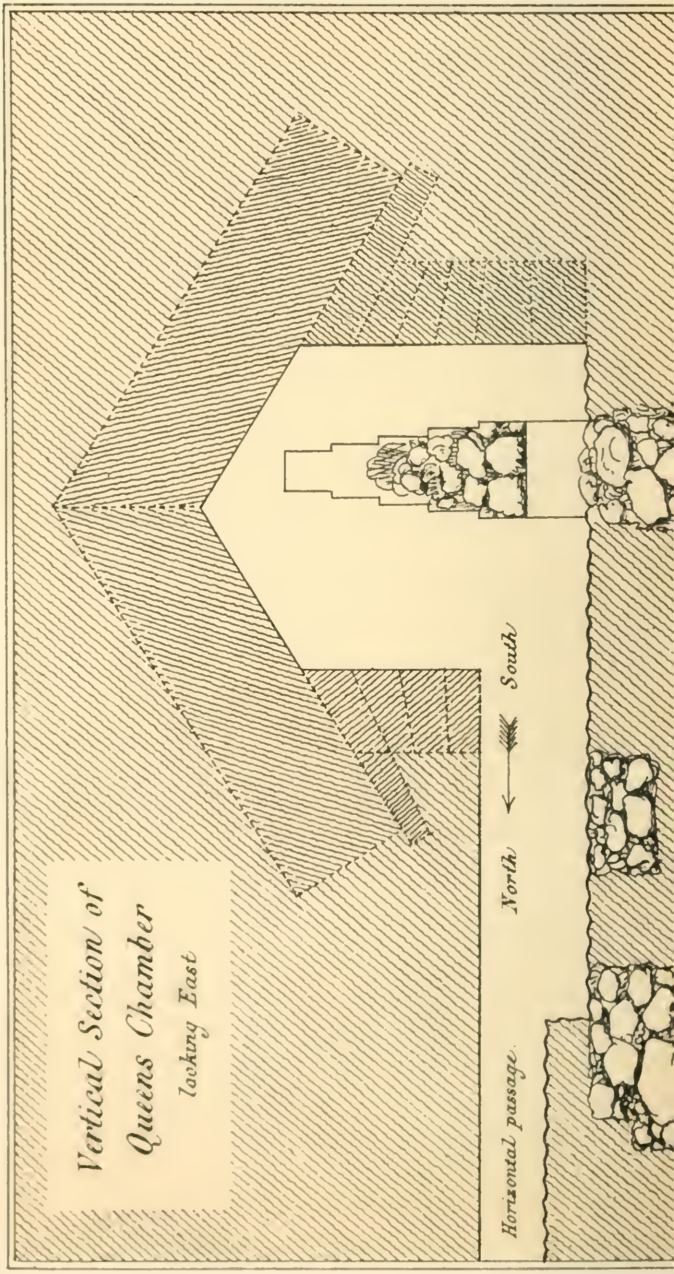
Floor, East and West sides, length,	=	205·
,, North and South ,, ,,	=	226·
Walls, North and South, length of,	=	226·
,, ,, height of,	=	183·
Walls, East and West, length of,	=	205·
,, ,, mean height of, or $\frac{183 + 244}{2}$	=	214·
Roofs, North and South, length of,	=	226·
,, ,, breadth,	=	119·
And angle of rise of each side of roof, computed from base = 102·5 and perpendicular = 61·0,	=	30·8°

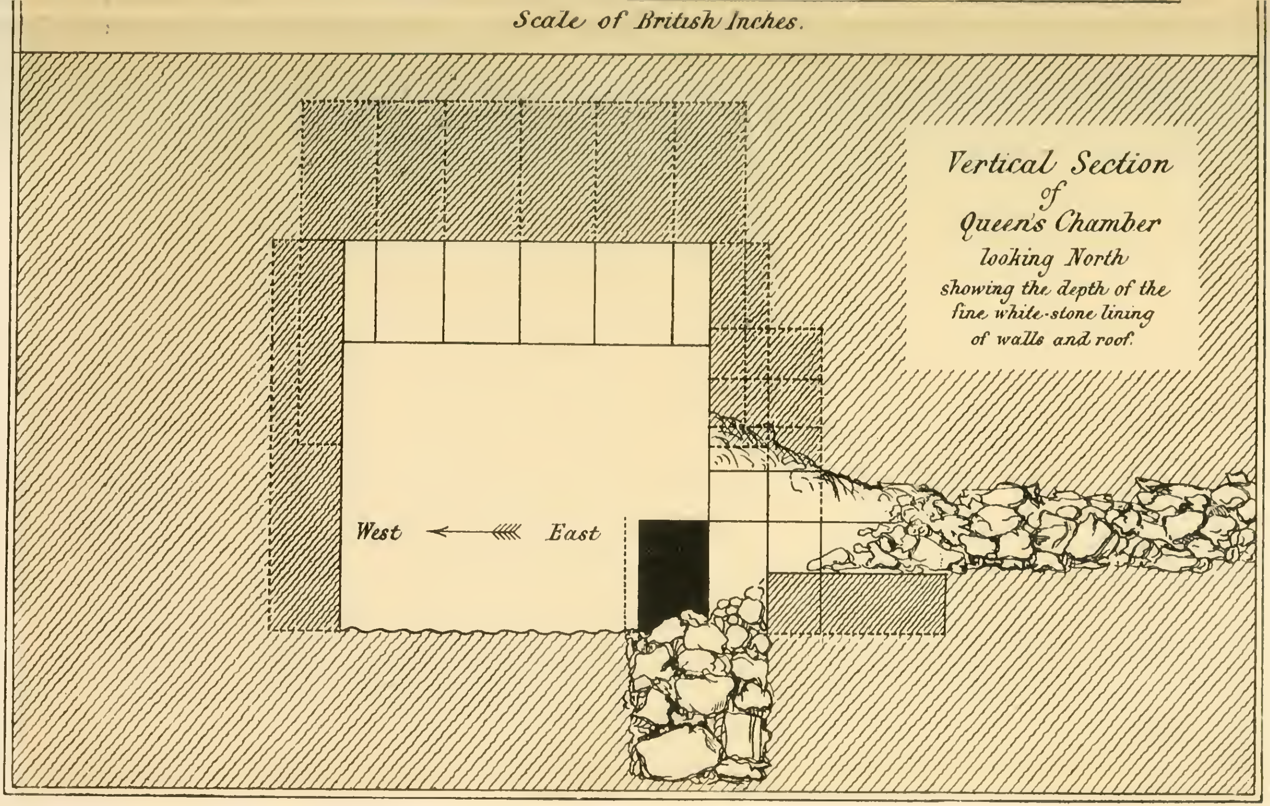
Hence room opened out on plane of east side, may be represented as in Plate VII.

The mark on the western side of the door (in Plates VII. and VIII.) shows a shallow projection of the stone material.

Of the niche above represented, the following measures were taken on February 20; but are rude in the extreme towards the higher parts, as I had then no ladder to stand upon :—

Breadth of *a* to *f*,	=	61·3
,, *b* to *g*,	=	52·3
,, *c* to *h*,	=	43·3 (estimated.)
,, *d* to *i*,	=	34·3 (estimated.)
,, *e* to *j*,	=	25·3 (estimated.)
Horizontal distance, North wall to *a*,	=	97·2
,, South ,, *f*,	=	46·6
,, Centre of niche from continuation of East wall, or roof,	=	25·3


Vertical Section of
Queens Chamber
looking East
North
South
Horizontal passage.



W H Mc Farlane, Lithr Edinr

		First measure.	Second measure.	Mean.
Height of portion *a* or *f*, . .	=	66·7	66·7	66·7
,, ,, *b* or *g*, . .	=	31·6	31·5	31·6
,, ,, *c* or *h*, .	=	28·3	29·0	28·7
,, ,, *d* or *i*, . .	=	28·5	30·2	29·4
,, ,, *e* or *j*, . .	=	29·7	29·0	29·4
Mean height of niche, . .	=			185·8

Workmanship of niche, originally very good and true: the intended depth of it generally seems to have been 41 inches; but the stones which reach back to form this depth, penetrate some 35 inches still farther eastward into the masonry. A portion of the niche, just above a level bank or long shelf about 38 inches above the floor, reached much farther back still, say 100·, with height of 40·; but all that part is now much disfigured by modern excavations. These are shown in the two following views of the Queen's chamber in Plate VIII.; where the arrangement of the roof and wall lining blocks is taken from Howard Vyse and Perring's views.

GRAND GALLERY.

From the larger space, and more numerous architectural features in the Grand Gallery over the simple passages, it requires much examination of the nature of each end, before attempting to measure the distance of one from the other. We shall also do well to look just now, only to the lower, or floor-ward portion of each end,—leaving everything with regard to the upper portions, whether of north or south ends, to a separate section for height.

Entering then the north end of Grand Gallery, by the first ascending passage, we enter there by a doorway 53·2 inches in vertical height (53·5, first measure, and 53·0, second measure), and 42·2 inches broad, *i.e.*, where not broader on account of manifest injury; and these measures are taken on the north wall of Grand Gallery, which is vertical for a certain height upwards from the floor.

The breadth of that wall, or end of Gallery, is about 82·0 (81·7 to 83·0) inches, and the lower storey of Grand Gallery progresses always at that breadth,—except in so far as its very lowest part is filled up on either side by the ramps or side-benches of stone; and these, for a vertical height of 23 inches, contract the breadth to about 42·0 inches, or the same approximately as the first ascending passage and its doorway.

The floor of the Grand Gallery may be considered to begin, with the protruding (southward) portion of the floor of first ascending passage; and if continued thence would run along the base of the ramps the whole way, up to the upper or southern end of Grand Gallery.

But in such case there would be no communication to the Queen's chamber. A long part, therefore, 220 inches, of the inclined floor has been removed, and that space has been dug (in a manner) vertically down, preserving the breadth between the ramps as its measure of breadth, and continued downwards until it reaches the level of six inches above the base of north wall of Grand Gallery. (See fig. on page 60.)

Hence the first part of the floor of Grand Gallery *seems* to casual observation to be level; but the level part is no portion proper to the Gallery; and is so much as six inches too high for its beginning. This state of things may generally be apprehended from the diagrams of Plate VI. vol. i.; which are also constructed to give an idea of the five holes in the vertical sides of the chink leading to the Queen's chamber, and of the entrance to the well. The well (Plate V. vol. i.) is one of the most peculiar structures in the Pyramid, and forms a rather dangerous place of stumbling at the first entrance into the Grand Gallery: the square hole, however, in the floor, is not that of the well itself, but only the beginning of a horizontal passage, some 28 inches deep, and 85 long, leading straight away west; and then and there only, plunging downwards to form the very well. Further, the hole spoken of as in the floor of Grand Gallery, is rather to one side of it, being within the limits of the western ramp, which has been broken away at the place, for the purpose. In fact there is every appearance that the entrance to the well was once completely closed, by the continuance of the ramp along the western side, similarly to what is now seen along the eastern. Under such circumstances, strangers would have passed through the Grand Gallery without suspecting any neighbouring well, or concealed passage of any kind; and it seems probable that it must have been opened by men ascending the well from its entrance below and bursting open its closed ramp-stone; when, thanks to the extraordinary strength of the cement employed in all the joints, a portion of the said stone was left sticking in the north-west corner of the Gallery, where it may still be seen, testifying to the once completion of the ramp.

The measures (February 18-22) on which the drawings of Plate V. vol. i., and Plate VI. vol. i., depend, are—

Entrance Passage, . .	Height vertical, . .	=	53·2
,, . .	Breadth, . .	=	42·2
Passage to Queen's chamber,	Height vertical, . .	=	46·7 ?
,, ,,	Breadth, . .	=	42·0

Grand Gallery, Breadth over ramps, ... = 82·0
,, ,, between ramps, ... = 42·0
,, ,, in 'dug-out' vertical depth leading to Queen's chamber, . = 42·0
North end of floor, Height of absolute cut-off, . . . = 39·7 and 39·8
,, ,, Length on the incline to second cut-off, . . = 40·5 and 40·8
,, ,, Height of second cut-off, = 9·0
,, ,, Same on opposite side, . = 9·0
Horizontal distance from North wall of Grand Gallery to North end, or absolute cut-off of floor, . . = 199·4
Inclined distance, computed from above for angle 26° 18′, = 222·4
Inclined distance, given by summing small measures connected with the five holes on either side within the above length, ... = 221·6

WELL, PARTICULARS OF.

Horizontal distance, North wall Grand Gallery, to beginning of hole in floor, measured near floor, ... = 19·3
Inclined distance of the same to beginning of break-out near upper level of ramp, ... = 25·5
Length North to South of hole in horizontal floor, . = 30·0
Inclined distance, North wall Grand Gallery to South end of break-out under ramp, ... = 54·3
Distance horizontal from North wall Grand Gallery to North side of Well, produced Eastward, . . . = 21·3
Distance North side, to South side of Well mouth, . = 28·0
Distance East side, to West side of Well mouth, . . = 28·0
Distance horizontal from North wall of Grand Gallery to centre of Well, ... = 35·3
Depth within wall, from which ramp-stone to close Well mouth, has been broken out, ... = 7·0
Horizontal length of Western passage to Well mouth, from East side of hole in floor to West side of Well, = 84·5
Do. do. do. East do., = 56·0
Do. from East side of acting roof to West side of Well, = 57·0
Depth of hole in floor, ... = 27·0
Depth of roofed portion of horizontal passage to Well mouth, ... = 27·0

Distance from North wall of Grand Gallery, to parallel of centre of Well mouth, measured horizontally on floor,	=	34·3
The same distance computed from above, for the ramp incline, ...	=	38·4
The same measured direct on broken indications, . .	=	39·9
Ramps, vertical height, ...	=	23·0
,, breadth (but for more particulars see a subsequent section), ...	=	20·0

The five side holes *a, b, c, d, e* (see Plate VI. vol. i.), on east side, measure thus :—

	a.	*b.*	*c.*	*d.*	*e.*
Distance from North wall on incline of ramp of North side, .	72·5	115·7	148·7	172·7	197·4
Do. do., South side, .	80·7	132·5	157·7	182·4	207·1
Length or tallness of North side,	11·0	15·0	14·8	14·0	15·0
,, South side,	14·0	20· ?	17·4	17·0	18·0
Length, inclined, of upper side,	8·2	16·8	9·0	9·7	9·7
,, horizontal, of lower side,	8·2	16·0	8·4	8·8	9· ?
Height of lower side above apparent floor, ...	18·0	31·8	47·2	57·8	68·8
Do. do., above horizontal plane of North wall base, . .	24·0	37·8	53·2	63·8	74·8
Horizontal depth eastward, .	15·5	9·5	22·0	21·7	10·4

The holes are worked very rudely ; and pick-marks are visible inwards ; some of them have also been mischievously enlarged in part.

The sides of the holes all deviate from being truly vertical, and affect a slight tendency towards the position of being at right angles to incline, thus :—

With hole *d*, South side at its base requires correction to vertical				=	1·1
and North	,,	,,	,,	=	0·6
With hole *e*, South	,,	,,	,,	=	1·0
and North	,,	,,	,,	=	0·4

The five holes on the *west* side measure thus:—

	a.	*b.*	*c.*	*d.*	*c.*
Distance from North wall on incline of ramp of North side of hole, ...	72·5	116·3	147·3	171·8	196·6
Do. do., of South side of hole, .	81·0	132·3	155·8	181·3	206·6
Length or tallness of North side,	10·0	16·0	14·5	14·0	14·0
,, South side,	13·0	21·0	18·0	20·0	18·0
Length, *inclined*, of upper side, .	8·5	16·0	8·5	9·5	10·0
,, *horizontal*, of lower side,	8·6	16·5	9·4	9·0	9·5
Height of lower side above apparent floor, . . .	18·0	32·0	45·5	58·0	69·4
Do. do., horizontal plane of North wall base, ...	24·0	38·0	51·5	64·0	75·4
Horizontal depth westward, .	10·5	23·0	11·0	10·0	19·0

These holes are worked very rudely; pick-marks are visible internally; and large injuries to the adjacent stones, and edges of the holes externally, have been committed.

The sides of the holes deviate from true *vertical* directions, slightly towards being perpendicular to incline, so that with hole *b*, north side requires for correction to vertical = 0·4; and with hole *c*, its south side requires for correction to vertical = 1·0.

UPPER OR SOUTH END OF GRAND GALLERY.

(FEBRUARY 22.)

A principal feature at this part is the grand step, which stretches all across the Gallery, and interferes with the last part of the ramps. The step, once grandly severe, is now lamentably fissured in two places, and much broken away about the middle, as indicated in the several sketches of Plate IX.

The measures on which the plan, and elevations, both front, and for either side, in the Plate, are founded,—stand thus :—

Breadth of Grand Gallery, above South doorway, . .	=	82·2
,, of South doorway, ...	=	41·4
,, ,, in broken places Westward,		45 to 50·0
Height of doorway, on East side, ...	=	43·8
,, West side, ...	=	43·3
,, Mean, ...	=	43·6
Horizontal length of great step on East side, North to South, 60·7 to 61·0, ...	=	60·8
Do. do., on West side, ...	=	61·0
Vertical height of great step, at North end, East side, 35·8 and 35·9, ...	=	35·8
Do. do., West side, ...	=	36·2
Distance from joint 28 to South wall, along ramp line produced, and on East side, ...	=	81·4
Do. do., on West side, ...	=	81·8

These two last measures are important, because they have to be added to what will presently be measured along the whole Gallery, to give its full length: they are also rather difficult to determine, as well on account of the interference of the corner of the great step, as the error of rectangularity of the joints 28, and the one above it. But although the ramp itself ends north of the step, its joint line produced, reappears visibly above the step, and thence extends to the south wall of the Gallery. Some minor measures connected with this feature are thus:

EASTERN SIDE OF SOUTH END OF GRAND GALLERY.

Horizontal distance from South wall of reappearance of ramp joint, ...	=	33·2
Vertical height attained by it on the South wall, .	=	16·6
Hole in South-East corner, length, 21·5 and 21·2 .	=	21·4
,, ,, breadth, 6·2 and 6·0 .	=	6·1
,, ,, depth, 5·5 and 5·5 ? .	=	5·5

WESTERN SIDE OF SOUTH END OF GRAND GALLERY.

Horizontal distance from South wall of reappearance of ramp joint, ...	=	33·4
Vertical height attained by it on the South wall, .	=	17·0
Hole in South-West corner, length, 20·5 to 21·0 .	=	20·8
,, ,, breadth, 5·7 to 5·8 .	=	5·8
,, ,, depth, 5·0 ? .	=	5·0?

but depth doubtful, on account of hard dust.

GRAND GALLERY, LENGTH OF, ALONG THE EAST SIDE.

(February 21, 22, 1865.)

Measured with rod 100 A, carrying brackets for candles: at first the rod was held from slipping by hand, but was afterwards attached to a cord, drawn up and clamped at pleasure to a peculiar wooden anchor fixed in a ramp-hole above it. (See Frontispiece.)

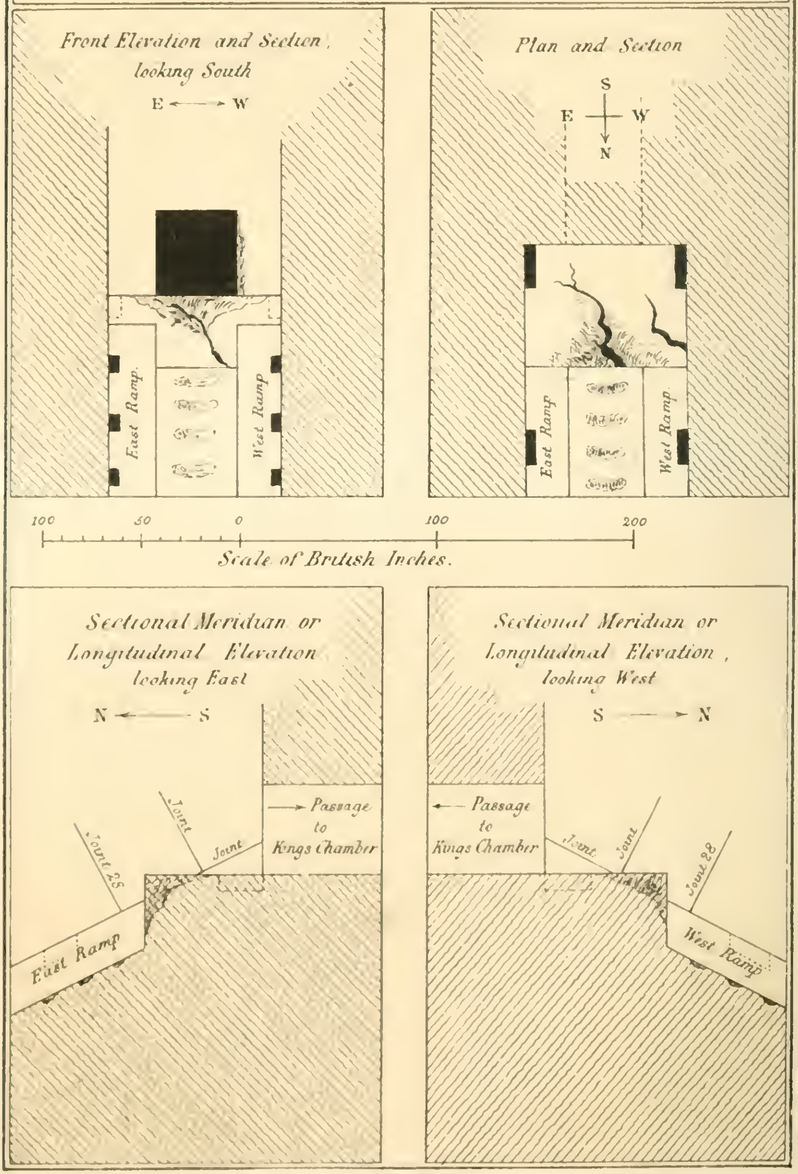
The measurement was made on the wall-joints where they meet the ramp-top; these joints are generally good, and perpendicular to the incline; but some of them are unfortunately concealed by a hard, brown, stone-like salt incrustation (something similar to that in Queen's chamber, but usually thinner, harder, and darker externally); others, again, of the wall-joints are absorbed in certain stones inserted vertically, or nearly so, over every ramp-hole, excepting only the north hole and that next to it; and the joints of these inserted stones are not very good:—

GRAND GALLERY,

LENGTH of, upon *East* side (February 21, 22, 1865), along inclined Ramp-line.

Number of joint.	First Measure.	Second Measure.	Mean, or length from joint to joint.	Total length of each joint from North wall.	Remarks.
North wall,	0·0	0·0	0·0	0·0	
Joint 1	55·6	55·6	55·6	55·6	
2	75·5	75·5	75·5	131·1	Absorbed in vertical joint.
3	67·4	67·4	67·4	198·5	At 222·0, absolute or final cut-off of floor.
4	40·7	40·7	40·7	239·2	
5	...	79·5	79·5	318·7	At 262·6, partial cut-off of floor.
6	(117·8)	38·3	38·3	357·0	
7	92·6	92·6	92·6	449·6	
8	54·4	54·4	54·4	504·0	
9	...	...	...	...	Hid behind an inserted stone.
10	137·5	137·5	137·5	641·5	
11	62·3	62·3	62·3	703·8	
12	67·3	67·4	67·4	771·2	
13	95·4	95·4	95·4	866·6	
14	38·0	38·0	38·0	904·6	
15	177·5	177·5	177·5	1082·1	Ramp almost entirely broken away from 1087 to 1186.
16	39·0	39·0	39·0	1121·1	
17	62·1	61·9	62·0	1183·1	
18	49·0	49·0	49·0	1232·1	Ends in a hole.
19	43·4	43·6	43·5	1275·6	
20	52·6	52·8	52·7	1328·3	
21	87·5	87·7	87·6	1415·9	
22	36·7	36·6	36·6	1452·5	
23	43·0	43·0	43·0	1495·5	Absorbed in vertical joint.
24	80·2	80·2	80·2	1575·7	Do. do.
25	55·3	55·3	55·3	1631·0	Do. do.
26	65·7	65·8	65·8	1696·8	Do. do.
27	63·2	63·2	63·2	1760·0	
28	41·1	41·3	41·2	1801·2	
Step, .	...	...	12·7	1813·9	
South wall,	81·4—12·7	...	68·7	1882·6	Full length of Grand Gallery on East side.

Lower part of Upper or South-end of Grand Gallery.



W H M^c Farlane Lith^r Edin^r

GRAND GALLERY,

Length of, upon *West* Side (February 21 and 22, 1865), along inclined Ramp-line.

Number of joint.	First Measure.	Second Measure.	Mean, or length from joint to joint.	Total length of each joint from North wall.	Remarks.
North wall,	0·0	0·0	0·0	0·0	
Joint 1	80·0	80·3	80·2	80·2	
2	52·8	52·8	52·8	133·0	Absorbed in vertical joint.
3	80·2	80·3	80·2	213·2	Do. do.
4	68·0	67·7	67·8	281·0	
5	54·6	54·6	54·6	335·6	Do. do.
6	44·0	44·1	44·0	379·6	
7	48·0	48·0	48·0	427·6	
8	43·7	43·7	43·7	471·3	Do. do.
9	56·7	56·8	56·8	528·1	
10	42·7	42·8	42·8	570·9	
11	96·8	96·8	96·8	667·7	
12	60·0	59·8	59·9	727·6	
13	76·5	76·7	76·6	804·2	
14	47·2	47·3	47·2	851·4	Close joint, almost concealed by hard, brown, salt incrustations.
15	64·4	64·3	64·4	915·8	
16	5(5)·8	51·7	51·7	967·5	Examined and proved error of first measure.
17	36·8	37·3	37·0	1004·5	
18	46·0	46·1	46·0	1050·5	
19	62·0	61·8	61·9	1112·4	
20	60·7	60·7	60·7	1173·1	Joint not quite perpendicular to incline.
21	96·7	96·5	96·6	1269·7	Ramp much broken from 1240 to 1317.
22	55·3	55·4	55·4	1325·1	
23	99·6	99·6	99·6	1424·7	Absorbed in vertical joint.
24	86·8	86·8	86·8	1511·5	Do. do.
25	93·4	93·9	93·6	1605·1	
26	90·5	90·8	90·6	1695·7	
27	56·8	56·6	56·7	1752·4	
28	48·7	48·8	48·8	1801·2	
Step, . .	...	...	14·4	1815·6	
South wall,	81·8—14·4	...	67·4	1883·0	Full length of Grand Gallery on West side.

Hence the total length of Grand Gallery from north wall, to south wall measured along surface of ramps—

= on Eastern side,	. . .	1882·6
„ Western „	. . .	1883·0
Mean,	. =	1882·8

And the partial length from north wall to beginning of great step—

= on Eastern side,	. . .	1813·9
„ Western „	. . .	1815·6
Mean,	. =	1814·8

RAMP HOLES IN GRAND GALLERY.

These holes are cut in the ramps, next the wall, rather rudely, and have their edges now much broken. (See Plate VI. vol. i., and Plate IX. vol. ii.)

Their upper and lower, or north and south sides, are cut nearly vertical, certainly far from at right angles to the general incline of the Gallery: the depth of the holes (vertical) varies from eight to eleven inches, probably as influenced by hardened dirt.

Their number,—*including* one at the south-east inside corner, and another at the south-west inside corner, of the upper horizontal surface of the great step at the upper and south end of the Gallery,—is, twenty-eight on either side.

Of these, all, except the two on the great step, and the *two* lowest or northernmost on *either* side (*i.e.*, four at the north end) have a piece of stone let into the wall vertically over their middle; the height of such inserted piece being usually 18·, and breadth 13· ; while the depth or thickness in one particular case where a neighbouring fracture enables it to be seen, is about 10· inches.

The holes on either ramp are always opposite, or nearly so, to each other.

The following measures of the ramp-holes were only taken once, excepting a few checks; though the general nature, character, number, and position of the holes were observed again and again. As touching the number too, which has been variously stated by different persons as from twenty-five to twenty-eight,—the method of mensuration adopted on this occasion will, it is hoped, put any mistake in that feature within the power of any one looking over the figures, and assisting themselves by the general symmetry in size and distance observed throughout,—to correct for themselves.

GRAND GALLERY,

Ramp-holes on East side.

Number of, beginning at North end of Gallery.	Distance from North wall, of: North side of hole.	Distance from North wall, of: South side of hole.	Distance between adjacent sides of two holes.	Length of hole from North to South.	Breadth from East to West.	Depth, vertical.	Remarks.
At N. wall, 1	0·0	23·0	41·9	23·0	6·0	11·0	
2	64·9	84·6	41·8	19·7	6·7	11·0	
3	126·4	151·0	44·6	24·6	6·7	+ 7·0	
4	195·6	216·1	46·1	20·5	6·7	+ 7·0	
5	262·2	285·7	45·9	23·5	6·4	12·0	
6	331·6	352·4	48·0	20·8	6·7	+ 7·0	
7	400·4	422·9	45·7	22·5	6·8	...	
8	468·6	488·8	46·3	20·2	6·2	...	
9	535·1	557·5	46·0	22·4	6·4	...	
10	603·5	624·4	46·8	20·9	6·4	...	
11	671·2	693·2	47·0	22·0	6·7	...	
12	740·2	759·7	45·8	19·5	7·0	...	
13	805·5	828·8	47·4	23·3	6·7	...	
14	876·2	896·5	46·7	20·3	6·3	...	
15	943·2	966·7	45·5	23·5	6·8	...	
16	1012·2	1032·7	47·0	20·5	6·4	...	
17	1079·7	1101·2	48·5	21·5	...	...	Ramp nearly broken out from 1087 to 1186.
18	1149·7	1169·7	45·8	20·0	...	...	
19	1215·5	1239·3	45·7	23·8	...	...	
20	1285·0	1305·6	46·2	20·6	6·3	8·0	
21	1351·8	1375·8	46·0	24·0	6·3	8·0	
22	1421·8	1441·8	46·0	20·0	6·2	8·0	
23	1487·8	1511·8	45·7	24·0	6·0	8·0	
24	1557·5	1577·5	44·7	20·0	6·5	+ 7·0	
25	1622·2	1647·2	45·3	25·0	6·8	8·0	
26	1692·5	1712·9	45·3	20·4	6·3	8·5	
27	1758·2	1781·7	79·7	23·5	6·2	8·0	
On step, 28	1861·4	1882·6		21·2	6·0	+ 5·5	

GRAND GALLERY,

Ramp-holes on West side.

Number of hole from North wall of Gallery.	Distance from North wall of North side of hole.	Distance from North wall of South side of hole.	Distance between adjacent sides of two holes.	Length from North to South.	Breadth from East to West.	Depth, vertical.	Remarks.
At N. wall, 1	0·0	23· ?	42·0	23· ?	6·0	(?)	Relics only of ramp.
2	65·0	86·5	41·5	21·5	5·7	9·0	
3	128·0	150·0	46·6	22·0	5·7	10·0	
4	196·6	216·3	44·7	19·7	6·0	9·5	
5	261·0	284·4	49·1	23·4	5·5	10·0	
6	333·5	355·0	44·6	21·5	6·2	11·0	
7	399·6	424·6	44·3	25·0	6·3	10·0	
8	468·9	489·9	45·4	21·0	6·3	11·0	
9	535·3	558·3	44·7	23·0	5·7	10·5	
10	603·0	623·1	46·1	20·1	5·8	10·0	
11	669·2	692·3	47·0	23·1	5·8	11·5	
12	739·3	759·8	45·2	20·5	6·3	10·5	
13	805·0	828·0	45·0	23·0	6·0	11·0	
14	873·0	893·2	50·4	20·2	6· ?	11·5	
15	943·6	966·1	44·7	22·5	5·9	8·0	
16	1010·8	1032·2	46·5	21·4	6·5	9·1	
17	1078·7	1102·2	45·8	23·5	6·3	7·5	
18	1148·0	1168·0	46·0	20·0	6·5	7·5	
19	1214·0	1236·4	46·0	22·4	6·3	8·3	
20	1282·4	1303·1	46·6	20·7	...	...	Ramp much broken from 1240 to 1317.
21	1349·7	1372·9	47·9	23·2	6·5	8·5	
22	1420·8	1441·5	44·7	20·7	6·2	7·5	
23	1486·2	1510·0	45·8	23·8	6·3	7·8	
24	1555·8	1577·0	45·5	21·0	6·4	7·5	
25	1622·5	1646·9	44·8	24·4	6·3	8·0	
26	1691·7	1712·5	46·2	20·8	5·5	7·0	
27	1758·7	1782·9	79·6	24·2	6·0	8·0	
On step, 28	1862·5	1883·0		20·5	5·8	5·±	

GRAND GALLERY,

Breadth of, between Ramps, and above Ramps.

At distance from North wall, nearly	Breadth between ramps.		Breadth just above ramps.
	First measure.	Second measure	
At North wall,	......	......	81·7
76	41·6	41·5	......
80	......	......	81·8
124	41·4	......	......
152	41·0	......	......
185	40·8	......	......
214	41·0	......	......
222	41·3	......	......
263	41·8	41·8	......
300	......	......	82·0
315	42·2	......	......
400	42·4	......	82·1
500	42·5	......	......
600	42·4	......	82·8
900	42·4	42·2	82·9
1100	41·8	41·9	83·0
1300	42·3	......	82·9
1600	42·6	42·4	82·9
1800	42·5	42·7	82·3
At South wall,	......	......	82·2

These measures show without doubt that the Grand Gallery is broader t[illegible] middle and upper or southern end than at [illegible]r or northern end; and this prevails equally [illegible] the breadth between, and that above, the ramps. The much more notable contraction of the breadth higher up, caused by the *overlappings* of the walls, will be given further on.

GRAND GALLERY,

RAMPS of, *Height* and *Breadth* of each.

Place of measurement, by distance from North wall of Gallery.	Ramp on East side of Gallery.			Ramp on West side of Gallery.		
	Breadth.	Height, at right-angles to incline.	Notes.	Breadth.	Height, at right-angles to incline.	Notes.
130	20·3	...	...	20·3	...	Through a considerable length this West side of floor is parted from ramp by a crevice 0·5 broad.
300	20·2	20·9	...	19·8	21·3	
570	20·4	21·0	Walls chipped and injured where ramps join them.	19·9	20·8	
640	20·1	21·2	...	19·9	20·9	
1000	20·3	21·8	Both ramps much fissured and parted from walls. Floor also from ramps.	20·2	20·9	
1400	20·3	21·3	...	20·3	21·3	
1430	20·1	21·3	...	20·3	21·2	
1500	20·0	20·9	...	19·8	20·9	
1740	20·4	20·6	...	20·1	20·5	
1800	19·3	20·3	...	19·8	20·6	
Mean,	20·14	21·03		20·04	20·93	

The above observations were taken with care, to avoid fractures of wall, or wearing of floor: matters that might easily have increased any of the above returns by 0·3 to 0·5, and sometimes even 1·0; without specially calling attention in themselves.

At each spot selected, generally for the goodness of the ramps at that part, the measurement was verified at the time as being certainly within 0·2 of the truth. This leaves, as may be noticed, a variation in the size of the ramps along the run of the Gallery as a measured fact; and also that the height, taken perpendicular to the incline, is greater than the breadth, by the quantity very nearly of 1 inch.

Along nearly the whole distance from 400 to 1800 of western ramp, and occasionally along eastern ramp, there are longitudinal parallel scratches, forming almost a border or species of intended ornament following the direction of the ramp; they are inflicted upon and along its upright edge, close under the top, and towards axis of Gallery. But although the very same lines are traceable far, they do not extend the whole distance, being more or less gradually replaced by others; they may therefore, be merely the accidental scratches caused by rough and heavy bodies having once been slided along the sloping floor.

VERTICAL HEIGHT OF GRAND GALLERY.

(March 1-11, 1865.)

Measured with Slider-scale of 400.

This element of the Grand Gallery has always been a difficult one to travellers with limited apparatus, on account of its enormous proportions, and the tilt or incline of both floor and ceiling, together with the darkness, bad air, etc. But I had had specially prepared for the work, by Mr. Cooke, a trunk of 300 inches long (formed in three pieces, but fixed together inside the Pyramid); and furnished with an inside pointed slider of 100, capable of being pushed up from below from 0 to 90; while the foot of the trunk was formed by a long steel peg, and levels were applied at the sides to test verticality. The mode of working was,—that two men held the apparatus vertical, or made it so by reference to the levels; I then pulled the string which raised the slider, until it touched the roof, and clamped; in which state the whole structure was lowered on the upward inclining floor, for me to read off the scale. The differences, at different parts of the length of the Gallery, are greater than I should have expected; and may be due partly to the roof being formed of slabs set at a tilt, each of them, to the general incline, like tiles.

The mean of the whole will, however, probably be pretty accurate; for there is no constant error of the apparatus amounting to a sensible quantity; seeing that one of the readings registering 350·2, being directly tested on the great rod by the known 100 B, was proved to be by that = 350·17.

The height sought to be measured, being the *vertical* height between *sloping floor* and *sloping roof*,—a large correction is needed at parts near the north end of Gallery, where the sloping floor has been cut away, and there is only the horizontal floor of Queen's chamber passage at a lower level to refer to. In such cases the elements of correction are, the distance from the north wall, and the angle of the Gallery assumed = 26° 18′.

GRAND GALLERY, *VERTICAL* HEIGHT OF.

Distance from North wall.	Measured on March 1.	Correction for level floor.	Measured on March 11.	Correction for level floor.	General results.	Notes.
20	...	...	344·2	...	344·2	On step of protruding passage floor.
30	350·2	— 8·8	...	...	341·4	8· South of step.
32	351·0	— 9·8	...	...	341·2	10· South of step.
77	...	...	366·4	— 32·0	334·4	On level floor.
125	...	...	394·2	— 55·8	338·4	On level floor.
270	...	...	343·7	...	343·7	On first six inches of true Grand Gallery inclined floor.
550	346·0	...	...	...	346·0	
620	...	...	336·0	...	336·0	
970	341·3	...	339·0	...	340·2	
1240	338·0	...	...	...	338·0	
1320	...	...	340·0	...	340·0	
1500	334·5	...	...	...	334·5	
1670	...	...	342·0	...	342·0	
1760	333·9	...	...	...	333·9	
1780	...	...	339·0	...	339·0	
Mean of height of Grand Gallery by 16 obs. =					339·5	*N.B.—Vertical* height.

ROOF OF GRAND GALLERY.

(MARCH 1, 1865.)

Examined the roof-stones of Grand Gallery, by a strong light from below, and made their number from north to south = 36.

Of these, the last nine towards the south are absolutely black with smoke; those preceding them towards the north, are only partially black. The stones are manifestly of unequal lengths, and the tile-angle at which they set to the general angle of the passage, is by no means constant; it was particularly marked at the fourth, seventh, and tenth from the north. Looking up from below, the absolute cut-off of north end of Grand Gallery floor, was found to point to 4·3 of the roof-stones, measured from the north wall of Gallery.

GRAND GALLERY, OVERLAPPINGS OF, AT NORTH END.

Noticed with regard to these overlappings, that the first one of the side walls above the ramps, though making its due compression in the width of the north end wall, is *not* developed on that end as an end-overlapping; wherefore north wall goes up higher in plane of door than it otherwise would do.

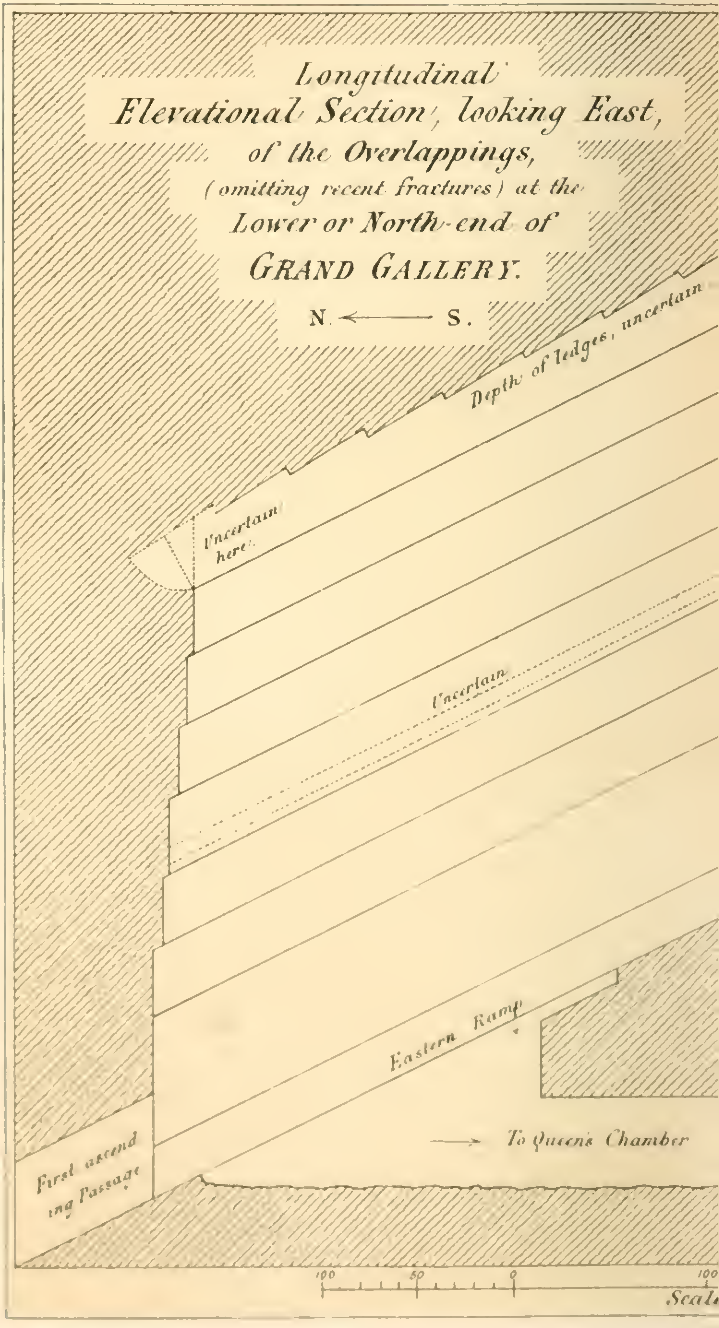
Noticed also, that when the end-overlappings of north wall *are* developed, their under surfaces follow the general incline of the Gallery.

The shape of the wall at the highest overlapping of north end-wall, where there is evidently a large forced hole, I could not examine: the figure indicated in the diagram by dots, is from Perring's large views: also the groove above the third overlapping, measured from below. (See Plate x.)

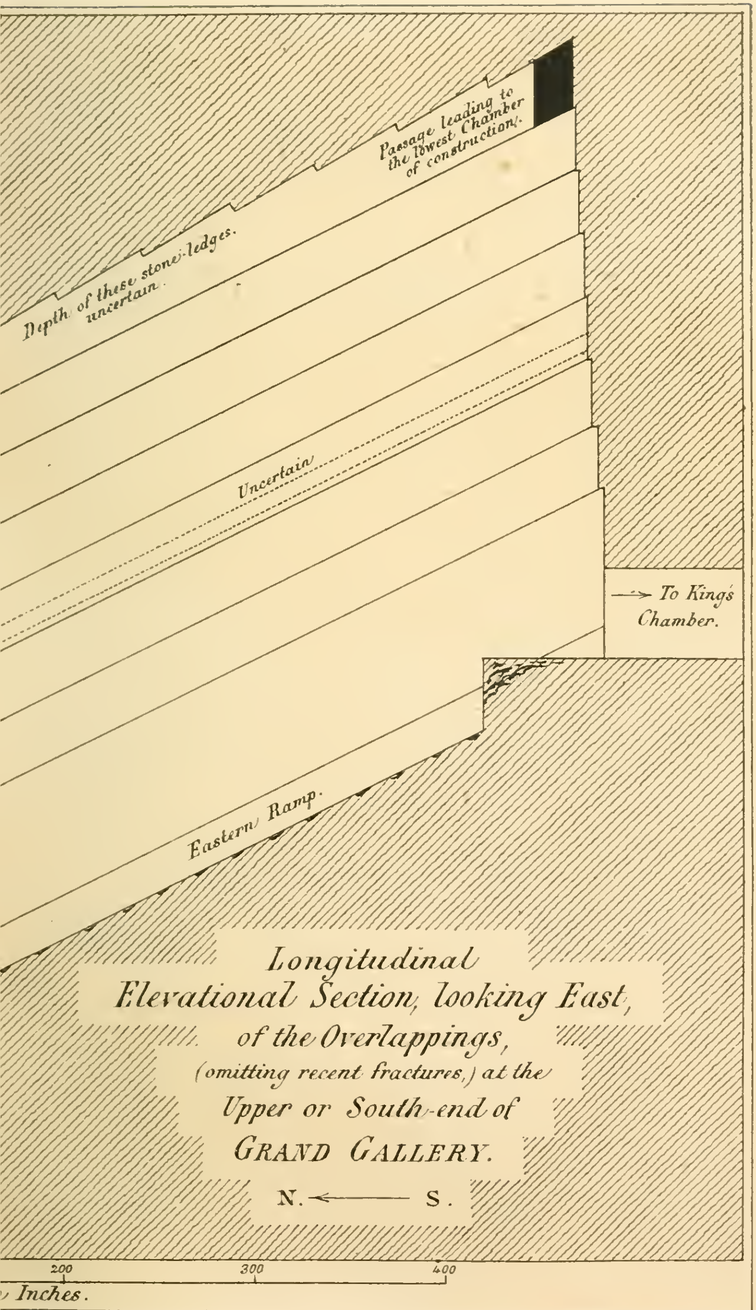
This groove on either side, did not catch my eye; but that may have arisen partly from much of the overlapping which it belongs to, having been recently broken away. Vyse and Perring say, 'For the long 'grooves running on each side the whole length of 'the passage, it is difficult to assign a use; they are 'roughly cut, and therefore could not have been 'used for a sliding platform, for which, at first 'sight, they appear adapted. Perhaps they were 'made to receive a scaffolding for the workmen 'employed in trimming off the sides of the passage.' To this I may add, that the groove is represented so near the bottom of its overlapping sheet, that there was little strength left, to support any weight ; and as the grooved portion has to a great extent perished, without any strain being put upon it,—we cannot regard it as anything connected with scaffolding, but rather with some symbolic meaning.

The same authors, who had more opportunities than any other men, since the building of the Pyramid, to examine the upper parts of the Grand Gallery, and are therefore to be listened to with great respect for facts, say of its *roof*,—'it has been 'laid on a flat bed at the incline of the passage ; but 'a settlement towards the lower end has given the 'roof-stones the angular direction shown in the 'figure.' I cannot altogether understand the mechanics of this paragraph, combined with the Pyramid method of forming the roofs of passages ; generally by large stones spanning all across them, and far over the walls on either side : but I had no means of examining the roof closely, and can only speak by appearances judged of from the floor, as to each 'tile' corner of a roof-stone really throwing a shadow ; and that there were thirty-six of them, in place of the thirty-one indicated by Howard Vyse and Perring, and thirty in the French work.

The further measures I was enabled to take from the floor, of the overlappings, are given below.



Longitudinal
Elevational Section, looking East,
of the Overlappings,
(omitting recent fractures) at the
Lower or North-end of
GRAND GALLERY.
N. ← S.
Depth of ledges, uncertain
Uncertain here.
Uncertain
Eastern Ramp
To Queen's Chamber
First ascending Passage
100
50
0
100
Scal



Longitudinal Elevational Section, looking East, of the Overlappings, (omitting recent fractures,) at the Upper or South-end of GRAND GALLERY.

N. ← S.

W. H. Mc Farlane, Lith. Edin.

GRAND GALLERY,

End-overlappings of, at NORTH END and on NORTH WALL.

Number of overlapping.	*Vertical* height above floor, following its incline.	Breadth of, from North to South.	Differences of Vertical heights.	Notes.
1st from floor,	94·4	0·0	...	The numbers in parentheses are concluded only from eye-estimate, checked by the whole height, previously measured.
2	130·4	5·5	36·0	
3	166·7	4·5	36·3	
4	203·5	(4·)	36·8	
5	(238·5)	(3·)	35·0	
6	(274·0)	(3·)	35·5	
7	(309·0)	(?)	35·0	A forced hole between 7 and roof.
Roof,	344·0	...	...	The vertical height of Grand Gallery at that point.

Side-overlappings at NORTH END, but on EAST AND WEST WALLS, and measured at *right angles* to incline, from *ramp-surfaces* upwards.

Number of overlapping.	East wall.		West wall.		Mean East and West.		
	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Differences of rectangular heights.
1st from ramps,	63·8	3·1	63·5	3·2	63·6	3·2	
2	95·9	3·0	95·6	3·0	95·8	3·0	32·2
3	128·0	2·9	128·1	3·0	128·0	3·0	32·2
4	159·9	(3·)	159·8	(3·)	159·8	(3·)	31·8
5	(192·)	(3·)	(192·)	(3·)	(192·)	(3·)	32·2
6	(224·)	(3·)	(224·)	(3·)	(224·)	(3·)	32·0
7	(255·)	(3·)	(255·)	(3·)	(255·)	(3·)	31·0
Roof,	286·	...	286·0	...	286·0	...	31·0

OVERLAPPINGS OF GRAND GALLERY AT SOUTHERN OR UPPER END.

This upper or southern end differs in many details from the northern end, as—

1*st*, The lowest side overlapping *is* developed on the end wall, together with all the rest.

2*d*, The under surfaces of all these overlappings are *level*, and not following the incline of the Gallery.

3*d*, The end wall is not vertical, but impends or hangs over the great step, *i.e.*, leans towards the north by a quantity of about 1°.

This circumstance may render the heights measured at this, the south end, always rather small; while, again, at the north end, the difficulty of eliminating fully the slope of the under-surfaces of the end-overlappings may have made them there rather too great. (See Plate x.)

GRAND GALLERY,

OVERLAPPINGS of, *at South or Upper end.*

Number of overlapping	*Vertical* height above great step upper surface.	Breadth of over-lapping from South to North, on South wall.	Reduction for surface of step to Gallery inclined floor, continued.	Vertical height above Grand Gallery floor, concluded.	Difference of vertical heights.
1st from floor of great step,	84·9	2·9	7·5	92·4	
2	119·3	3·0	9·0	128·3	35·9
3	152·6	3·0	10·5	163·1	34·8
4	185·7	(3·0)	12·0	197·7	34·6
5	...	(3·0)	...	(232·)	34·8
6	...	(3·0)	...	(267·)	35·0
7	...	(3·0)	...	(302·)	35·0
Roof, .	...	...	...	337·±	35·0

N.B.—The numbers in parentheses not directly measured.

GRAND GALLERY,

Side-overlappings, South end; but on *East and West walls*, and measured at RIGHT ANGLES to incline from ramp-surfaces upwards.

Number of over-lapping from ramp-surface up.	East wall.		West wall.		Mean East and West walls.		
	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Rectangular height.	Breadth.	Differences of Rectangular height.
1	63·0	3·	62·0*	3·	62·5	3·	32·3
2	95·5	3·	94·1	3·	94·8	3·	30·9
3	126·3†	3·	? ‡	3·	125·7	3·	31·7
4	157·9	...	157·0	...	157·4	(3·)	(31·6)
5	...	...	...	...	(189·)	(3·)	(32·0)
6	...	...	...	...	(221·)	(3·)	(31·0)
7	...	...	...	...	(252·)	(3·)	(32·0)
Roof,	...	...	...	...	284·	...	

* Large corner of overlapping much broken.

† Large piece of this overlapping, from its lower edge upwards, broken away; and extensive dripping marks, as of water escaping at the place, hang vertically down from it.

‡ After the first 100 inches or so from the south, so very long a portion of this overlapping is broken away, that no good measure can be obtained.

This is that overlapping, towards the lower side of which Howard Vyse and Perring have placed their longitudinal groove. Hence much decay has evidently taken place since their day. (See Plate x.)

ANTECHAMBER AND ITS PASSAGES.

(March 14, 15, 1865.)

Floor, from North end of great step at the top of Grand Gallery, on through the antechamber and passage beyond, into King's chamber (see Plate xi.) :

The joints of this floor all go right across it from East to West wall ; the floor is horizontal.

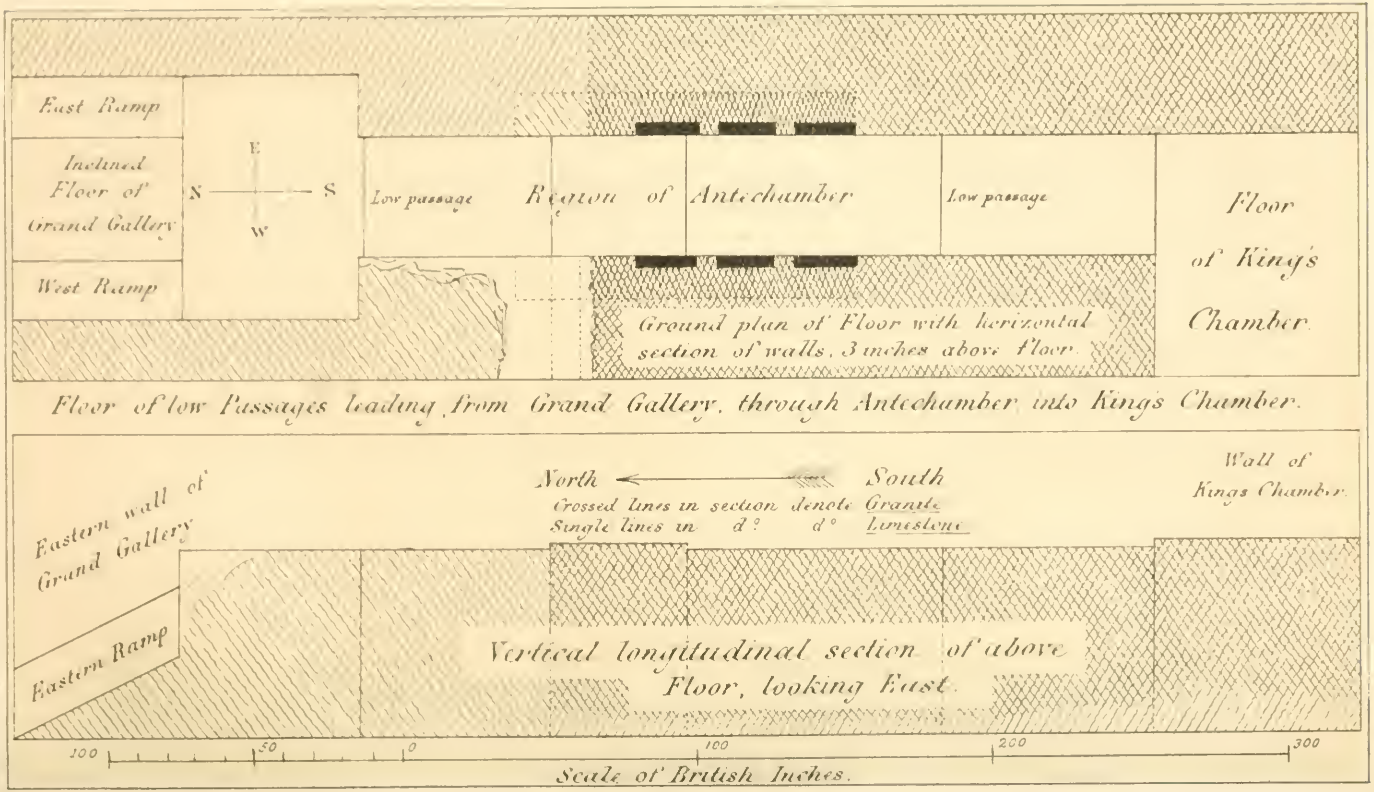
Floor-joints on East side.

No. of Joints on floor.	First measure.	Second measure.	Mean, or length from joint to joint.	Total horizontal distance from N. end of great step of Grand Gallery.	Notes.
1st or N. end of great step,	0·0	0·0	0·0	0·0	
2	62·2	62·3	62·2	62·2	
3	64·5	64·5	64·5	126·7	Limestone ends here, and granite begins.
4	47·3	47·2	47·2	173·9	
5	85·8	85·8	85·8	259·7	
6	70·6	70·5	70·6	330·3	

Floor joints on West side.

No. of Joints on floor.	Length from joint to joint.	Total distance from N. end of great step.	Notes.
1st, or great step N. end.	0·0	0·0	
2	62·0	62·0	
3	64·6	126·6	Limestone up to this point, granite beyond it for the floor.
4	47·3	173·9	
5	85·8	259·7	
6	70·6	330·3	

The northernmost *granite* stone, as from 126·6 to 173·9 in the above passage, is about 0·3 in level *above* the two limestones preceding, and the two granite stones following it ; and the last of them is about 0·8 below the level of first stone of King's chamber floor.



W. H. McFarlane, Lith. Edin.

ANTECHAMBER AND ITS PASSAGES,

FLOOR OF—*continued.*

BREADTHS of, above floor, at different parts of its length, from North end of great step of Grand Gallery.

Distance from great step.	Breadths measured.	Notes.
91	41·8 ±	This is from East wall to certain marks on floor, obscurely indicating where old West wall, now broken away, once stood.
...	50·5 ±	To present broken-away West wall.
136	41·45	Between the true ancient walls, both East and West, of granite, and under Greaves' granite leaf.
171	40·8	Normal part of floor, save chippings.
...	48·1	To sides of small rectangular trenches cut on either side of floor and into the walls high up.
214	41·2	Floor proper.
...	48·0	Floor extended by breadth of the small trenches three to four inches deep: this peculiar part of the floor is in the antechamber, and extends from 153·5 to 228·7, barring interruptions from pilasters now nearly broken away.
251	41·4	
321	41·4	

N.B.—The parts shaded in Plate XI. of this passage, with *crossed* lines, represent granite; and with *single* lines, limestone. The two walls and floor do not begin their respective granites in the same vertical plane; but all other features, as of joints, the broadened part of the floor, etc., are truly rectangular to axis of passage.

The numbers on which the particulars connected with the base of the walls are given in the above plan, are as follows :—

DISTANCE MEASURES NEAR BASE OF ANTECHAMBER PASSAGES.

	East side.			West side.		
	Distance from great step.		Longitudinal breadth of pilasters and of floor side holes.	Distance from great step.		Longitudinal breadth of pilasters and of floor side holes.
	First measure.	Second measure.		First measure.	Second measure.	
Beginning of the granite, .	136·6	136·0	...	134·0	134·3	
Beginning of cut-out in floor,	153·0	152·5		153·4	153·8	
			22·0			22·1
North edge of first pilaster,	175·2	174·5		175·4	176·0	
			5·8			5·6
South ,, ,,	181·0	180·5		181·0	182·0	
			21·4			21·
North edge of second pilaster,	202·5	202·0		202·4	203·±	
			5·8			5·6
South ,, ,,	208·3	208·0		208·0	209·±	
			21·1			20·4
End of cut-out in floor, .	229·3	229·±		229·8	230·0	
Beginning of King's chamber,	330·3	330·2	...	330·3	330·3	

Of Northern part of above passage, or near great step—
Height = 43·7, and breadth = 41·5.

And of Southern part of above passage, or near King's chamber—
Height = 43·6 to 43·8, and breadth = 41·4.

This very peculiar little antechamber, which finds itself rather north of the middle of the short horizontal passage leading from the Grand Gallery to the King's chamber,—has a much greater width than the passage, even in the part which is somewhat increased by the breadth of the side depressions in the floor. But the full width of the antechamber does not appear in the plan previously given of the passage, except by certain dotted lines, because the lower two-thirds about, of the room are filled in, on the east and west sides, by a thick wainscoting of granite ; hence the full width of the room is only clearly visible near the ceiling, and is then found to measure from

		65·0 to 65·3
while its length measures from North to South—		
near East side, ...	=	116·3
and near West side, ...	=	116·8
but along floor near East side, ...	=	116·2
the height of the room from floor to ceiling varying according to the more or less sunken position of the floor stones, ...		from 149·2 to 149·5
Circumference of walls, under ceiling, . . .	=	363·4

At a depth of 46·2 below ceiling on east side, and 37·5 on the west side, the above width of 65·2 is suddenly decreased to 41·4 and 42·0 by the sort of granite wainscot mentioned, rising from the floor up to the above-mentioned 46·2 and 37·5 from the ceiling. But the width is again increased to 48·1 in the parts extending between 39·0 and 116·0 from the north end of the room towards the south ; for within these limits of space certain broad grooves were originally cut out, leaving only narrow pilasters between, which pilasters have since been nearly completely knocked away, chip after chip, by specimen-seekers.

The position of the antechamber in the course of the passage may be obtained from the following numbers, amongst which are marked some of details which will be recognised in Plate XII.

MEASURES OF A PLAN, NEAR TOP-LEVEL OF ANTECHAMBER.

Parts measured.	East side.	West side.
North end of antechamber from North end of great step, ...	113·1	113·5
North side of slit containing granite leaf, .	132·6	133·0
North side of granite leaf, omitting boss, .	134·0	134·6
South side of granite leaf, ...	150·3	150·8
South side of slit containing granite leaf, .	150·3	150·8
South side of ridge containing granite leaf, .	153·9	153·8
South end of antechamber, ...	229·4	229·8
South end to a fractured edge, . . .	236·?	230·0

Referring now to the large opening-out of all the sides of the antechamber, Plate XII., we may state :—

Of the *ceiling*, it is of granite, in three lengths, from North to South, measuring,

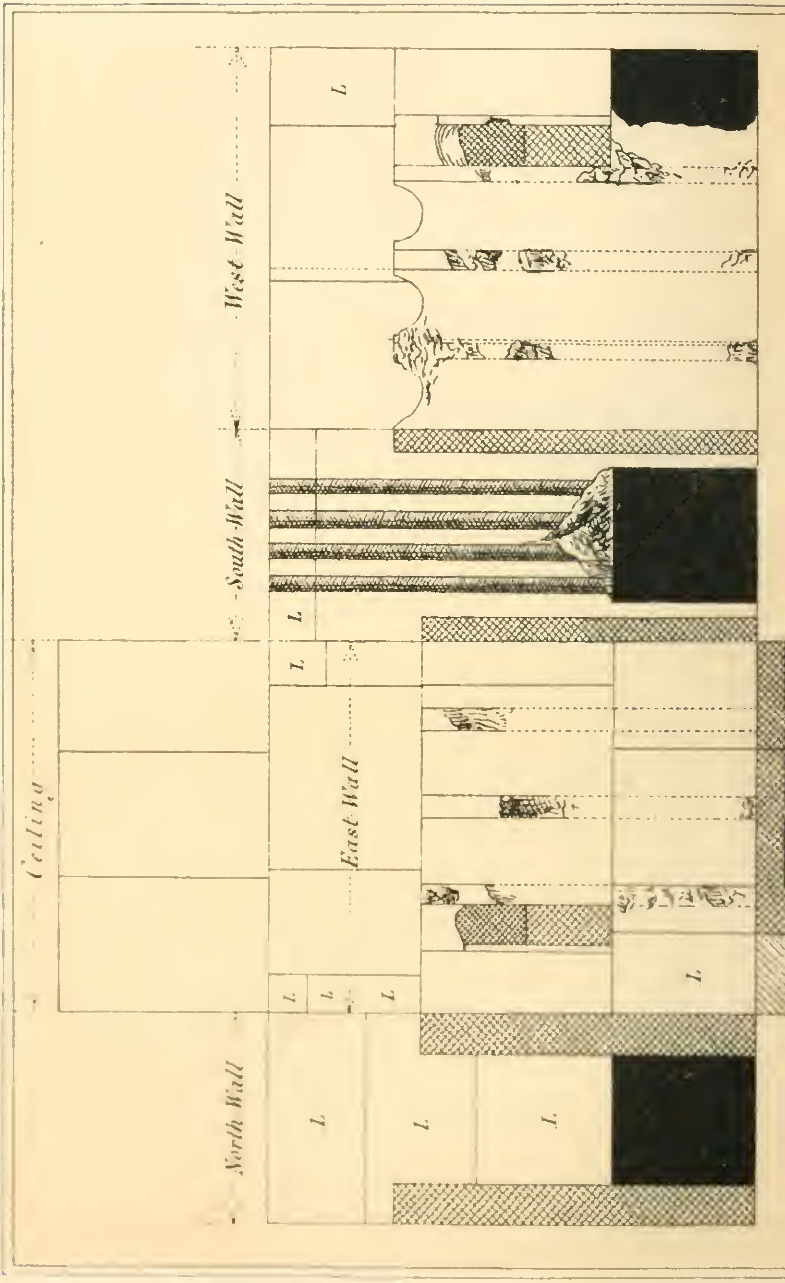
the 1st, ... = 41·5
2d, ... = 38·5
3d, ... = 36·5 nearly.

Of the *North wall*, it is of limestone, rough with pickmarks; and in three courses, measuring from the top,

1st, ... = 29·0
2d, ... = 35·3
3d, ... = 41·5
Whole height from floor, ... = 149·3
Breadth at top, ... = 65·2
,, inside granite wainscot, ... = 41·7
Depth from ceiling to granite wainscot on East side, = 46·2
,, ,, ,, West ,, = 37·5

Of the *South wall*, it is entirely of granite, except the topmost course, which is 12·0 deep of limestone,

Whole height from floor surface to ceiling, . = 149·4
,, bottom of side-hollows to do., = 152·5±
Breadth at top, ... = 65·2
Breadth elsewhere, ... = 48·1±
(*N.B.*—In this, different from its congener the North wall, where the breadth is 41·7 only.)


Ceiling
West Wall
South Wall
East Wall
North Wall
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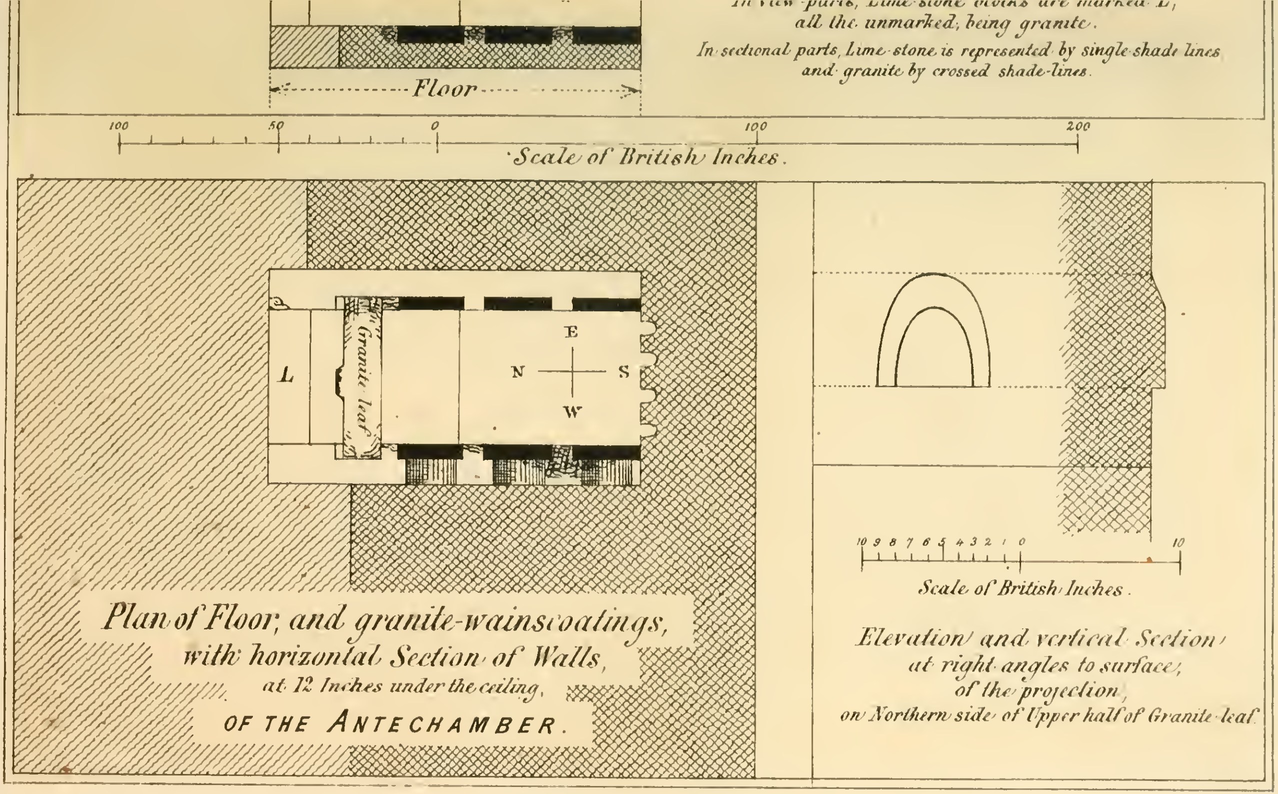

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This south end wall is chiefly remarkable for the disputed '*four*' or '*five*' vertical lines of many authors.

They are actually and really four, (4) in number; and are deep, straight, vertical grooves, which subdivide the space from east to west side, at the level of any eye, symmetrically into five parts. (Plate XII.)

Their depth, = 2·8, and their breadths, taking them from east to west, are—

Near the top,	=	3·6, 4·0, 4·0, and 4·0
And near the bottom,	=	3·4, 3·8, 3·5, and 3·3

Their shape in cross-section being somewhat parabolic. Measured from east wall near top, and therefore above the granite wainscot, their central lines are distant therefrom 17·0, 27·4, 37·9, and 47·9 respectively, and near the bottom = 9·1, 19·6, 29·6, and 39·7 respectively.

The grooved granite stone is much fissured and broken away below. (See Plate XII.)

East wall, all composed of granite, except the small stones marked L :—

Whole height from floor to ceiling, ...	=	149·3
,, length from North to South, ...	=	116·3
Height of joint of first course, above floor surface, .	=	43·7
Height from first to second course, or top of granite wainscot, ...	=	59·4
Height from second to third course or ceiling, . .	=	46·2

The granite wainscoting of this wall is 12·0 thick from wall; but has four broad grooves cut back upon it, 4·0 deep. Of these, from the north,

The first is 16·5 broad,	and extends over from	19·5 to 36·0	from N. wall
second 22·0	,, ,,	39·6 to 61·6	,,
third 21·8	,, ,,	66·4 to 88·2	,,
and fourth 22·5	,, ,,	93·5 to 116·0	,,

or to South wall.

The intervening spaces, or ribs, or pilasters, are 3·6, 5·0, and 5·3 broad respectively, but are now broken away for by far the greater part of their height. The first groove, however, is only cut to a depth of 59·4, or to bottom of granite leaf, which spans the room, leaving solid stone wainscot or wall under that; while the others all go down to about three inches under the floor.

West wall, all composed of granite, except the stone marked L.

Along the southern edge of the northernmost of the two granite stones, next under the ceiling,—is an appearance, partly of a bad joint edge and partly of a flattish curved beading; making a sensible difference from all the ordinary joints.

This west wall differs mainly from the east wall in having a higher wainscoting (higher by 8·7); and, in the tops of the three southern flat grooves (4· deep) having three semi-cylindrical hollows cut straight back to the wall, through the remaining 8·3 of thickness of the granite wainscot. These semi-cylindrical hollows have a radius of curvature = 9. The first flat vertical groove from the north descends only to the bottom of the granite leaf—

and is	17·1	broad, and extends from	20·2 to	37·3	from N. wall
the second	21·7	,, ,,	41·0 to	62·7	,,
third	21·8	,, ,,	68·0 to	89·8	,,
fourth	21·3	,, ,,	95·2 to	116·5	,,

leaving the projecting ribs between them, in the few places where they at present exist, in breadth = 3·7, 5·3, and 5·4 respectively.

This west side wall is also noteworthy at present, on account of the forced passage made from its lower north-west corner, to meet north air-channel from King's chamber.

THE 'GRANITE LEAF.'

In the antechamber's first groove from the north, is to be seen Greaves' 'granite leaf,' or the 'port-'cullis' of many authors. It is, in thickness from north to south, on east side, = 15·4; and on west side, = 16·0; crossing the antechamber from east to west in two courses,—whereof the lower is from 27·5 to 28·0 high, and the upper from 18·0 on the east to 23·5 on the west, the upper surface of this upper stone being very rude and fractured. Further, the lower side of the whole granite leaf is 43·7 above the floor, and the upper side 57·0 nearly below the roof. (See Plate XII.)

I had concluded, before visiting Egypt, that this granite leaf could not be a portcullis; because, if lowered to the floor, it would not come near enough to the door to stop it up. Local examination proved this idea correct; for the space between north wall of antechamber and north surface of granite leaf is 21 inches, so that a man can easily stand between; and he could also easily clamber over said granite leaf, if lowered to the floor. But it has not been so lowered; and cannot be, without its grooves in the east and west walls being cut lower than they are by

43·7 inches, for it stands on firm granite and limestone at that height. The granite leaf is moreover cemented into its place, and wedged in after a fashion from the north, the groove being one inch broader than the stone. The groove, as visible above the granite leaf, up to the top of the granite wainscot, is remarkably well, truly, and smoothly, made in the solid granite.

So much care could hardly have been taken to introduce, once and for all, two stones which ever after were to have been fixtures; and the present appearances are certainly in favour of their being intended to slide upwards again, rather than downwards. For what purpose? Perhaps to disclose some secret; and it is well to call prominent notice to the raised ornament on the upper of the two stones forming the 'leaf;' it is something like one of the rudimentary handles on later sarcophagi, and a most unique thing certainly, throughout the whole of the Great Pyramid. It is of the following shape in elevation and vertical section; and is 7 inches broad, and 7 high, measured on its second surface, or that next the whole stone slab; and 5 inches high, and 5 broad, measured on its first or outer surface; 1 thick, and has its lowest line 5 inches above the joint between the lower and upper stone. It is further 16 from west wall and 18 from east at its boundaries, or 19·5 and 21·5 respectively at its centre. (See Plate XII.)

KING'S CHAMBER.

(MARCH 11, 16, 18, 19, 20.)

GENERAL PROPORTIONS OF.

THIS fine room is entirely constructed in polished granite, and *appears* rectangular everywhere; the general measures of it are as follows; either by the 400-inch slider, or the 100 A and 100 B rods :—

Height of, floor to ceiling, granite both, but the floor-blocks sensibly disarranged from mutual level—

Near North-East angle of room,	=	230·8
,, middle of North side,	=	229·7
,, North-West angle,	=	229·2
,, South-West ,,	=	229·9
,, middle of South side,	=	229·5
,, South-East angle,	=	230·8
,, North-East angle, repeated,	=	230·8
Mean height,	=	230·1

The differences amongst the above measures are chiefly owing to the errors of floor-blocks, or effects of modern dilapidation.

Length of, or from East to West wall, along *South* side, near floor level—

First measure, on March 11,		=	412·6
Second ,,	,,	=	412·58
First ,,	March 16,	=	412·5
Second ,,	,,	=	412·7
South side mean,		=	412·60

And along *North* side—		
First measure, on March 11, ...	=	412·4
Second ,, ,, ...	=	412·5
First ,, March 16, ...	=	412·5
North side mean,	=	412·5
Mean length for whole room,	=	**412·55**
Breadth, or from North to South wall—		
Near East side, first measure, ...	=	206·4
,, second ,, ...	=	206·2
East side mean,	=	206·3
Near West side, first measure, ...	=	206·3
Mean breadth for whole room,	=	**206·3**
Diagonals of Floor—		
From South-West to North-East corners, . . .	=	462·0
,, North-West to South-East ,, . . .	=	461·3
Mean measured diagonal floor,	=	461·7
And same computed from sides, 412·6 and 206·3, . . .	=	461·3
Diagonals of East wall—		
Low North-east corner to high South-East, . .	=	309·2
Low South-East corner to high North-East (subtracting 1·6 for hole in low South-East corner),	=	310·0
Mean diagonal for East wall,	=	309·6
And same computed from breadth and height, 206·3 and 230·1, .	=	309·0
Diagonals of West wall—		
Low South-West corner to high North-West, .	=	310·4
Subtract 1·0 for a sunk floor stone, . .	=	1·0
		309·4

Low North-West to high South-West cannot be measured by reason of deep hole in floor in low North-West corner.

The diagonals of the north and south walls were unfortunately rather too long to measure: there is however every probability, from angular measures subsequently taken, that they are as nearly rectangular and parallel, as are the east and west walls.

KING'S CHAMBER, FLOOR OF.

This floor, though once exquisitely level in polished granite, and greatly praised by Howard Vyse and others for its remarkably close joints,—is now much decomposed as to some stones being higher, some lower, than others, by a total quantity of more than an inch. An effect, one is inclined to think, resulting, possibly, from earthquake action subsequently to the large excavations in the neighbourhood of this room, carried on both by the Colonel and Signor Caviglia: and it is worth while to record here, that Mr. Sopwith, in his *Notes on Egypt*, mentions finding the house of the engineer of the railway between Alexandria and Cairo half ruinous, in December 1856, from a then recent shock of earthquake.

The blocks of the floor are notably arranged in six grand stripes crossing the length of the room: but they are not equal in breadth. The joints, measured in the usual manner, give the following results :— (See Plate XIII.)

JOINTS ALONG SOUTH SIDE.

Joint.	Lengths, joint to joint.	Total distances from East side.	Remarks.
East wall,	0·0	0·0	
	(29·5)	(29·5)	A half stone merely.
1	63·2	63·2	
2	67·9	131·1	
	(46·6)	(177·7)	A half stone again.
3	88·3	219·4	
4	67·6	287·0	
5	67·0	354·0	
West wall,	58·6	412·6	

KING'S CHAMBER,

Floor of—*continued.*

Joints along North Side.

Joint.	Lengths from joint to joint.	Total Distances from East side.	Remarks.
East side,	0·0	0·0	
1	63·2	63·2	
2	68·0	131·2	
3	88·0	219·2	
4	67·8	287·0	Portions of the northern ends of these last three rows of stones have been extracted, leaving a hole.
5	66·9	353·9	
West wall,	58·6	412·5	

Joints along East Side of the several North and South Floor-courses.

Name of Joint.	East side.	Second line of blocks West of East wall.	Third line of blocks West of East wall.	Fourth line of blocks West of East wall.	Fifth line of blocks West of East wall.	Sixth line of blocks West of East wall.
North side,	0·0	0·0	0·0	0·0	0·0	0·0
1	107·4	20·1	55·0	21·1	34·3	21·0
2	78·8	93·2	46·9	136·2	152·0	...
3	...	...	83·9	...	...	...
South side,	20·1	93·1	20·6	49·1	20·1	185·3
Sum, giving breadth of chamber,	206·3	206·4	206·4	206·4	206·4	206·3

The 'coffer' stands upon the open floor of this room, without apparently any mark to guide its placing, or anything to prevent its being pushed about anywhere. It is nevertheless most probably still very near its original position, for its place is very similar to that of the sarcophagus *sunk* up to its top in the floor of the large chamber of the second Pyramid. But the place evidently has been *somewhat* disturbed, for the south end of coffer is tilted up on a stone, a black flint pebble of modern pushing in, and about 1·5 high; the coffer is also nearer the north wall than the south by 20 inches; and is further askew on the floor, so that north end of west side is nearer to west wall, than is the south end of same side, by 2·5 inches; the distances measured in direction of coffer's sides being thus:—

South-East corner,	from	South wall, ...	=	68·6
South-West	,,	,, ,, ...	=	67·9
North-East	,,	North ,, ...	=	47·7
North-West	,,	,, ,, ...	=	48·6
North-West	,,	West ,, ...	=	53·8
South-West	,,	,, ,, ...	=	56·3

KING'S CHAMBER, WALLS OF, GENERALLY.

These walls, by many persons thought the chief triumph of the Pyramid-builders' architectural skill, from the fineness and evenness of the joints, are also symbolically remarkable in being composed of five horizontal courses which run round and round the room, of the same height everywhere, and all of them of equal height with each other to 0·1 of an inch,—with only the single interference, viz., that over the doorway, to make its roof very strong, there is an enormous block introduced, equal, throughout its length of 122·7 inches, to exactly *two* of the courses.

The '*fiveness*' of these courses is all the more noteworthy, because, while it seems to have been called attention to by the builders, in the four deep lines which subdivide the space over the antechamber entrance to this room into *five* portions,—many travellers have written that the number of courses in the King's chamber is *six*. (See Plate XIII.)

Yet not only are they five only, but all the five are of equal height, viz., 47·0 inches; for though the lower course appears, on being measured off the floor, to be only 42·0 inches,—yet the hole which exists in the north-west corner of the floor, enables one to see there the construction of the walls, and to perceive and feel that the granite of the lowest wall-course goes down five inches under the level of the floor before it comes to a joint; and then rests on limestone, as shown in a sketch made at the place, and to be seen in one corner of Plate XIII.

To prove beyond all doubt that there are five, and not six courses, I wished to have measured the height of each course, and then compared the sum of their heights with the whole height previously given by the great measuring-rod; but not being able to reach the *upper* courses, I give *them* only by eye-estimation, placing them in brackets in the following table: but supplying everything else by direct measure: the *roughness* of the first-course measures being due to the disorganized state of the floor.

VERTICAL HEIGHTS OF WALL COURSES IN KING'S CHAMBER, AS MEASURED IN DIFFERENT DIRECTIONS SEEN FROM THE CENTRE OF ROOM.

Directions bearing from centre.	Height of first course from floor.	Height of second course from floor.	Height of third course from floor.	Height of fourth course from floor.	Height of fifth course from floor.	Sum of heights of courses.	Height of room in same part by a previous independent measure.
E.-N.-East,	42·1	47·0	47·1	(47·0)	(47·0)	230·2	230·8
East, . .	42·4	47·0	(47·0)	(47·0)	(47·0)	230·4	...
E.-S.-East, .	42·7	47·1	47·0	(47·0)	(47·0)	230·8	230·8
S.-S.-East, .	Wall much fissured through several courses.						...
South, .	41·1	47·0	(47·0)	(47·0)	(47·0)	229·1	229·5
S.-S.-West,	41·4	47·0	47·0	(47·0)	(47·0)	229·4	229·9 (S.-S.-West and W.-S.-West)
W.-S.-West,	41·6	47·0	47·0	(47·0)	(47·0)	229·6	
West, .	41·6	47·0	(47·0)	(47·0)	(47·0)	229·6	...
W.-N.-West,	41·2	46·9	47·0	(47·0)	(47·0)	229·1	229·2
N.-N.-West,	Hole in floor caused by removal of three blocks.						...
North, .	42·0	47·1	(47·0)	(47·0)	(47·0)	230·1	229·7
N.-N.-East,	42·3	47·0	47·0	(47·0)	(47·0)	230·3	230·8

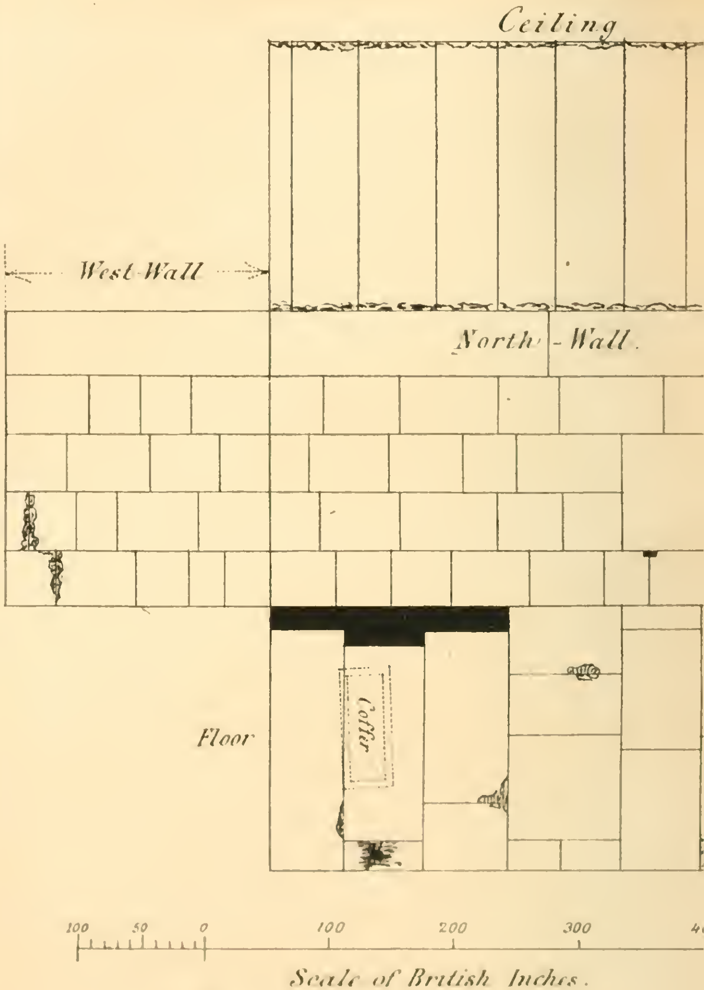
The above table can leave no doubt of the number of courses being five, or a characteristic Pyramid number: and as respects their equality of height round every side of the room, that must have cost a great effort in many ways; for elsewhere in the Pyramid, and as more particularly seen in the granite lining of King Shafre's tomb, if the object was to build a wall surface merely, the architect simply built a good surface, and cared not what the sizes and even heights of two adjoining stones were, so long as the joints between them were close and true. The argument therefore follows, that something more than a good wall was wanted, or that something further was intended to be symbolized, by these *five* courses in the King's chamber.

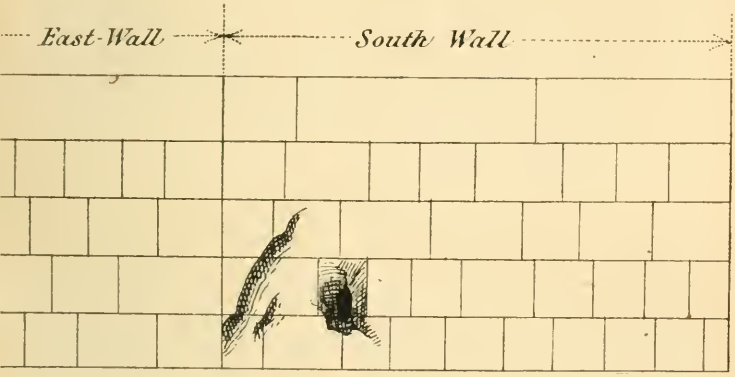
Each of the above five courses is formed in the run of its length, of many blocks, whose lengths are various; and apparently therefore, symbolically unimportant. I measured the lengths, however, in the three lower courses; and am enabled now, by the kindness of Mr. Aiton, to add the measures of all five, as taken soon after I had left by Mr. Aiton's assistant, Mr. Inglis. A comparison of his numbers with mine, through the three first courses, will indicate the possible limits of error where his stand alone: I have noted to my own, that the measures are very rude, and *not* worthy of competing in their united lengths for determining the whole length of any of the walls.

EAST WALL, VERTICAL JOINTS IN.

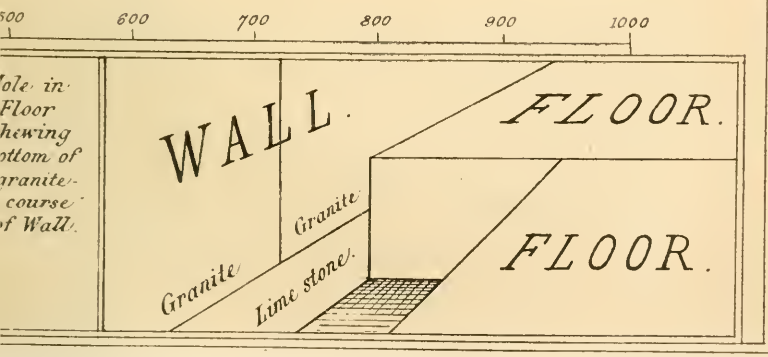
Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
North wall.	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	16·8	15·9	16·8	71·6	72·0	71·6	52·7	52·9	52·7	43·0	43·0	..	..
2	30·5	31·0	47·3	56·8	55·9	128·4	(44·8	33·0	97·5	37·9	80·9	..	..
3	44·0	44·0	91·3	..	..	..	(58·2	69·0)	155·7	48·0	128·9	..	..
4	65·4	65·0	156·7	..	..	..	..	..	..	35·0	163·9	..	..
South wall.	49·5	49·9	206·2	77·7	78·0	206·1	50·5	51·0	206·2	42·0	205·9	205·9	205·9

The brackets on two sets of numbers of the third course call attention to a case of certain blunder, either of mine, or Mr. Inglis's; but which,—it is now left to some third observer to determine.


Ceiling
West Wall
North -Wall.
Coffer
Floor
100 50 0 100 200 300
Scale of British Inches.



THE SIDES OR WALLS, FLOOR & CEILING
OF KING'S CHAMBER
opened out on
plane of North-Wall.



W H Mc Farlane Lithr Edinr

West Wall, vertical Joints in.

Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
South wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	36·0	36·0	36·0	14·7	15·0	14·7	47·8	48·0	47·8	65·0	65·0	..	..
2	61·7	61·9	97·7	37·6	37·0	52·3	67·4	67·9	115·2	41·0	106·0	..	..
3	42·0	42·0	139·7	34·9	35·0	87·2	58·3	58·1	173·5	41·0	147·0	..	..
4	32·3	31·9	172·0	69·0	69·0	156·2	..	..	..	..	..	..	..
North wall,	34·4	34·1	206·4	50·2	47·9	206·4	32·5	31·9	206·0	58·8	205·8	205·9	205·9

North Wall, vertical Joints in.

Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
West wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	54·5	55·9	54·5	38·7	37·9	38·7	(36·0	48·5)	36·0	46·0	46·0	222·0	222·0
2	45·4	42·6	99·9	65·8	66·0	104·5	(63·6	51·4)	99·6	61·9	107·9	..	..
3	49·5	49·9	149·4	77·4	77·0	181·9	61·5	61·4	161·1	79·0	186·9	..	..
4	63·0	63·0	212·4	53·5	53·0	235·4	44·2	44·0	205·3	51·0	237·9	..	..
5	57·5	57·5	269·9	54·5	55·4	289·9	83·9	84·0	289·2	84·0	321·9	..	..
6	40·2	40·0	310·0	..	..	..	..	..	..	54·0	375·9	..	..
Door side or } 7	62·0	61·4	372·1	..	..	..	..	..	..	..	..	..	..
East wall,	41·2	41·5	413·3	122·7	122·4	412·6	122·7	122·4	411·9	36·0	411·9	190·0	412·0

South Wall, vertical Joints in.

Joint.	Lowest course.			Second course.			Third course.			Fourth course.		Fifth or top course.	
	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Length joint to joint.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.	Aiton and Inglis.	Total distance.
East wall,	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0
1	37·1	37.4	37·1	79·8	79·8	79·8	43·0	43·0	43·0	51·0	51·0	60·0	60·0
2	63·0	63·0	100·1	35·0	35·3	114·8	55·5	55·0	98·5	67·0	118·0	193·0	253·0
3	37·5	37·4	137·6	39·0	40·0	153·8	70·6	72·0	169·1	45·0	163·0	..	..
4	46·0	46·1	183·6	38·8	39·0	192·6	119·8	120·0	288·9	42·0	205·0	..	..
5	47·4	47·5	231·0	56·2	55·6	248·8	63·7	63·8	352·6	72·0	277·0	..	..
6	39·5	39·6	270·5	47·5	47·5	296·3	..	..	..	43·0	320·0	..	..
7	40·3	40·0	310·8	41·0	41·0	337·3	..	..	..	42·0	362·0	..	..
8	40·3	40·1	351·4	38·7	38·5	376·0	..	..	..	..	..	..	..
9	42·6	43·0	393·7	..	..	..	..	..	..	..	..	..	..
West wall,	19·1	18·0	412·8	36·2	35·3	412·2	59·0	58·0	411·6	49·9	411·9	159·0	412·0

REMARKS ON THE WALLS INDIVIDUALLY.

East Wall.

Good joints, and smooth surfaces of granite; no peculiarity except the unfortunate Russian-German inscription

TCHARIKOFF NADLERBERG
1845 $\frac{10}{22}$ Mai

smeared on in black oil-paint, and in letters six to twelve inches high.

West Wall.

This wall has joints in two courses near its southern end, low down, and therefore not far from the coffer,—seriously chipped by travellers for specimens.

North Wall.

This is chipped all round the corners of doorway, and round the air-hole.

This northern air-hole goes straight and rectilineally in, to a distance of more than 100 inches; after which it is stopped up with modern broken stones and sand.

On the north wall the measures of the mouth of the air-channel, which is rectangular, are as follows:—

East side of North air-hole distant from East end of room,	=	98·3
West ,, ,, ,,	=	106·6
Breadth of air-hole,	=	8·3
Height of top, from floor of room,	=	42·0
,, bottom on East side, from floor,	=	36·4
,, ,, West ,,	=	36·2
Tallness of air-hole,	=	5·7

South Wall.

Remarkable for fissures near east end, passing through several courses as they stand ; there is much surface-fissuring also about the mouth of the air-channel. (See Plate XIII.)

This air-channel's mouth is a large, arch-roofed, tunnel-shaped thing ; but at a distance inwards of from 50 to 100 inches it gradually decreases to much about the same size and proportions as the northern air-hole.

East side of South air-hole, at its broadest part, distant from East end of room, ...	=	91·4
East side of South air-hole, at level of first course, distant from East end of room, . . .	=	93·0
Breadth of the hole, at its broadest part, . .	=	17·5
,, at level of first course, . .	=	11·0
Tallness of hole, ...	=	23·1
Height from floor to top of hole, . . .	=	59·5
,, bottom of hole, . .	=	36·4

N.B.—The far-in, narrowed portion of this hole, seems to be beneath the level of the first wall course, similarly with the northern air-hole.

Ceiling.

The ceiling of the King's chamber is remarkably finished in appearance, being composed of polished granite, which crosses the room in lengths from north to south. In the run from east to west there are *nine* of these flat beams, but the two end beams have something more than the half of their breadth concealed ; there are therefore in reality only *seven* full beams, and two portions of beams to form the ceiling. The breadths, however, of the whole ones are not equal; and hence the number is probably not important symbolically. (See Plate XIV.)

I did not measure the breadth of these beams myself; but having compared Mr. Perring's drawings with Messrs. Aiton and Inglis's measures, and found a certain amount of resemblance, though not so close as it might be,—have deduced the following probable breadths, approximately :—

						Whole distances from East wall.
East wall of ceiling of King's chamber,					= 0·0	0·
East wall to Joint 1			,,	,,	= 22· (?)	22· (?)
Joint 1	to	2	,,	,,	= 50· (?)	72· (?)
,, 2	,,	3	,,	,,	= 52· (?)	124· (?)
,, 3	,,	4	,,	,,	= 53· (?)	177· (?)
,, 4	,,	5	,,	,,	= 49· (?)	226· (?)
,, 5	,,	6	,,	,,	= 46· (?)	272· (?)
,, 6	,,	7	,,	,,	= 61· (?)	333· (?)
,, 7	,,	8	,,	,,	= 57· (?)	390· (?)
,, 8 to West wall,			,,	,,	= 22· (?)	412·

These beams, of course, cross the King's chamber in one entire length; and not only so, but extend over the thickness of the granite lining of the walls, or 60· inches on either side. As the beams are further of greater depth than breadth, in joist fashion, they form altogether some of the largest and heaviest stones known to exist in the whole Pyramid; and one of them at least, has a

Breadth of	. . .	60· inches
Depth of	. . .	80· ,,
And Length of	. . .	326· ,,

The sum in cubic inches, amounting to 1,564,800.

Yet this mighty ceiling, as every one knows since Colonel Howard Vyse's admirable discovery, has above it, five successive ceilings, all designed to assist in taking off the extreme pressure of the upper part of the Pyramid on the lowest ceiling. I did not visit those upper chambers, being quite content with the Colonel's and Mr. Perring's measurements thereof; but inasmuch as they contain the dark and closed-up hollows, wherein the quarry-marks expressing the names of kings of the fourth dynasty have been found on some of the stones, and are necessary to understanding the mechanics of this room,—I subjoin two drawings of them, prepared from the Colonel's large publication. (See Plate XIV.)

The granite, in section is indicated by cross lines; limestone, by single lines. The quarry-marks are found only on limestone, and that from Mokattam. The lowest of the five chambers of construction had been known before Colonel Howard Vyse's time, being called indeed after an English consul, Davison, in the eighteenth century, as duly mentioned by the Colonel in his honest and faithful volumes.

THE COFFER.

MARCH 20-23, 25.

THIS vessel, the sole contents of the King's chamber, and termed, according to various writers, stone box, granite chest, lidless box, porphyry vase, sarcophagus, and coffer,—is composed, as to its material, of a blackish variety of red granite. And there is no difficulty in seeing this; for although the ancient polished sides have long since acquired a dark chocolate hue,—there are such numerous chips effected on all the edges in recent years, that the component crystals, quartz, mica, and felspar may be seen even brilliantly. (See Plate I. vol. i.)

The vessel is chipped around, or along, every line and edge of bottom, sides, and top; and at its south-east corner, the chippings extend to a breaking away of nearly half its height from the top downwards. It is, moreover, tilted up at its south end, by a black flint pebble, about 1·5 inch high, pushed in underneath the south-west corner. The vessel is therefore in a state of strain, aggravated by the depth to which the vertical sides have been broken down near one corner; and great care must be taken in outside measures, not to be misled by the space between some parts of the bottom and the floor.

As for the under surface of the bottom, I felt it, near the south end, with my hand; and tried to look under it also, when a piece of magnesium wire was burning there,—without being sensible of any approach to hieroglyphics or engraving. But as to the inside, or upper, surface of the bottom, and the vertical sides of the vessel, both inside and out,—all the ancient surfaces there are polished smooth; they are also, all of them, simple, plain, and flat (sensibly to common observation); excepting only the top margin,—which is cut into, in a manner implying that a sarcophagus lid once fitted on, sliding into its place from the west, and fixable by three steady pins, entering holes on that side.

The west side of the coffer is therefore lowered all over its top surface, except at the north and south ends, by the amount of depth of such lid cut-out, or 1·72 inch; and the other, or east, north, and south sides, are, or should be, lowered to the same depth *on their inner edges*, and to a distance from inside to out, of about one-third the whole thickness. But the fulness of this arrangement cannot be seen now, because in some places, both ledge and top of sides are broken away together; and in others, though much of the inner angle of the ledge remains,—thanks to its protected position,—the upper and true surface of the side has all been chipped away. In fact it is only over a short length near the north-east corner of the coffer, that the chippers have left any portion of the original top surface.

The whole question, therefore, of the full depth of the coffer, rests on that one small portion of the north-east wall, so to speak, of the coffer.

At the north-east corner only, is there an opportunity of measuring the vertical depth between the ancient top surface of a side, and the bottom surface of the *ledge;* and it was, by repeated measure, found = from 1·68 to 1·70 and 1·75 ; say mean = 1·72 inch.

The sides of the depression are vertical, or without any dovetailing: and the horizontal breadth of such cut-out,—measuring from within, to, or towards, the 'without' of the coffer,—and restoring the sides to their original completeness before the chipping away of the edges,—is—

On and near Western portion of Northern side,			=	1·65
,,	Middle	,, ,,	=	1·62
,,	Eastern	,, ,,	=	1·73
,,	Northern part of Eastern side,		=	1·55
,,	Middle and North-east ,,		=	1·60
,,	Southern	,, ,,		*all broken.*
,,	Eastern and Western parts of Southern side, . . .			*all broken.*

Along the western side are three fixing-pin holes, 1·2 deep, and 0·84 in diameter, save where they are broken larger, as is chiefly the case with the middle, and southern one. The three holes have their centres at the following distances from north end ; viz., 16·0, 45·3, and 75·1 respectively.

It is inconceivable how the French Academicians could have pictured the coffer, without noticing the ledge cut-out; unless they looked upon that, as a comparatively modern attempt to convert the original pure coffer, into a sarcophagus: and which they were therefore bound to overlook.

OUTSIDE OF COFFER: ITS FIGURE.

The planes forming the four external vertical sides of the coffer, are far from true; excepting the east one, whose errors are under 0·02; while the north, west, and south sides are so largely concave as to have central depressions of 0·3 and 0·5; or more particularly—

At North side, central hollow or depression of coffer's side (measured from a horizontal straight-edge touching the side at either end, and in a horizontal plane), or the quantity, *d*, near bottom,	=	0·45
,, middle of height,	=	0·20
,, top,	=	0·12
Mean,	=	0·26
At West side, *d*, near bottom,	=	0·35
,, ,, middle,	=	0·15
,, ,, top,	=	0·10
Mean,	=	0·20
At South side, *d*, near bottom,	=	0·28
,, ,, middle,	=	0·18
,, ,, top,	=	0·10
Mean,	=	0·19

Again, when the straight-edge is applied *vertically* to the sides,—east side comes out true, but the others concave—

On North side, the maxima of such depression, or $d' = 0\cdot20$ and $0\cdot28$
On West side, d', at South end, ... = 0·00
and d', at North end, ... = 0·20
And on South side, d', at different distances from East to West, ... = 0·08, 0·12, and 0·04

ITS SIZE, OUTSIDE.

The corners and edges of the coffer are so much chipped, that the steel claws I had had prepared for the sliding-rods to adapt them from inside to outside measures, were found not long enough to reach the original polished surfaces. A method was therefore adopted, of making up the sides with straight-edges projecting beyond the coffer at either end; and then measuring between such straight-edges, and on either side, or end, of the coffer.

LENGTH OF COFFER OUTSIDE, MEASURED WITH BAR 100 A.

	1st Measure.	2d Measure.	3d Measure.
On East side, near bottom, . .	90·5	90·3	90·5
,, 10 inches under top,	90·15	...	...
,, above top, . .	90·20	...	...
On West side, near bottom, . .	89·2	89·2	89·2
,, above top, . .	89·95	...	...
,, near top, . .	90·05	...	...
Mean, . . .	90·01	...	...

The above mean, however, represents only the mean length of the edges of the two sides, not of the whole coffer, on account of the concavity of the two external ends; wherefore, if we desire to state the mean length, for the mean of each end surface, we must subtract two-thirds of the mean central concavity, as previously determined; *i.e.*, = 0·17 for the north end, and similarly 0·13 for the south end; wherefore, then, the mean length for mean of each end of coffer . . = **89·71**

Breadth of Coffer, outside.

	1st Measure.	2d Measure.	3d Measure.
At North end, near bottom, . .	39·05	39·1	39·2
,, near top, . .	38·7	...	...
,, over top, . .	38·67	...	...
At South end, near bottom, . .	38·8	38·7	...
,, near top, . .	38·6	...	...
,, over top, . .	38·5	...	...
Mean, . . .	38·72	...	...
Correction for curvature of West side, . .	·07	...	...
Mean breadth of mean sides,	38·65	...	...

Height of Coffer, outside.

Height of coffer outside, eliminating the stone under bottom, and the sarcophagus ledge of 1·72; *i.e.*, measuring from coffer-bottom to *extreme* top of sides, is—

At North end, eastern part of it, ...	=	41·3
Same repeated, ...	=	41·3
At North end, north-eastern part of it, . .	=	41·22
At other parts, no top left.		
	Mean,	41·27

Correction for a supposed hollow curvature of under side of bottom; agreeably with three, out of the four, upright sides; and also agreeably with the construction of the under sides of the casing-stones, which rest on their circumferences, on account of a slight hollowing away of their central areas; not less than . . = ·10

41·17

SIDES, THICKNESS OF.

For this purpose two vertical straight-edges were placed opposite each other, in contact with the inside and outside surfaces of any flank of the coffer, and the distance across measured; finding at successive parts of the coffer circumference, bearing from centre—

South-south-west,	thickness,	=	6·0
South,	,,	=	6·0
South-south-east,	,,	=	5·95
East-south-east,	,,	=	5·85
East,	,,	=	5·95
East-north-east,	,,	=	6·10
North-north-east,	,,	=	5·95
North,	,,	=	5·98
North-north-west,	,,	=	6·10
West-north-west,	,,	=	5·95
West,	,,	=	6·10
West-south-west,	,,	=	5·95
	Mean thickness of vertical sides,	=	5·99

The above measures were repeated on March 28th, and proved sensibly true for this method of measurement over the top edge of the coffer; but if calipered lower down, it is extremely probable that a notably different thickness would have been found there.

BOTTOM OF THE COFFER, THICKNESS OF.

By difference of heights of two straight-edges of equal length, applied, one inside and one outside,—the outside one being further propped up where required by a third straight-edge, inserted under the bottom,—there was found—

Under South-west corner, thickness of bottom,			= 7·0
,, East side,	,,	,,	= 6·6
,, East-north-east,	,,	,,	= 6·87
,, East-north-east, again,	,,	,,	= 6·90
,, North end,	,,	,,	= 6·90
,, North-north-west,	,,	,,	= 6·85
,, North-north-east,	,,	,,	= 6·80
,, West-north-west,	,,	,,	= 7·20
,, West,	,,	,,	= 6·90
,, South-south-west,	,,	,,	= 7·15
Mean thickness of bottom around the edges (the thickness of bottom in the centre cannot at present be measured),			= 6·92

INTERNAL MEASURES.

The inside surfaces of the coffer, seem very true and flat over the greater part of their extent; but betray, on examination by straight-edges, a slight convergence at the bottom, towards the centre.

INSIDE LENGTH OF COFFER, BY SLIDER 70.

(Correction + 0·13 added to all the readings for length of Slider.)

Distance between East and West sides of the North and South ends.	Level at which observations were taken.			
	4 to 6 inches under top.	Middle of height.	6 to 7 above bottom.	0·6 above bottom.
Close to Eastern side,	Broken at S.-E. corner.	78·08	77·93	77·68
At ⅓d breadth from East,	78·06	78·06	77·97	77·56
Halfway between E. and W.,	78·06	78·08	78·06	77·53
At ⅔ds breadth from East,	78·05	78·09	78·06	77·59
Close to west side,	78·03	78·06	78·01	77·57
Mean at each level,	78·05	78·07	78·01	77·59
Mean of the whole, or inside length of coffer,	= 77·93			

Inside Breadth of Coffer.

(By Slider 25, not requiring any correction.)

Distance between North and South end, along the East and West sides.	Level at which observations were taken.				
	Near top.	Near middle.	6 to 7 above bottom.	0·6 above bottom.	0·6 Re-measured.
Close to North end, .	26·68	26·69	26·65	26·40	26·39
At ⅓d length from N. end,	26·60	26·69	27·00	26·72	26·54
Near middle of length, .	26·64	26·80	27·10	27·05	27·05
At ⅔ds length from N. end,	26·67	26·78	26·77	26·67	26·75
Close to South end, .	26·78	26·78	26·63	26·49	26·49
Mean at each level, .	26·67	26·75	26·83	26·67	...
Mean of the whole, or inside breadth of coffer, .	= 26·73				

Inside Depth of Coffer.

The measure of this element is taken from the inside bottom of the coffer,—which is apparently smooth and flat,—up in the shortest line to the level of the original top-surface of the north, the east, and the south sides; and of the west side also, *presumably*, before it was cut down to the level of the ledge which runs round the inner edges of the north, east, and south sides.

Now, the depth of that ledge was before ascertained = 1·72 inches below the original top; a block of wood was therefore prepared of that thickness, and placed on the west side, to support one end of a straight-edge, whose other end rested on some part or parts of the original top, which is still preserved at and about the north-east corner.

INSIDE DEPTH FROM ORIGINAL TOP OF NORTH, EAST, AND SOUTH SIDES.

(By Slider 25, not requiring any correction.)

Part of Length where observations were taken.	Part of Breadth where observations were taken.			
	Near East side.	Near middle.	Near West side.	Mean at each part of length.
0·6 south of inner N. end,	34·30	34·28	34·26	34·28
3·0 south of inner N. end,	34·44	34·36	34·35	34·38
5·0 Do. do. .	34·42	34·41	34·28	34·37
10·0 Do. do. .	34·40	34·38	34·28	34·35
24·0 Do. do. .	34·36	34·38	34·26	34·33
Mean at each part of breadth, .	34·38	34·36	34·29	34·34
General mean, or inside *depth* of coffer, .	= 34·34			

COFFER, INSIDE MEASURES OF.

DIAGONALS.

Diagonals inside the north end; from either low corner at bottom, up to a measured height of 30·0, or the greatest height quite free from fractures; then—

from low North-east to 30· high North-west, = 39·71
and from low North-west to 30· high North-east, = 39·70

Diagonals inside west side; from either corner below, up to a height of 30 inches measured at the sides—

or from low South-west to 30· high North-west, = 83·19
and from low North-west to 30· high South-west, = 83·13

CUBICAL DIAGONALS.

From low South-west	to 30· high North-east,	=	87·13
,, South-east	,, North-west,	=	87·05
,, North-east	,, South-west,	=	87·06
,, North-west	,, South-east, temporarily supplied,	=	87·11

These diagonals give sensibly less than the mean lengths and breadths; on account, apparently, of the extreme points of the corners of the bottom not being perfectly worked out to the exact intersection of the general planes of the entire sides. But they seem abundantly sufficient to prove general rectangularity of figure, in the main part of the coffer's interior.

AZIMUTH TRENCHES.

JANUARY.

On the east side of the Great Pyramid, several explorers have described certain *trenches* cut in the rock. Their notices, nevertheless, generally refer to a system of Pyramid *passages*, one entering the ground at a steep angle from the south, and another from the north; and meeting below the surface, in a vertical and meridian plane. These are therefore not trenches proper, or hypœthral cuts in the ground,—but tunnellings into its substance; on a very much smaller scale too, than the *trenches* of which we have now to speak,—and have denominated *azimuth* trenches.

These azimuth trenches, then, are a sort of large open ditches, spread about here and there on the surface of the hill, before the eastern face of the Great Pyramid; and not very noticeable, except for their relative angles in a horizontal plane; for these gave me the idea, at first sight, of being strangely similar to the dominant angles of the exterior of the Great Pyramid. (Plate xv.)

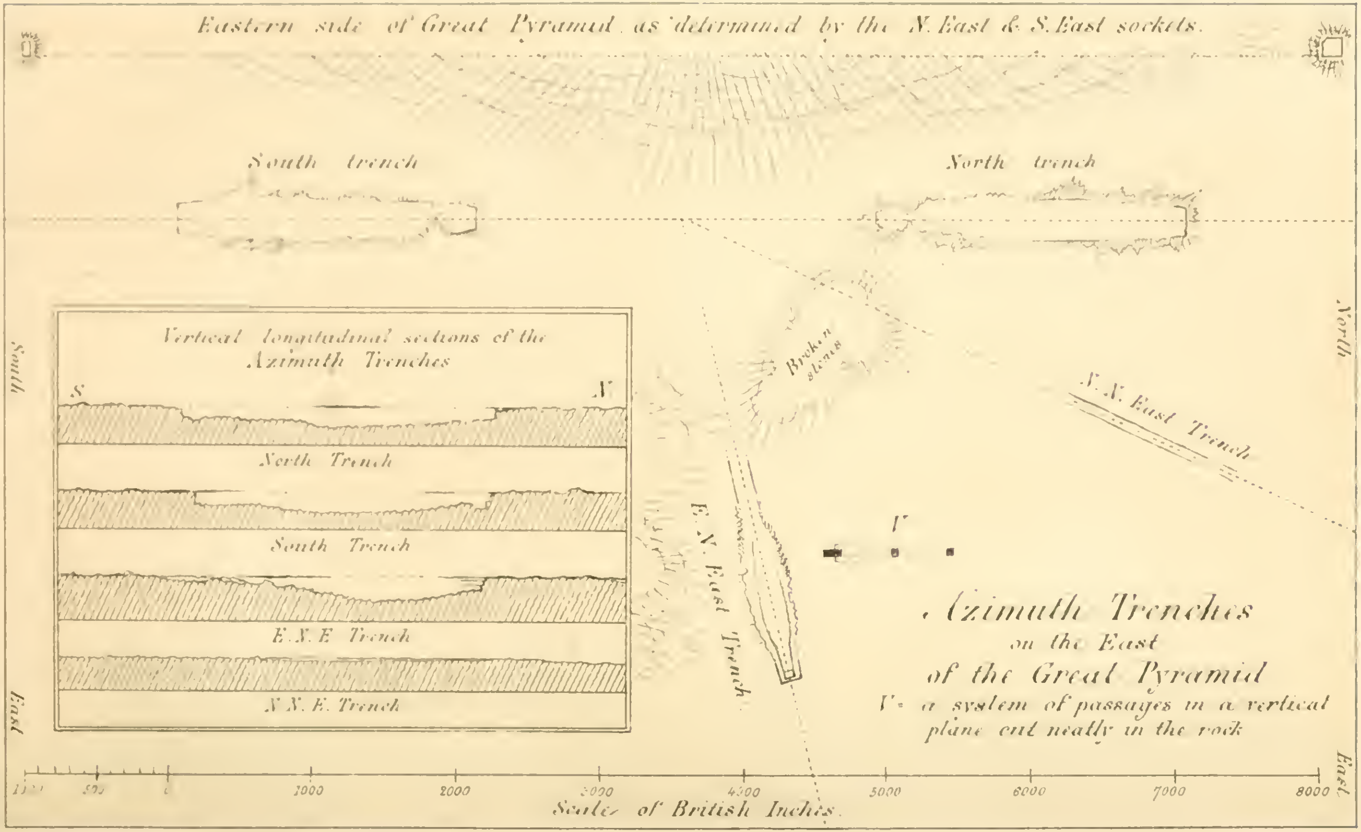
To ascertain whether this idea was true or not, I determined to measure all the angles rather carefully; and, as a necessary preliminary, proceeded to make myself acquainted with the forms of the trenches, by approximate linear measures. The trenches are four in number, named the North, the South, the East-north-east, and the North-north-east; the latter being a very small one (in breadth and depth), and only to be thought of in connexion with the others when looking to its angular position on the ground. The trenches are shown on the accompanying Plate (xv.), where I have endeavoured to mark wherever there is a *worked* surface still existing; and the numerical dimensions are as follows :—

NORTH TRENCH.

Total axial length, ...	=	2138 inches.
Distance of its furthest end from central point c, .	=	3492
Distance of same from North side of base of Pyramid, produced eastward, but uncertainly, . .	=	950 ?
Distance of longitudinal axis, from East side of Pyramid base, uncertainly, ...	=	1220 ?
Depth, at North end, worked surface, . .	=	70
,, near middle, worked surfaces, ...	=	110
,, about 200· short of South end, . . .	=	100
Breadth, at North end, worked corners, . .	=	177
,, near middle, ...	=	280
,, South end, smaller than North, but uncertain.		

SOUTH TRENCH.

Total axial length, ...	=	2060
Distance of its furthest end from central point c,	=	3490
Distance of same from South side of base of Pyramid, produced east, but uncertainly, . .	=	1020 ?
Distance of longitudinal axis, from East side of Pyramid base, uncertainly, ...	=	1250 ?
Depth at South end, worked surface, ...	=	70
Depth at North end, first step, worked surface, .	=	25
,, ,, second step, ,, .	=	22 ?
Breadth, at South end, worked surface, . .	=	200
,, near middle, rough and worn, . .	=	280 ?
,, at North end, first step, . . .	=	127
,, ,, second step, . . .	=	106



W H M^c Farlane Lith^r Edin^r

EAST-NORTH-EAST TRENCH.

Total axial length uncertain, because no termination inwards to C, could be found, . . .	=	1530 + x.
Distance of its furthest end from C, . . .	=	3280
Depth, at outer or E.N.E. end, first step, worked surfaces, ...	=	40
,, ,, second step, ,,	=	50
,, ,, third step, ,,	=	60
Depth, near middle, ...	=	150
,, towards inner end, as far as traceable, but much filled with rubbish, ...	=	40
Breadth, at outer or E.N.E. end, first step, worked surfaces, ...	=	150
,, ,, second step, .	=	44
,, ,, third step, .	=	50
Breadth near middle, ...	=	250
Breadth, near inner end, between longitudinal worked surface, ...	=	165

NORTH-NORTH-EAST TRENCH.

Neither outer nor inner ends sharply defined.

Total length, of two marked portions, . . .	=	1280
Distance of furthest visible part from C, . .	=	4200
Breadth, at all parts, worked surfaces, 39· to 40·, say	=	40
Depth, at all parts, roughly, 10· to 12·, say .	=	12

The system of vertical *passages* is only inserted approximately on the plan of the trenches in Plate XV., as I did not *measure* their distance from other known objects. Their general appearance and nature are shown in fig. 4, of Plate II., in vol. iii. Compare also the map in Plate II. vol. i.

The bottoms of all the azimuth trenches were filled with more or less broken stones and rubbish, to an extent beyond my means of clearing out.

LINEAR MEASURES OF THE GREAT PYRAMID.

April 6, 10, 27, 1865.

HEIGHT, VERTICAL.

On the evening of April 10, in ascending the Great Pyramid, I measured in a rough manner the height of every course of stones; and repeated the measure next morning in descending. The two sets were not always quite so similar as they should have been, and the second gave 202 courses, while the former gave 201. Differences which may have arisen, both from the tracks up and down not being precisely the same; and because it was often difficult to say, from dilapidation, where any particular course began or ended: especially as the courses of masonry,—though generally running uniformly along all four sides, if not also through the whole Pyramid,—were in some particular places composed of two layers of stone, each of which might then be taken inadvertently as a single course; or again, two small courses rather ruined, might appear as one large one. There is, however, abundant proof, on looking over the numbers, that the courses are not of uniform or regular decreasing or increasing thickness; and that they form little more than a core or substance upon which the ancient builders fastened the casing-stones with their fixing series, and *thereby* gave truth of figure to the whole Pyramid.

At the time of measuring, I merely made a guess at the depth of rubbish concealing the true foot of the Pyramid; but was able afterwards to correct it, when the socket of the corner-stone was uncovered at the north-east angle. And, reducing this to the supposed 'pavement' surface (see p. 136), we have the following numbers:—

MEASUREMENT OF VERTICAL HEIGHT OF GREAT PYRAMID.

Number of course in ascending.	Vertical measure in inches.	Whole height from pavement	Every tenth course.	Whole height from pavement.	Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.
Pavement	0·	0·	0·	0·	21	24	747		
1 & 2	79	79			22	23	770		
3	56	135			23	35	805		
4	48	183			24	33	838		
5	40	223			25	31	869		
6	40	263			26	38	907		
7	38	301			27	26	933		
8	39	340			28	28	961		
9	38	378			29	31	992		
10	36	414	414	414	30	30	1022	299	1022
11	34	448			31	26	1048		
12	33	481			32	28	1076		
13	30	511			33	28	1104		
14	30	541			34	24	1128		
15	28	569			35	24	1152		
16	30	599			36	50	1202		
17	28	627			37	41	1243		
18	26	653			38	39	1282		
19	32	685			39	38	1320		
20	38	723	309	723	40	34	1354	332	1354

MEASUREMENT OF HEIGHT OF GREAT PYRAMID—*continued.*

Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.	Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.
41	32	1386			81	22	2524		
42	32	1418			82	24	2548		
43	28	1446			83	24	2572		
44	32	1478			84	26	2598		
45	42	1520			85	26	2624		
46	37	1557			86	25	2649		
47	28	1585			87	25	2674		
48	35	1620			88	24	2698		
49	36	1656			89	24	2722		
50	30	1686	332	1686	90	25	2747	245	2747
51	28	1714			91	36	2783		
52	30	1744			92	33	2816		
53	26	1770			93	31	2847		
54	27	1797			94	28	2875		
55	24	1821			95	26	2901		
56	26	1847			96	25	2926		
57	22	1869			97	24	2950		
58	26	1895			98	24	2974		
59	27	1922			99	41	3015		
60	30	1952	266	1952	100	37	3052	305	3052
61	28	1980			101	34	3086		
62	26	2006			102	32	3118		
63	26	2032			103	30	3148		
64	26	2058			104	28	3176		
65	28	2086			105	27	3203		
66	26	2112			106	27	3230		
67	26	2138			107	26	3256		
68	34	2172			108	25	3281		
69	33	2205			109	29	3310		
70	31	2236	284	2236	110	25	3335	283	3335
71	28	2264			111	24	3359		
72	28	2292			112	24	3383		
73	27	2319			113	24	3407		
74	26	2345			114	23	3430		
75	31	2376			115	23	3453		
76	28	2404			116	23	3476		
77	26	2430			117	25	3501		
78	24	2454			118	23	3524		
79	24	2478			119	35	3559		
80	24	2502	266	2502	120	31	3590	255	3590

MEASUREMENT OF HEIGHT OF GREAT PYRAMID—*continued.*

Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.	Number of course in ascending.	Vertical measure in inches.	Whole height from pavement.	Every tenth course.	Whole height from pavement.
121	29	3619			161	21	4557		
122	28	3647			162	21	4578		
123	26	3673			163	24	4602		
124	26	3699			164	23	4625		
125	24	3723			165	25	4650		
126	24	3747			166	22	4672		
127	23	3770			167	22	4694		
128	23	3793			168	21	4715		
129	23	3816			169	21	4736		
130	23	3839	249	3839	170	20	4756	220	4756
131	27	3866			171	21	4777		
132	25	3891			172	20	4797		
133	23	3914			173	21	4818		
134	22	3936			174	21	4839		
135	22	3958			175	20	4859		
136	22	3980			176	21	4880		
137	25	4005			177	20	4900		
138	23	4028			178	20	4920		
139	25	4053			179	21	4941		
140	25	4078	239	4078	180	20	4961	205	4961
141	22	4100			181	26	4987		
142	22	4122			182	25	5012		
143	22	4144			183	23	5035		
144	22	4166			184	24	5059		
145	28	4194			185	22	5081		
146	27	4221			186	21	5102		
147	24	4245			187	21	5123		
148	22	4267			188	20	5143		
149	22	4289			189	21	5164		
150	21	4310	232	4310	190	21	5185	224	5185
151	26	4336			191	21	5206		
152	26	4362			192	21	5227		
153	25	4387			193	21	5248		
154	22	4409			194	20	5268		
155	21	4430			195	21	5289		
156	21	4451			196	22	5311		
157	21	4472			197	24	5335		
158	21	4493			198	22	5357		
159	21	4514			199	22	5379		
160	22	4536	226	4536	200	22	5401	216	5401
					201	22	5423		
					202	22	5445	44	5445

The course marked above 202, forms the present effective flat summit of the Pyramid; for though there are portions of two other and higher courses (one of 21 and the other of 19 inches) they are too fragmentary to allow any calculations to be made upon them, for approximating to the ancient height of the Pyramid.

But course 202 is complete, in so far as it forms a general square, and an equally good or bad termination to all the four present Pyramid sides, as now deprived of their casing-stones. Said course is built of good, hard, firm, rectangular blocks of Mokattam stone, browned with oxide of iron over the surface; but the original workmanship was only that of the core masonry, and the corners of the platform have been sadly broken in upon. When these were rudely made up, or supplied as to the missing stones, with measuring-rods,—each of the four sides measured something like 400 inches in length; and the diagonals 570 or 580; which implies a length of side = 406; but there were more obstructions in the way of the diagonal, than the side, measures.

Hence then, we conclude that the present height of Great Pyramid, from surface of pavement to top of present platform, or 202d course, = 5445 British inches; and that said platform is a square, of 400 inches in the side, nearly.

The peculiar shelf, or great cut-out in the north-east angle, known among the Arabs as 'half-way,' is considerably more than half-way, or occurs with its floor at or near both the 105th course, and a height of 3203 inches; leaving therefore from thence to platform summit, 97 courses, and 2242 inches.

LENGTH OF SIDES OF PYRAMID BASE.

On April 6th, I attempted to measure the length of each side of the Pyramid's base with a 500-inch cord; and made each side between 8900 and 9000 inches in length; leaving an unknown quantity to be added on for the casing-stone thickness.

The above numbers, therefore, apply only to the internal core of masonry; and include an attempt to supply its lower corners, which are egregiously broken away, and rendered thereby absurdly blunt in figure. But the problem is next to impossibly difficult; both from the extent and abnormal character of the fractures, and the concealment of one end from the other, of each side of the base by the intervening heap of rubbish; that heap of rubbish too, not only altering the line vertically,—which would be its only effect if lying against a vertical wall,—but azimuthally also, on account of the sloping flank of a Pyramid.

In the third and fourth weeks, however, of April, Mr. Inglis, deputed by Mr. Aiton, having uncovered all four sockets of the Pyramid,—the sockets, as believed, of the corner stones of the ancient casing,—he was enabled to eliminate all uncertainties of thickness of such once existing casing, and had only remaining the difficulties of the ground to contend with. Subject therefore still to those difficulties, —and they are excessive—Mr. Inglis handed me, on April 27, the following measures :—

				Inches.
Length of North side of base of Great Pyramid, from socket to socket (their outer corners),			. . . =	9120
Length of South	do.	do.,	. . . =	9114
,, East	do.	do.,	. . . =	9102
,, West	do.	do.,	. . . =	9102
			Mean, =	9110

CORNER SOCKETS.

Now these corner-sockets of the Pyramid were, from my own measures, of the following sizes and shapes :—

North-east socket—

East side, length = 152· inches.
North ,, = 137· ,,
South ,, = 121·0 to a cut-off of 26· and then another of 21·
West ,, = 157·0 to South side produced rudely.
Diagonal North-west to South-east = 200·0.
Semi-diagonal, centre to North-east corner = 100·0, + thickness of measuring-rods.
Depth, varying from 3 to 7 inches.
Distance of outer, or North-east corner of this North-east socket, from present North-east corner of Pyramid as standing now, = about 350 inches.

The above socket was once cut neatly in the firm live rock of the hill ; and is still remarkably true in level, and smooth all over its floor ; the sides are evidently injured by wear and tear, and are of unequal depth, besides their symptoms of erosion.

The diagonal, computed from the north and east sides, comes out 4·5 inches longer than that directly observed, which is probably owing to the greater wearing of the outer corner; for the diagonal was really so very close to 200 inches, that the two rods of 100 inches each in length would just extend along the straight line, when put in edgeways, but not when put in flatways. (See Plate of Sockets; or Plate IX. vol. i.; also Plate IV. vol. i.)

South-east socket—

East side in length,				=	52· inches.
North ,,				=	81·5 ,,
South ,,				=	86· ,,
West ,,				=	53· ,,
Diagonals, N.-E. to S.-W. corner, observed	= 100,	computed	=	101·	
,, S.-E. to N.-W. ,, ,,	= 100,	,,	=	97·	

Depth somewhere from 12 to 20.

Distance of outer or South-east corner, from present South-east corner of Pyramid = 330.

This hole is cut in the rock, and its bottom is well and smoothly levelled; the sides are rather sloping and converging towards the bottom, so that the 100-inch rods, measuring both diagonals, jammed about halfway down; the upper surface of the rock was not cleared and was not distinct.

North-west socket—

North side in length,	=	87
East ,,	=	137 + x.
West ,,	=	100 + x.
South ,,	=	not uncovered, or not visible.

Diagonals not to be measured, as well from South side not being discoverable, as from a large block of building-stone out of the Pyramid having chanced to fall into the middle of the area of the socket, and being, to us, immovable.

Depth about sides observed, from 4 to 11 inches.

Floor smoothly levelled.

Distance of outer or North-west corner of socket from present North-west corner of Pyramid = 350· about.

South-west socket—

North side in length,	. . . .	=	141·
East ,,	. . . .	=	72· + *x*.
West ,,	. . . .	=	74·3
South ,,	. . . .	=	142·

Diagonals not measured.

Depth of North-east sides from 2 to 3 inches.

But South side is high, above the rock surface outside, or South of it, by about 1 inch.

And West side is level with what is outside it, being merely marked by a line drawn with a blunt tool, similarly with the lines of rectangle in the entrance passage of the Great Pyramid.

Distance of outer or South-west corner of socket, from South-west corner of Pyramid, = 350·, about.

Floor well cut, smoothed, and levelled.

The floors of all the above sockets are exquisitely cut out in the rock, and levelled within their own area; but they are neither cut to the same depth in the rock near them, nor to a uniform general level; for according to Mr. Inglis's measures—

Taking the North-east socket floor for 0·0 in level.				
South-east	,,	is 13·6	inches	low.
North-west	,,	4·2	,,	low.
and South-west	,,	5·6	,,	high.

THE PAVEMENT.

But the floors of no sockets can form the commencing surface, *i.e.*, the datum plane, or bench mark for level of the whole Pyramid, and for referring all heights to. That end is rather fulfilled by the upper surface of the *pavement* which Colonel Howard Vyse, when cutting down through the middle of the northern rubbish-mound, discovered in front of that side of the building; and on which his casing-stones, *in situ*, stood, and from which the inclined side of the Pyramid rose. The pavement was there, about 400 inches broad and 21 thick; and was thence supposed to extend all round the Pyramid, with the same thickness and breadth; but when the same northern rubbish-mound was cut into again, in the middle of each half of it, east and west of its centre,—the pavement was only found there, about 120 inches broad, though broken, and thickness is not stated: nor has it been reported as having been seen anywhere else; while the very high pavements or pedestals of some authors, are pure inventions from ideas of modern architecture.

At the north-west socket, however, of which we took a photograph, there is, close to the east of it, something which looks like a portion of the pavement; it is only about ten inches thick, and stands up by that amount of height, above the floor of that socket. Hence, reducing all the sockets to such apparent pavement surface, we have—

North-east socket floor is		5·8,	below pavement	upper surface.
South-east	,,	19·4,	,,	,,
North-west	,,	10·0,	,,	,,
and South-west	,,	0·2,	,,	,,

numbers which are very descriptive of the general appearance of depth, to which each socket has been dug at its own corner.

SECTION II.—ANGULAR MEASURES, GEOMETRICAL.

INTRODUCTION.

The principal instruments for measurement of angle were three in number, each of very diverse character to the others :—

First, A sextant-horizon instrument, for vertical angles. This consisted of an ordinary box-sextant by Troughton and Simms, reading by vernier to 1′; but attached to one end of a slab of wood,—the other end of which carried a 'spontaneous-horizon-point' made for me by Adie and Son of Edinburgh, according to my own invention in 1854. It was exhibited at the Paris Universal Exposition of 1855, and has the following qualities; viz., that a level bubble, whose size can be adjusted, is seen in the field of view of the sextant, in place of the usual *horizon* reference of sea observations; and the angular place of that level bubble with reference to the horizontal direction, is not altered by any amount of tilting either of sextant, or level, or both, within the range of the field of view, say 5°. Hence an object to be observed has merely to be brought down, technically as with sextant observations of the sun, to the level bubble; and the observation is equally good, in whatever part of the field of view the bubble may be situated at the moment.

Such an instrument, therefore, giving vertical angles, true within its powers, and independent of level errors in its own position of several degrees, is important as a field instrument,—for it may be held in the hand, and so used with tolerable results for any altitude, from 0° to 90°. But in practice I used always to place it on a rough stand, with which it could be easily brought within half a degree of absolute level, and then remained steady thereat.

This instrument was in almost daily employ; being used for observations of the time both by the sun and stars when near the prime vertical; and for the latitude by meridian observations as a means of getting the combined index-error; also to determine the angles of ascent of all the Pyramid passages, as well as the slope of the Pyramid sides. The limits of error of an ordinary observation, I used to regard as from 3′ to 4′; and this quantity was partly due to the bad or broken silvering of the glasses, which prevented good definition of the reflected object,—and partly to a slow change of the index-correction of the whole instrument, caused probably by a change in the tin box holding the level, and altering either with time or heat, from 1° 21′ to 1° 8′ in the course of four months.

Second, A circular clinometer presented expressly for these observations at the Great Pyramid, by Andrew Coventry, Esq., of Moray Place, Edinburgh.

This instrument was constructed in the summer of 1864 by T. Cooke and Sons of York; and is probably unique for its excellence and power among all similar instruments for measuring mechanically the tilt of any given surface. It is generally constructed of gun-metal, with divisions on silver; the verniers being in form of a complete circle, with their surfaces in the same plane as that of the divided circle. The divisions are to every 10′, and the vernier readings to 10″; and there are six, or three pair of opposite, verniers, so that by comparing the mean of two with the mean of six, the errors of division, as well as those of eccentricity and motion of the centre, may be kept in check. The whole circle can likewise be shifted on a stout central screw, so as to bring any set of divisions whatever into a given direction. There is a powerful longitudinal level attached to the vernier circle, also a small cross level; and the frame of the instrument stands on three feet,—two of them being fixed feet, at either end of the frame, and in plane of the circle; and the third being a screw-foot, opposite the middle point of the other two feet, and intended to correct in level the cross position of the instrument, on whatever uneven foundation it might at any time be erected.

The circle is eight inches in diameter, and the two longitudinal feet thirteen inches apart; but in use on the worn and rough stones of the Pyramid passages, it was mounted first on a very stout beam of mahogany, fifty inches long, and about six deep; and afterwards on a compound beam of deal and mahogany of greater depth, and 129 inches long, as will be more particularly described in connexion with the observations themselves. (See Plate I.)

The mahogany packing-box of the instrument had been fitted with a large thermometer; but at some time on the journey, the screws fastening the straps of the glass-tube to the metal scale, loosened; the glass-tube tumbled off, broke and scattered the contained mercury about the box, to the grievous injury of much of the silver-divided circle, as to visibility. With this one exception, the instrument answered admirably, and worked perfectly up to the full degree of accuracy of its 10″ readings, or rather much closer; and the misfortune above mentioned might have been avoided, had there been a wooden block beneath the metal scale, to receive the screws: for a metal screw in a metal socket shakes loose very easily. This was witnessed in a small way when the late Professor Playfair, as mentioned in Stevenson's large volume on the Bell Rock Lighthouse, found that every screw, of a telescope sent him from London by mail-coach, had shaken out. And in a large way, in the recent Government experiments of firing at iron-plate targets; for there, metal nuts and metal screws positively flew off from each other, all around any place where a ball struck;

while in another experiment where long metal screws were screwed into thick *wood* planks, the cannon-balls did every sort of mischief both to the iron plates, wooden backing, and even the screws themselves, but not one of these turned itself on its axis or got loose.

And third, An altitude-azimuth instrument by Troughton.

This had been a splendid instrument of its order, and was presented to the great Playfair, by students in his class of Natural Philosophy, in the year 1806. It is of the general figure rendered famous by Troughton, and his successor Simms, and measures as follows :—

Distance from foot-screw to foot-screw, . .	=	15·3 inches.
Diameter of azimuth circle, ...	=	14·0 ,,
,, vertical circle, ...	=	15·5 ,,
,, object-glass, ...	=	1·8 ,,
Focal length of telescope, ...	=	19·7 ,,
Magnifying power, with eye-piece generally employed, ...	=	25·0 ,,
Azimuth circle divided in direction of hands of a watch from 0 to 360.		
Vertical circle divided in quadrants.		
Both circles reading off by pairs of opposite microscope-micrometers to single seconds.		
Usual tripod-stand, solid, and high, . . .	=	32·4 ,,
Height from surface of stand to centre of horizontal axis, in mean position of foot-screws, .	=	19·9 ,,

Hence the optical and angle-reading power of this instrument were immense, wherever they could be brought to bear on any of the Pyramid slopes ; and were not unworthy of accurate determinations of latitude as well.

ENTRANCE-PASSAGE ANGLE.

SEXTANT HORIZON INSTRUMENT.

February 9, 1865.—Fixed a bar horizontally across mouth of entrance passage, at a height of 23·7 inches from floor, measured perpendicularly to incline,—for a signal to be observed from below.

Placed sextant-horizon on a stand prepared yesterday, over the 'slide' part of the floor under portcullis: index-mirror axis 23·7 inches above floor, perpendicular to incline, and at a place 1036 inches south of and below basement-beginning; then, subtracting 1° 20′ for index-correction,—

1st measure of vertical angle of altitude of signal,	=	26° 24′
2d ,, ,,	=	26 28
3d ,, ,,	=	26 24
Readjusted instrument to a *vertical* height of 26·2 inches above floor.		
1st measure, ...	=	26 28
2d ,, ...	=	26 32
3d ,, ...	=	26 28
Mean, ...	=	26° 27′

February 11.—Sextant-horizon again.

In place of former signal, put up a board 14·8 high, but with a perforated observing centre 23·7 inches perpendicularly above floor.

Placed instrument as before, at lower end of passage, and subtracting for index-correction 1° 18′, we have—

First observation,	=	26° 27′
Second ,,	=	26 25
Third ,,	=	26 25
Fourth ,,	=	26 28
Fifth ,,	=	26 27
Sixth ,,	=	26 27
		26° 26·5′

Mean of both days, for angle of elevation of entrance passage as seen from below, under portcullis, = 26° 27′.

CIRCULAR CLINOMETER.

February 6.—This instrument was mounted on its 50-inch mahogany base, and taken down the west side of the entrance passage floor, step by step of its own length, so that the first or highest foot in the second observation was as near as possible on the spot occupied by the second and lowest foot at the first observation. In going down, or indeed up, the west side, the face of the instrument was necessarily looking east, and *vice versâ* when measuring along the east side of the passage floor. Hence a combination of all the observations on either side of the passage floor, enabled a fair approach to the index-correction to be obtained ; it was large, viz., 35′ 22″, and therefore completely masked—in the progress of the work—what the final result was likely to be. Each observation is, however, now presented with the finally determined index-correction applied to it ; that is, to the mean of the two opposite verniers A and D, which were always read and entered in the observing-book separately, though they are hardly worthy of being now reproduced. The following readings of all six verniers at the parts of the circle which came into play for the readings west, and the readings east, will show the limits of errors of divisions, and prove them to be practically insensible. The degree readings of all the verniers except A, are purposely kept out of sight, as quite unnecessary in such a question.

Vernier A,	27° 3′ 0″	Vernier A,	334° 3′ 0″
,, B,	3 10	,, B,	3 20
,, C,	3 50	,, C,	3 40
,, D,	4 10	,, D,	4 10
,, E,	3 50	,, E,	3 40
,, F,	2 50	,, F,	2 50
Mean of A and D, =	27° 3′ 35″	Mean of A and D, =	334° 3′ 35″
Mean of all, =	27° 3′ 28″	Mean of all, =	334° 3′ 27″

February 6.—For part of Passage Floor extending from 426 to 1035 Southward and below the basement-beginning North.

Distance of centre of clinometer from basement-beginning.	Circular clinometer. Angle at Western side of floor.	Circular clinometer. Angle at Eastern side of floor.	Mean angle of floor.	Remarks.
426	26° 29′ 28″	26° 30′ 57″	26° 30′ 12″	
475	26 29 43	26 31 37	26 30 40	
524	26 27 3	26 26 37	26 26 50	
574	26 32 13	26 33 37	26 32 55	
623	26 25 28	26 33 12	26 29 20	Bad standing for cross level.
672	26 29 3	26 31 7	26 30 5	
722	26 22 43	26 23 12	26 22 58	
771	26 32 8	26 24 37	26 28 22	
820	26 37 23	26 22 52	26 30 8	
870	26 16 48	26 19 57	26 18 22	
919	26 32 48	26 37 12	26 35 0	Next stones below this much broken.
1035	26 20 48	26 20 47	26 20 48	Under granite portcullis.
		Mean, =	26° 27′ 58″	

February 7.—For the higher part of the Ascending Passage, or from 134 to 572, Southward from basement-beginning. Index correction = 35′ 42″, — applied to West, and + to East observations.

Distance of clinometer from basement-beginning, nearly.	Circular clinometer. Angle of dip Southward of floor, West side.	Circular clinometer. Angle of dip Southward of floor, East side.	Mean angle of floor.	Remarks.
134	26° 17′ 12″	26° 25′ 12″	26° 21′ 15″	
177	26 33 58	26 32 2	26 33 0	A hole on East side, below this.
227	26 27 53	26 23 27	26 25 40	
276	26 29 53	26 25 2	26 27 28	
325	26 22 18	26 23 57	26 23 8	
375	26 33 3	26 28 52	26 30 58	
424	26 26 33	26 30 57	26 28 45	
473	26 27 43	26 33 22	26 30 32	
523	26 26 23	26 33 42	26 30 2	
572	26 37 33	26 26 17	26 31 55	No place for cross foot below this, on the East side.
		Mean, =	26° 28′ 16″	

Mean of both sets by circular clinometer, = 26° 28′ 7″

OPTICAL MEASURE WITH PLAYFAIR ALT-AZIMUTH INSTRUMENT.

April 3.—The Playfair instrument was mounted over the beginning of the basement-sheet, northwards, by means of a stand specially prepared for the place by measure; and the centre of its vertical circle was placed in the line of axis of passage produced up northwards, as well as I could judge by eye, and referring to measures on either side.

The signal was the light of an oil-lamp, shining through a hole, 0·3 inch in diameter, and with bevelled edges, in a board fixed over the slide under granite portcullis; and found by measure, to be 25·9 inches distant from floor, and 25·9 from roof; or on level of axis of passage at that place.

The depression, or angle of dip of this signal from the Playfair instrument, was then observed as follows:

Time of observation.	Face of circle turned to	Microscope A.	Microscope B.	Angle with index-error.	Mean angle.
h. m. 5·15 P.M.	East, West,	63° 27′ 51″ 26 18 27	63° 27′ 56″ 26 18 45	26° 32′ 6″ 26 18 36	26° 25′ 41″
Re-levelled.	West, East,	26 18 22 63 28 2	26 18 23 63 28 4	26 18 22 26 31 57	26 25 10
6·5 P.M.	East, West,	63 27 58 26 18 18	63 28 5 26 18 25	26 31 58 26 18 22	26 25 10
				Mean, =	26° 25′ 20″

This determination would probably be preferable to either of the two preceding, on account of the great calibre of the Playfair circle, had it not the drawback that the placing of the instrument in the line of the passage produced outwards, was a difficult matter, and perhaps not very accurately accomplished. Hence I am inclined to give equal weight to the mean determination of the several methods employed, which then stand as follows:—

ANGLE OF DIP OF ENTRANCE PASSAGE FROM NORTH TO SOUTH.

By sextant-horizon, ...	=	26°	27′	0″
By circular clinometer, ...	=	26	28	7
And by Playfair altitude-azimuth, . . .	=	26	25	20
Mean, to nearest minute,	=	26°	27′	0″

FIRST ASCENDING PASSAGE.

SEXTANT-HORIZON INSTRUMENT.

February 16.—This passage begins the perfectly dark parts of the Pyramid : a lamp-holder was therefore arranged, so that a dark lamp might illuminate the level-horizon bubble ; the signal was likewise an artificial light, *i.e.*, a candle shining through a hole in a board ; which board was wedged in to upper end of this passage, close to where it enters the Grand Gallery. Both hole in the board at upper, and index-mirror of sextant on a stand at lower end of passage just above the granite portcullis, were tested by measure to be 23·7 inches perpendicularly from inclined floor ; and the limits of error were thought to be ± 0·2 inch. Then subtracting 1° 12′ for index-correction, the following results were obtained, for angle of ascent of this passage from north to south :—

First measure, ...	=	26° 10′
Second "	=	26 5
Third "	=	26 4
Fourth "	=	26 5
Fifth "	=	26 5
Sixth "	=	26 5
Seventh "	=	26 4
Eighth "	=	26 4
Mean,	=	26° 5′

March 2.—Repeated the measures, with index-correction = 1° 11′, and found angle = 26° 6′.

April 7.—The floor of this first ascending passage was too much broken to employ the circular clinometer upon it with advantage. But upon this day, an important check upon the above measures was obtained, by observing the depression of the lower northern end, from the upper or southern end, of the passage, with the Playfair altitude-azimuth instrument.

The signal below, was a lamp shining through a small bevelled hole in an upright board, attached to a long plank foot, which butted against the upper end of the granite portcullis; while the Playfair instrument was mounted on its own strong tripod-stand on the level floor of the horizontal passage leading to the Queen's chamber, or 103 inches beyond the south end of the first ascending passage, measured in its own incline.

On carefully testing the positions of both instrument and signal when the angular observations were over,—the signal was found to be 0·3 inch too high, and the instrument 0·4 too low, as referred to the inclined floor-line of the passage; and as the distance from instrument to signal was 1395 inches, there is a correction of + 1′ 43″ to be applied to the observed dip; and it has been applied accordingly in the last column of the following table:—

Face of circle turned to	Microscope A.	Microscope B.	Angle with index-error.	Mean angle, corrected also for residual errors in position of instrument and signal.
West,	63° 48′ 0″	63° 49′ 0″	26° 11′ 30″	26° 6′ 40″
East,	25 58 2	25 58 47	25 58 24	
West,	63 48 2	63 48 48	26 11 35	26 6 41
East,	25 58 4	25 58 36	25 58 20	
West,	63 48 5	63 48 36	26 11 40	26 6 40
East,	25 58 5	25 58 23	25 58 14	
				26° 6′ 40″

Whence, angle of first ascending passage rising from North to South,
is, by sextant horizon, ... = 26° 5′ 30″
And by Playfair alt-azimuth, ... = 26 6 40

And mean = 26° 6′ 0″

HORIZONTAL PASSAGE TO QUEEN'S CHAMBER.

On March 3d the level of the floor of this passage (for the part extending from the north end towards the south, but only to the edge of the deep step, or 1303 inches in length), was tested with the sextant-horizon by means of reciprocal angles, with the result of finding a dip southward = 0° 7′.

On March 10th, the level was again tested, and by the circular clinometer on its long 126-inch foot; but as the floor is very rough and uneven,—no proper passage flooring at all,—it could only be brought to bear between the distances 200 and 1300, from the north end of the Grand Gallery: the results, corrected for index-error = 24′, were as follows:—

Clinometer length.	Instrument against West wall.	Instrument against East wall.	Mean angle of Passage.
	Dip.	Dip.	Southward dip.
1	South, 0° 19′	South, 0° 6′	0° 12′
2	,, 0 10	,, 0 26	0 18
3	,, 0 13	,, 0 16	0 14
4	,, 0 7	,, 0 6	0 6
5	,, 0 4	,, 0 2	0 3
6	,, 0 29	North, 0 2	0 14
7	North, 0 4	South, 0 23	0 10
Mean dip southward, . . =			0° 11

The two instruments seem tolerably confirmatory of each other; but when I tested afterwards the whole length of the passage, by looking along its ceiling from the Queen's chamber, to a scale set up by the north wall of the Grand Gallery, there was a dip northwards indicated, amounting to several inches, and equivalent to not less than 0° 8′. It is possible, however, that part of this apparent quantity, is owing to the ceiling bending down somewhat in the middle of its length.

GRAND GALLERY ANGLE.

SEXTANT-HORIZON.

March 3.—This instrument was placed on a stand previously prepared to suit the spot, and to stand partly on the sloping floor of top of first ascending passage, and partly on flat floor leading to Queen's chamber; the instrument was then nearly in the plane of the doorway, or north wall of the Grand Gallery; and its position as to height, was 28·5 inches above floor, and 24·5 below ceiling, of first ascending passage, or two inches vertically too high.

At the other or south end of Grand Gallery the signal was a candle shining through a 1·1-inch hole in a board; first naked and afterwards through oiled paper. The board was held by hand in plane of south wall, or in south doorway of Grand Gallery; and the board was cut to such a length that when resting on the floor there, the hole was 18 inches above the ground,—equivalent to 25·0 inches above the line of the Gallery floor, continued up to the south wall, or through the substance of the 'great step;' and 25·0 inches below roof of short horizontal passage leading to antechamber: it was therefore in the concluded axis of that passage.

Above the first hole, by 3·5 inches, was a smaller one of 0·6 inch diameter, similarly illuminated. The mean of the two holes was therefore 1·75 inch too high; or 0·25 lower than it should have been, to be similar to the error of the instrument at the other end.

The observations then commenced as follows; but were only rendered fully satisfactory in the taking, when I had rigged up a cross plank and rope holdings, to prevent the otherwise inevitable sliding away of myself from the instrument, by reason of the steep slope of the passage.

	Top of level bubble.	Bottom of level bubble.	Centre of level bubble, —1° 10′ 56″ index-correction.
LOW LIGHT SIGNAL—			
First observation,	26° 56′	27° 55′	26° 14′ 34″
Second ,,	27 52	26 56	26 13 4
Third ,,	27 56	26 56	26 15 4
And single observation,	......	......	26 17 4
HIGH LIGHT SIGNAL—			
First observation,	27° 58′	27° 1′	26° 18′ 34″
Second ,,	27 5	27 54	26 18 34
Third ,,	27 1	27 57	26 18 4
And single observation,	......	......	26 22 4
	Correction for mean place of signals,		+ 0° 0′ 30″
Mean angle of Grand Gallery, rising from North to South by sextant horizon, . =			26° 17′ 38″

The index-correction above given was determined by two series of star observations the same night, one of them giving —1° 11′ 0″ and the other —1° 10′ 52″.

CIRCULAR CLINOMETER.

March 9.—To prepare the instrument for this work, I made it a new and longer foot, cutting up its former mahogany 50-inch foot into three pieces, and fastening them to the lid of the long box of the reference-scale in such a manner, by means of powerful screws, that a joist-shaped stand was formed of the following size,—

Total length of foot, or beam, ...	=	129· inches.
Length between two longitudinal bearing points,	=	126·
Breadth, total, ...	=	8·5
Breadth between the line of the two longitudinal bearing points and the middle bearing for cross level, ...	=	6·8
Vertical depth of beam through the 115· inches of its middle length, ...	=	7·5

To the above were further fastened four angular lamp-holding blocks, two of them acting when beam was used face west, and two face east; while the whole structure was prevented from slipping when on the incline, by a rope fastened to a wooden anchor, and placed in a ramp-hole above it. This arrangement was found to work well; the level and tangent screws were easy to turn, and the verniers to read off. (See Plate I., or Frontispiece.)

The observing method followed was, to take a series of readings stepping up the east ramp, by steps the length of the clinometer foot, = 126 inches, wherever there was a fair ramp-surface for it to stand on ; and then, having reached the top of the Gallery, the clinometer was taken into the King's chamber, turned round there, and next made to descend the western ramp of the Grand Gallery, also by steps.

When the ramp permitted, these steps were made exactly equal to the distance between the bearings of the clinometer foot, as before ; but occasionally large deviations were obligatory, by reason of severe fractures of the ramp.

The ramp-surface is nowhere smooth, or nicely true ; but is corrugated in a manner, from the decay of the stones ; and has therefore inequalities which produce large differences in the angle. It is expected, however, that the mean of the whole observations east, will give the mean east inclination, so nearly, that compared with the similar mean inclination west (and trusting to the equality of the two ramps on the whole), the index-correction of the instrument may be obtained,—and also the angle of inclination of the Grand Gallery. It should, however, be remarked, that the index-error of the instrument is not the same as when last used in the entrance passage, in consequence of its now standing on a new foot.

GRAND GALLERY CLINOMETER ANGLE.

Stepping up *East* Ramp, March 9.—9 A.M. to Noon.

Distance of centre of clinometer from North wall of Grand Gallery, nearly	Clinometer readings.		Mean reading, — 23′ 30″ index-correction.	Remarks.
	Vernier A.	Vernier B.		
inches. 400	26° 37′ 50″	39′ 0″	26° 14′ 55″	Lowest foot of clinometer above sixth ramp-hole from North.
530	26 38 20	39 40	26 15 30	Up one length.
660	26 25 40	26 50	26 2 45	Up one length.
790	26 56 10	57 0	26 33 5	
920	26 46 0	47 0	26 23 0	Cross level of ramp much out, viz., dipping to East.
1005	26 26 40	27 50	26 3 45	Up about 80 only, on account of a great break in ramp.
1240	26 36 50	38 20	26 14 5	Skipped over the great break of ramp by ten inches.
1370	26 39 20	40 40	26 16 30	
1500	26 41 50	43 0	26 18 55	
1630	26 51 20	52 20	26 28 20	
1720	26 39 50	41 0	26 16 55	Advanced only 90 inches, or with upper foot near upper end of first inclined ramp-hole below great step.
Mean of East ramp,		. =	26° 17′ 4″	

Stepping down *West* Ramp, March 9.—Noon to 3 P.M.

Distance of centre of clinometer from North wall of Grand Gallery, nearly	Clinometer readings.		Mean reading, + 23′ 30″ index correction.	Remarks.
	Vernier A.	Vernier B.		
Inches. 1730	334° 7′ 40″	8′ 50″	26° 15′ 15″	Upper end of clinometer half-way between South end of ramp, and first inclined ramp-hole.
1600	334 5 0	6 10	26 17 55	Down one step or length of the clinometer.
1470	334 2 50	4 10	26 20 0	
1370	334 7 30	8 40	26 15 25	Not down a full length on account of a broken ramp.
1170	333 47 40	48 50	26 35 15	Down more than a length past the broken ramp.
1040	334 0 10	1 20	26 22 45	
910	334 9 0	10 20	26 13 50	
780	334 20 40	21 50	26 2 15	
650	334 13 50	15 0	26 9 5	
520	334 3 0	4 20	26 19 50	
390	334 7 0	8 10	26 15 55	
Mean of West ramp,		. =	26° 17′ 3″	

PLAYFAIR ALT-AZIMUTH INSTRUMENT.

April 7.—On this occasion there had been prepared carefully beforehand a lamp-signal apparatus, to be used either above or below instrument; and consisting of a plank 40· inches long, 10· broad, and 0·7 thick, carrying two solid angular shelves, and between them a board with a 0·3-inch hole, worked to an edge inside. (See Plate I.) The height of the centre of the hole above what the plank rested on, was 6·2 inches; and the hole was well illumined by a lamp placed in turn on either shelf,—when looked to, at an angle of 26° or 27° to the horizon, and from the opposite side to the illuminating lamp for the time being.

For measuring angle of Grand Gallery,—above apparatus was taken to upper end of Gallery, and pinned to the ledge of a chance hole in the floor, close in front of great step; front lamp being then of course removed, and hole in board illumined by back lamp; hole being then about 1755 inches from north wall of Grand Gallery, measured along the slope, but only 1652 inches from the place selected for the Playfair instrument. Said hole being further, 6·2 inches vertically above the floor, and the ramp 21·0 inches perpendicular, or 23·4 vertically high,—the hole may be assumed as 17·2 *inches vertically below upper surface of ramp in its parallel.*

The Playfair alt-azimuth instrument was then set up on the level floor leading to Queen's chamber, but at only 103· inches, nearly, within, or south of, north wall of Grand Gallery ; and was first adjusted so as to have, it was believed, its centre of horizontal axis, 6·2 inches vertical, above the trace which is visible there on either side of the ancient floor-line produced, or base of ramps. But being dissatisfied with the difficulty of accurately performing the above adjustment,—I proceeded, after the angular observations were over, to test the position of the instrument with reference to the ramps in another manner. This was, to take the vertical depression of either pivot of horizontal axis, by measuring along a plumb-line, hanging from a straight-edge resting on the ramps on either side of the instrument, and so placed that the plumb-bob touched the end of the pivot. There was some trouble in getting the Arabs to hold the straight-edge steady on the steep slope, and the following various readings were obtained :—

Vertical depression of East pivot,	= 17·5,	of West pivot,	=	17·3
,, ,,	17·9,	,,		17·9
,, ,,	17·6,	,,		17·5
,, ,,	17·5,	,,		17·5
Mean of all, . .		= 17·6		

Hence instrument was after all too low by 0·4 inch, and its angle for the upper signal requires a correction = $-0' 50''$.

The angular observations began at 4 P.M., after careful levelling.

PLAYFAIR ALT-AZIMUTH INSTRUMENT IN GRAND GALLERY.

Reversals of circle.	Microscope A.	Microscope B.	Angle with index-error.	Mean angle corrected for index-error and position of instrument.
Zen. distance, Altitude, . .	63°34′ 17″ 26 11 30	63°35′ 3″ 26 12 34	26°25′ 20″ 26 12 2	26°17′ 51″
Zen. distance, Altitude, . .	63 34 8 26 12 4	63 35 6 26 12 46	26 25 23 26 12 25	26 18 4
Zen. distance, Altitude, . .	63 34 24 26 11 40	63 35 11 26 12 16	26 25 12 26 11 58	26 17 45
Mean angle of elevation from North to South of floor of Grand Gallery, .			=	26°17′ 53″

Hence the three different methods of observation for the angle of Grand Gallery give—

Sextant-horizon, ...	=	26°	17′	38″
Circular clinometer, . . .	=	26	17	4
Playfair alt-azimuth, . . .	=	26	17	53

and giving them the respective weights of 1, 5, and 10, according to the calibre of the instrument, and care taken in the observation,—the final mean is

26° 17′ 37″.

KING'S CHAMBER LEVELS.

March 10.—The circular clinometer on its 126-inch foot, was employed to test on this day the levels of the short passage leading from Grand Gallery to King's chamber; and also the level of the floor of the latter room in two directions. But the stones composing these floors are so much risen in some places and sunk in others, that no accuracy of observation could be secured: and the full limit of the results seemed to be—that the north and south level both of said passage floor, and of King's chamber, and the east and west level of the latter,—are nowhere so much as half a degree in error.

The walls of the King's chamber were then tried, by rearing up the clinometer-foot vertically against them, and reversing it at each place; and their, the walls', surfaces were found much more smooth and appropriate to measure.

Similar observations were again made on the walls on March 29, the index-error of the clinometer having been in the meanwhile changed nearly five whole degrees; and three sets of complete observations were taken against every wall.

The final results for the mean surface of each wall, between the heights of 1 and 127 inches above the general floor, are as follows :—

	March 10.	March 29.	Mean.
E. wall, leans inwards at top, or to W.,	10′ 0″	9′ 50″	9′ 55″
W. wall, leans outwards at top, or to W.,	4 0	0 45	2 22
N. wall, leans inwards at top, or to S.,	8 0	11 44	9 52
S. wall, leans outwards at top, or to S.,	2 0	2 31	2 16
Mean of East and West walls, at top to West, .			6′ 8″
Mean of North and South walls, at top to South, .			6 4

Hence the *quasi*-vertical axis of the whole room is tilted at the top, towards the south-west; and the different observed amount of tiltings of east *versus* west, and north *versus* south walls, indicate that every wall inclines towards its opposite wall at the top ; the east and west walls by the amount of 3′ 46″ each ; and north and south walls by the amount of 3′ 48″ each.

VENTILATING CHANNELS.

THESE ventilating channels, or long and very small-bore passages, being found hopelessly stopped up somewhere in their length,—I made no other trial of their angles, than merely to put, or have put, a little pocket-clinometer on the floor of them, just within their upper mouths, on the outside of the Pyramid,—and take the angle there within a degree. This being close enough to indicate, whether the angles were the same as those of the larger inclined passages, viz., 26° to 27°; or whether they were nearer to what I had concluded from theory in my published book in 1864; viz., the north one = 33° 42′, and the south one = 45°.

The result of my measure in this rude manner, in January 1865, on the northern air-channel, at its outlet high up the Pyramid side, was, 32° 45′.

And the result of a similar measure on the southern air-channel, kindly performed at my request by an enterprising traveller, Mr. Smyth, from Lincolnshire, who visited the Pyramid in February 1865,—was, 46°.

EXTERIOR FACES OF GREAT PYRAMID.

April 7, 8.—Measured with sextant-horizon, the angles of ascent of Great and Second Pyramids; those of the former only, entered here; going consecutively to the top of the heap of rubbish lying against the middle of each side; and, after choosing some stone only slightly weathered, placing both eye and instrument in line of that and upper part of Pyramid foreshortened.

Tested each day the index-correction of instrument by reciprocal angles, observed in succession from two fixed stands, about 5000 inches asunder; and found it 1° 12′ on the 7th; and 1° 8′ on the 8th. Correcting the observations accordingly, we have for angle of ascent of each face of the Great Pyramid from the horizon:—

	April 7.	April 8.	Second observation.	Mean.
East face, . .	51° 46′	51° 44′	51° 49′	51° 46′
North face, .	51 39	...	..	51 39
West face, .	51 42	...	...	51 42
South face, .	51 55	51 59	51 49	51 54
Mean of all, giving weight to each observation,				51° 48′

These measures have no pretence to being closer than a handful of minutes, on account of the large weathering of the sides of the Pyramid, and the rudeness of the present denuded courses: but they will suffice to show that the 3°, 4°, and more of some travellers have no necessary place, touching the original unweathered Pyramid.

CASING-STONE FRAGMENTS.

After various preliminary trials, I had an apparatus made in March 1866, to measure the angles of the fragments of casing-stones brought home from the Great Pyramid in 1865. This apparatus was in the form of a double-pronged wooden compass, 25 inches long, 1·8 broad, and 1·1 in the collective thickness of its two moveable limbs. These were made in hard mahogany, and worked on a brass screw-bolt in the centre of their lengths; one limb, only 18 inches long, passing inside the other, which was therefore a double frame so far, but solid at either end. This machine having been opened, made to touch two sides of a casing-stone at their own angle, and clamped firm,—was then conveyed to a gun-metal circle 11·9 inches in diameter, and divided to every 20′ by Adie and Son,—to ascertain the angle. The screw-head of the compass-arms, entering a hole in centre of circle, gave a nearly concentric position; and the angle was then read off through small holes, in the central axis of each compass-arm at a radius of 5·7 inches. To correct residual error of eccentricity, the angle was read off on both ends of both arms, or on opposite sides of the circle's centre; and to correct index-error of the instrument, the angle of the stone was taken twice,—once on the right, and once on the left, of the principal bar of the compass. Hence each reading now given, is the result of four independent readings and two measures of the angle; and is free, I trust, from all sensible instrumental defects.

Indeed, the apparatus proved itself superior in accuracy to the fragments which it had to measure; where, the almost constantly prevailing fault was found,—that the surface of the stone which had formed part of the horizontal course of masonry,—was more or less hollowed towards the central region: partly, from a purposed intention of the builders to cause the stones to rest on their edges only, not on their centres, which would make them unsteady; and partly, from the thin pointing of lime in the outer part of the joints, having tended to preserve the stone from decay along its angular edge, and to keep it high there; causing the measured angle, when straight-edges are applied to the *whole* surface indiscriminately, to give a too acute angle, by a quantity of a degree more or less. The original outer, or bevelled surfaces of the stones were nearly free from this defect; though three fragments from the northern rubbish-heap of the Pyramid had it rather severely, and indeed so evidently to the eye from their large decay, that they ought perhaps to have been thrown away at the place. But as they have been brought to this country, I give their angles with those of every other fragment brought home, though not allowing them to mix in the mean.

Of nineteen fragments, seven came from the north side of the Great Pyramid, five from the east, two from the south, and five from the west.

And again, of the same nineteen,—fifteen were examples of the obtuse angle along the upper edge of every original casing-stone; and four of the acute angle at the lower edge. The angles observed in them run thus:—

OBSERVED ANGLES OF CASING-STONE FRAGMENTS.

Side of Great Pyramid found at	Number for reference.	Length of worked surface: In horizontal course. General.	Length of worked surface: In horizontal course. Trust-worthy.	Length of worked surface: In the outer bevelled slope.	Angle.	Mean for each side.
		Inches.	Inches.	Inches.		
North,	1	3·	1·	1·	(127° 18′)	128° 6′
,,	2	4·	1·	3·	128 6	
,,	5	4·	0·5	(?)	(126 50)	
,,	6	1·	0·5	3·	128 5	
,,	7	3·	0·5	(?)	(127 15)	
East,	1	1·5	0·3	1·3	128 12	128 5
,,	2	1·	1·	2·	128 10	
,,	3	6·	0·3	4·	128 6	
,,	4	1·	0·5	8·	128 6	
,,	5	0·5	0·3	1·	127 50	
South,	1	1·	...	3·	127 40	127 54
,,	2	4·	0·2	2·	128 9	
West,	1	3·	0·4	3·	128 4	128 2
,,	2	1·	0·7	3·	128 2	
,,	5	0·4	0·2	2·	128 0	
North,	3	2·	...	2·5	51 55	51 56
,,	4	3·	1·	3·	51 56	
West,	3	3·	1·5	3·	51 26	51 42
,,	4	4·	4·	6·	51 58	

Whence the mean of all the obtuse angles is 128° 2′, yielding trigonometrically **51° 58′** as their inference for the acute angle, or angle of slope of the sides of the Pyramid with the horizon; and the mean of the same acute angle, actually observed, is **51° 49′**.

CORNER ANGLES OF GREAT PYRAMID.

ANGLES OF ALTITUDE OF CORNER-LINES OF GREAT PYRAMID.

April 25, 26, 1865.—These were measured with the Playfair altitude-azimuth, from the corner socket-holes of the casing, cut in the rock. The instrument therefore was powerful, the station marks below accurate, and if only there could have been obtained at the top of the Pyramid, a true memorial of its ancient surface, the observations would have been in the very highest degree important. But there is no such memorial there; and we must either supply on the present 400-inch-sided upper platform, a pole about 360 inches high to represent the masonry and summit casing-stones now removed; or, push out horizontally a signal from 100 to 150 inches to represent the *side casing*, now also removed.

Of the two methods, the latter was adopted—as containing the least amount of deduction from theory: and Mr. Inglis kindly undertook each day to ascend the Pyramid; and hold out as required, an observing-signal at a distance of, first 100 inches, and then 150 inches, from each corner of the summit-platform in succession, and in the direction of a diagonal of the Pyramid.

In the meanwhile I marked off the Pyramid diagonal lines on the socket-floors below; and measuring from the outer corner of the socket, along that line a distance of 58·1 inches, marked that as the spot for erecting the Playfair instrument over, because then its centre was seen at an angle of altitude of 42° (the approximate vertical corner angle of the Pyramid), from said outer corner of socket floor. Hence, although the instrument stood near the middle of each floor, and high above it,—the angles may be considered as having been measured from the outer corner of the floor itself.

OBSERVATIONS AT NORTH-EAST SOCKET, OF THE 100-INCH DIAGONAL SIGNAL AT NORTH-EAST CORNER OF SUMMIT-PLATFORM OF GREAT PYRAMID.

Time.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 25, 4 P.M. .	Alt., . .	41° 45′ 6″	41° 51′ 24″
	Zen. dist., .	48 2 12	
	Alt., . .	41 44 22	41 51 2
	Zen. dist., .	48 2 19	
Mean of both sets for a diagonal distance at top of 100 inches, =			41° 51′ 13″

N.B.—A strong north-east wind blowing at summit of Pyramid, making the signal-staff difficult to hold steadily; wherefore bisection with telescope-wire was found often varying.

OBSERVATIONS AT SOUTH-EAST SOCKET, OF SIGNAL AT SOUTH-EAST CORNER OF SUMMIT-PLATFORM, AND DISTANCE IN DIAGONAL OF PYRAMID OF 100 INCHES *virtual.*

Time.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 25, 6 P.M. .	Zen. dist., .	47° 58′ 16″	41° 54′ 55″
	Alt., . .	41 48 6	
	Zen. dist., .	47 58 20	41 54 46
	Alt., . .	41 47 51	
Mean for South-east corner and socket,		=	41° 54′ 50″

The 100-inch distance above is called *virtual*, because it was actually 130 inches, but then the instrument below was pushed 30 inches outwards from its intended place of 58·1 inches inwards, on account of the small size of the floor of the south-east socket.

OBSERVATIONS AT THE NORTH-WEST SOCKET, ON TWO SIGNALS, ONE AT 100, AND THE OTHER AT 150 INCHES IN THE HORIZONTAL DIAGONAL FROM N.-W. CORNER OF SUMMIT-PLATFORM.

Time.	Signal.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 26, 4 P.M.	150	Zen. dist.,	47° 49′ 26″	
	100	Zen. dist.,	48 3 56	150 = 42° 2′ 56″
	150	Altitude,	41 55 16	100 = 41 48 40
	100	Altitude,	41 41 16	
Single reading of one microscope.	150	Zen. dist.,	47° 50′ 30″	
	100	Zen. dist.,	48 4 10	150 = 42° 2′ 30″
	150	Altitude,	41 55 30	100 = 41 48 45
	100	Altitude,	41 41 40	
Mean for 150 signal, . . =				42° 2′ 47″
Mean for 100 signal, . . =				41 48 42

OBSERVATIONS AT SOUTH-WEST SOCKET, ON TWO SIGNALS, ONE AT 100, AND THE OTHER AT 150 INCHES IN THE HORIZONTAL DIAGONAL FROM THE NORTH-WEST CORNER OF SUMMIT-PLATFORM.

Time.	Signal.	Quantity observed.	Mean of opposite microscopes.	Mean altitude freed from index-error.
April 26,	150	Alt., .	41° 53′ 6″	......
5 P.M.	100	Alt., .	41 39 46	150=42° 0′ 19″
	150	Zen. dist.,	47 52 28	100=41 46 53
	100	Zen. dist.,	48 6 0	......
Single mi-	150	Alt., .	41 54 0	......
croscope.	100	Alt., .	41 40 20	150=42 0 55
	150	Zen. dist.,	47 52 10	100=41 47 5
	100	Zen. dist.,	48 6 10	......
Concluded mean at South-west socket—				
For 150 signal, ... =				42° 0′ 31″
And for 100 signal, ... =				41 46 57

Hence, supplying places of the 150-inch signals to north-east and south-east sockets, from what was observed at the north-west and south-west sockets, we have—

As seen from Socket.	Angular altitude at top of Pyramid—	
	Of 100-inch corner signal.	Of 150-inch corner signal
North-east, . .	41° 51′ 13″	42° 5′ 3″
South-east, . . .	41 54 50	42 8 40
North-west, . .	41 48 42	42 2 47
South-west, . .	41 46 57	42 0 31

But the floors of the sockets are not on the same level; nor apparently intended to be so, by their builders,—from the different depths to which they are cut into the rock. It will be proper therefore to reduce the above angles of altitude, to what they would have marked, had they all been observed from a *uniform level* pavement extending round the whole Pyramid; and a portion of such a grand pavement is to be seen near the north-west socket, about ten inches or more above that socket's bottom.

Hence, reducing Mr. Inglis's levels of the socket-floors to above pavement (see page 137),—we find each of them to have been too low by the quantities stated in the *second* column of the following table. Wherefore, if the *third* column gives the 150-inch signal as observed from the actual socket-floors, the *fourth* gives it as it would have been observed from the uniform pavement. And the *fifth*, gives the angles from the same pavement, due to a decreased distance from 150 to 143 inches for the signal, in the direction of a horizontal diagonal from the corner of present summit-platform; (143 inches being equivalent, in the diagonal, to a side, horizontal thickness of casing and backing stones of 101· inches.)

Socket floor.	Below pavement surface.	150-inch signal from socket floor.	Same signal reduced to pavement surface.	A 143-inch signal from pavement surface.
	inches.			
North-east,	6·	42° 5′	42° 3′	42° 1′
South-east,	19·	42 9	42 3	42 1
North-west,	10·	42 3	42 0	41 58
South-west,	0·	42 1	42 1	41 59
			Mean, =	41° 59′ 45″

HORIZONTAL ANGLES AT THE CORNERS OF THE BASE.

These angles cannot be directly observed at present, because the rubbish-heap in the middle of every side interferes with any one socket seeing any other. But by comparing two sides *successively* with the Pole-star, as will be described in the next department of angular measures,—it was concluded, that the horizontal angle at the outer corner of the north-east socket, subtended between the outer corners of the south-east and north-west sockets, is 90° 0′ 44″.

This observation, however, was made under such remarkably disadvantageous conditions, and on the last observing evening we had,—that it eminently requires repetition under more favourable circumstances.

SECTION III.—ANGULAR MEASURES, ASTRONOMICAL.

TIME OBSERVATIONS.

All these observations were, with one or two exceptions, taken with the sextant-horizon; on account of the portability and expedition of that instrument: but its accuracy was usually considered somewhere, not nearer than 2′ or 3′; though by care it might be brought within 1′. Latitude observations by various stars were occasionally taken as a check on the index-error; and though the time was usually obtained from the sun, it was also sometimes found from star observations; which last occasions may be distinguished in the following table, by the hours against which the quantity for the day is entered.

The chronometer alluded to was my pocket-watch, compensated for temperature, and going, as will be observed from the column of error on mean solar time, very fairly,—considering the amount of motion it was subjected to. The first column of errors on *apparent solar* time, was computed for the sake of having that sort of time certain for the meteorological observations; and the last, or the errors on *sidereal* time, for the sake of the astronomical observations with the Playfair alt-azimuth instrument; which, however, being only employed on the Pole-star, never required the time to be known with any very great degree of exactness.

In the first fortnight following January 24th, there was only one day on which weather prevented me from obtaining a time-observation of the sun; and the climate was so fine, that the series could have been kept up, probably for the whole four months, almost daily; but my time was too much limited by other work, to allow of doing more than what is given below :—

Time Observations at East Tombs in 1865.

Day.	Hour.	Chronometer's correction on time.		
		Apparent Solar.	Mean Solar.	Sidereal.
January	h.	m. s.	m. s.	h. m. s.
20	8 A.M.	− 7 49	+ 3 35	......
22	8 ..	− 8 27	......	......
..	7 P.M.	......	......	− 3 48 36
23	7 ..	......	......	− 3 44 23
24	8 A.M.	− 9 17	+ 3 10	− 3 42 36
25	8 ..	− 9 27	+ 3 14	− 3 38 34
26	8 ..	− 9 28	+ 3 24	− 3 34 30
27	8 ..	− 9 52	+ 3 16	− 3 30 39
28	8 ..	− 10 1	+ 3 15	− 3 26 46
29	8 ..	− 10 23	+ 3 3	− 3 22 50
30	8 ..	− 10 29	+ 3 11	− 3 18 59
31	8 ..	− 10 42	+ 3 3	− 3 15 10
February				
1	7 ..	− 10 49	+ 3 4	− 3 11 11
2	7 ..	− 10 57	+ 3 3	− 3 7 15
4	7 ..	− 11 22	+ 2 52	− 2 59 35
5	7 ..	− 11 37	+ 2 42	− 2 55 58
6	7 ..	− 11 39	+ 2 44	− 2 51 49
8	7 ..	− 11 36	+ 2 53	− 2 43 36
11	7 ..	− 12 5	+ 2 26	− 2 32 26
14	7 ..	− 11 53	+ 2 33	− 2 20 24
17	7 ..	− 11 55	+ 2 20	− 2 8 50
19	8 ..	− 11 49	+ 2 16	− 2 0 56
21	7 ..	− 11 49	+ 2 4	− 1 53 19
28	7 ..	− 10 29	+ 2 19	− 1 25 29
March				
1	7 ..	− 10 31	+ 2 5	− 1 21 57
3	10 P.M.	......	......	− 1 11 20
7	7 A.M.	− 8 44	+ 2 32	− 0 57 45
11	10 P.M.	......	......	− 0 39 52
13	7 A.M.	− 7 51	+ 1 50	− 0 34 43
..	9.47 P.M.	......	......	− 0 32 20
18	8.41 ..	......	......	− 0 12 48
20	7 A.M.	− 5 56	+ 1 44	− 0 7 17
April				
1	8 ..	− 2 13	+ 1 46	+ 0 40 14
2	7.30 A.M.	− 1 58	+ 1 43	+ 0 44 2
3	8.30 ..	− 1 51	+ 1 31	+ 0 47 55
4	8.45 ..	− 1 36	+ 1 28	+ 0 51 52
6	8.0 ..	− 1 6	+ 1 23	+ 0 59 31
7	8.40 ..	− 0 36	+ 1 35	+ 1 3 47
..	8.50 P.M.	......	......	+ 1 5 40
8	9 A.M.	− 0 31	+ 1 22	+ 1 7 33
10	7.40 A.M.	+ 0 12	+ 1 33	+ 1 15 25
12	6.40 ..	+ 0 26	+ 1 16	+ 1 22 51
25	7.33 ..	+ 3 11	+ 1 4	+ 2 14 2
26	7.37 ..	+ 3 9	+ 0 52	+ 2 17 58
27	7.37 ..	+ 3 25	+ 0 59	+ 2 21 51

LATITUDE OBSERVATIONS.

MARCH 11—APRIL 10.

WITH THE PLAYFAIR ALT-AZIMUTH INSTRUMENT, MOUNTED ON A FIRM TRIPOD.

On March 11, at East Tombs,—Barometer = 30·06, and Thermometer = 68·6 at 14h. 0m. per watch,—the following observations were taken for Latitude :—

Nos. for reference.	Time by watch.	Quantity observed.	Microscope A.	Microscope B.	Means of microscopes, still affected by index-error.
	h. m. s.				
1	12 0 0	Alt.	28° 34′ 22″	28° 37′ 50″	28° 36′ 6″
2	12 15 45	Z. dist.	61 6 22	61 9 54	28 51 52
3	12 28 30	Alt.	28 30 8	28 33 38	28 31 53
4	13 56 10	Alt.	28 26 45	28 27 10	28 26 58
5	14 7 20	Z. dist.	61 14 36	61 14 46	28 45 19
6	14 24 30	Alt.	28 27 52	28 28 15	28 28 4
7	14 31 40	Z. dist.	61 13 12	61 13 34	28 46 37

STEPS OF COMPUTATION.

Nos. for reference.	True sidereal time.	Mean of microscopes.	Refraction.	Reduction to meridian.	Resulting latitude of station.
	h. m. s.				
1 and 3	11 34 45	28° 34′ 0″	...	...	...
2	11 36 15	28 51 52	...	...	...
Mean, .	11 35 30	28 42 56	−1′ 42″	+1° 17′ 29″	29° 58′ 43″
4	13 16 55	28 26 58	...	...	...
5	13 28 5	28 45 19	...	...	...
Mean, .	13 22 30	28 36 8	−1 42	+1 24 15	29 58 41
6	13 45 15	28 28 4	...	...	...
7	13 52 25	28 46 37	...	...	...
Mean, .	13 48 50	28 37 20	−1 42	+1 23 9	29 58 47

On March 18, at East Tombs,—Barometer = 30·20, and
Thermometer = 62·8 at 13h. 11m. per watch,
And ,, = 62·5 at 13h. 30m. ,, ,—
the following observations were taken for Latitude :—

Nos. for reference.	Time by watch.	Quantity observed.	Microscope A.	Microscope B	Means of microscopes, still affected by index-error.
	h. m. s.				
1	9 29 36	Alt.	29° 5′ 21″	29° 7′ 17″	29° 6′ 19″
2	9 38 7	Z. dist.	60 37 24	60 39 0	29 21 48
3	13 3 20	Alt.	28 26 24	28 28 10	28 27 17
4	13 11 12	Z. dist.	61 13 52	61 15 42	28 45 13
5	13 29 20	Alt.	28 26 18	28 27 49	28 27 4
6	13 36 20	Z. dist.	61 13 55	61 15 27	28 45 19

STEPS OF COMPUTATION.

Nos. for reference.	Sidereal time.	Mean of microscopes.	Refraction.	Reduction to meridian.	Resulting latitude of station.
	h. m. s.				
1	9 16 58	29° 6′ 19″	...	...	...
2	9 25 29	29 21 48	...	...	...
Mean, .	9 21 14	29 14 4	−1′ 44″	+0° 46′ 23″	29° 58′ 43″
3	12 51 20	28 27 17	...	...	...
4	12 59 12	28 45 13	...	...	...
Mean, .	12 55 16	28 36 15	−1 46	+1 24 16	29 58 45
4	13 17 20	28 27 4	...	...	...
5	13 24 20	28 45 19	...	...	...
Mean, .	13 20 50	28 36 12	−1 46	+1 24 19	29 58 45

The meridional distance between the parallels of East Tombs and the centre of Great Pyramid, being paced,—was found equal nearly to 10,000 inches; wherefore a correction of + 8″ is necessary to reduce the above latitude of East Tombs to that of Great Pyramid, Great Pyramid being north of East Tombs.

On April 10, 1865, on summit of Great Pyramid, Barometer concluded from East Tombs observation combined with height, = 29·75; correction of watch, or sidereal time, at

h.			h.	m.	s.
8 P.M.	=	+	1	17	22
10 P.M.	=	+	1	17	41
Midnight	=	+	1	18	0
2 A.M.	=	+	1	18	18

observed as follows with Playfair alt-azimuth instrument for latitude; instrument erected about 100 inches south of centre of summit-platform:—

Nos. for reference.	Time by watch.	Thermometer.	Quantity observed.	Microscope A.	Microscope B.	Mean of microscopes, still affected by index-error.
	h. m. s.	Fahr.				
1	8 37 10	...	Alt.	28° 57′ 23″	28° 57′ 5″	28° 57′ 14″
2	8 44 55	60·0°	Z. dist.	60 50 46	60 50 8	29 9 33
3	8 54 13	57·3	Alt.	28 52 56	28 52 16	28 52 36
4	9 7 20	56·0	Z. dist.	60 56 16	60 55 52	29 3 56
5	9 14 3	55·4	Alt.	28 48 0	28 47 24	28 47 42
6	12 25 4	54·3	Z. dist.	61 16 20	61 15 45	28 43 58
7	12 35 30	...	Alt.	28 30 28	28 29 46	28 30 7
8	12 46 42	53·9	Alt.	28 31 20	28 30 42	28 31 1
9	12 58 20	54·3	Z. dist.	61 13 36	61 13 2	28 46 41

STEPS OF COMPUTATION.

Nos. for reference.	Sidereal Time.	Refraction.	Reduction to meridian.	Latitude, with index-error.	Latitude.
	h. m. s.				
1	9 54 38	− 1′ 42″	+ 0° 56′ 9″	29° 51′ 41″	} 29° 58′ 54″ (1, 2)
2	10 2 25	− 1 42	+ 0 58 16	30 6 7	
3	10 11 44	− 1 43	+ 1 0 42	29 51 35	} 29 58 53 (3, 4)
4	10 24 52	− 1 33	+ 1 3 58	30 6 11	} 29 58 51 (4, 5)
5	10 31 37	− 1 43	+ 1 5 32	29 51 31	
6	13 43 7	− 1 45	+ 1 23 42	30 5 55	} 29 58 39 (6, 7)
7	13 53 35	− 1 45	+ 1 23 0	29 51 22	
8	14 4 49	− 1 45	+ 1 22 5	29 51 21	} 29 58 37 (8, 9)
9	14 16 28	− 1 45	+ 1 20 56	30 5 52	

Adding 8″ for geographical reduction to each of the East Tombs observations, we have then for the latitude of the Great Pyramid, the following series of results :—

March 11.	First set,	. . .	=	29°	58′	51″
	Second ,,	. . .	=	29	58	49
	Third ,,	. . .	=	29	58	55
,, 18.	First ,,	. . .	=	29	58	51
	Second ,,	. . .	=	29	58	53
	Third ,,	. . .	=	29	58	53
April 10.	First ,,	. . .	=	29	58	54
	Second ,,	. . .	=	29	58	53
	Third ,,	. . .	=	29	58	51
	Fourth ,,	. . .	=	29	58	39
	Fifth ,,	. . .	=	29	58	37

Considering that the strange anomaly of the two last must have been due to want of level adjustment, they deserve to have only half weight in taking the mean, in which case the final result for latitude north of Great Pyramid is

$$+\ 29^{\circ}\ 58'\ 51''.$$

ROUND OF AZIMUTHS.

This round was taken very hastily, and only intended to be approximate; chiefly also to settle whether second Pyramid was in diagonal of Great Pyramid, and whether a certain supposed distant Pyramid in the desert, spoken of by Dr. Lieder, was really west of the Great Pyramid.

SUNRISE ON SUMMIT OF GREAT PYRAMID, WITH PLAYFAIR ALT-AZIMUTH INSTRUMENT.

APRIL 11.

South point of horizon (computed), ...	=	0°	0′
Second Pyramid summit, ...	=	43	20
Diagonal Great Pyramid, ...	=	44	55
Distant Pyramid (?), reputed west, ...	=	77	35
Full moon near setting, about	=	78	35
West point, ...	=	90	0
Pyramid of Aboo-Roash, ...	=	135	56
Delta of cultivated land, begins, ...	=	161	0
North end of meridian, ...	=	180	0
Delta of cultivated land, ends, ...	=	211	0
Dome of Mehemet Ali's mosque in Cairo, .	=	245	38
Sun rising, ...	=	260	10
East point of horizon, ...	=	270	0
Pyramids of Sakkara, begin, ...	=	323	36
,, ,, end, ...	=	326	25
A distant Pyramid, probably 'the False Pyramid,'	=	337	25
Dashoor, sharp and straight Pyramid, . . .	=	339	51
Dashoor, re-entering angle Pyramid, . . .	=	340	53
Distant ruins of Pyramids, ...	=	345	0
Some very distant, ...	=	355	0
South point, ...	=	360	0

AZIMUTH TRENCHES.

MARCH 21, 23.

WITH THE PLAYFAIR ALT-AZIMUTH INSTRUMENT.

THE observations of the 21st being only approximate as to signals, those of the 23d are alone preserved. The work began about 3 P.M. and finished at 8 P.M., in the shade of the Pyramid all the time from the sun; but exposed to a hot wind from the south-west, which made the temperature 94·2° at 5.18 P.M., and 91·0° at 6.0 P.M., and contracted the size of the level-bubble fearfully.

The azimuth trenches here observed upon, are described in the linear measures, p. 126.

The first step was, to place the Playfair instrument midway between the north and south trenches; and in the line of their mutual axes, as indicated by poles carefully planted at their outer ends. That done, the two inclined trenches, viz., the east-north-east and north-north-east, were looked at, and found not to converge precisely on the instrument, but on a point about 100 inches west; so that the correct line to have taken with the north and south trenches would have been,—not their central axes, as I had done,—but a parallel line 100 inches west of that;

in fact nearly the west side of their *ends*. Instead, however, of moving the instrument and signals to that new western position, I preferred to move the instrument in the axial line of the north and south trenches. First northward, until it reached the intersecting point of the north-north-east trench, as shown by poles at its either end; and again southward, for the intersection of the east-north-east trench: separate observations of the north and south poles being made at each station. Hence we have for the crude observations—

AT CENTRAL STATION FOR NORTH-NORTH-EAST TRENCH.

Time.	Signals at	Mean of two opposite microscopes.
h. m.		
5 30 P.M.	North end of North trench, . .	30° 21′
	Axis of North-north-east trench, .	54 52
	South end of South trench, . .	210 18
	North end of North trench, . .	30 21

AND AT CENTRAL STATION FOR EAST-NORTH EAST TRENCH.

Time.	Signals at	Mean of two opposite microscopes.
h. m.		
6 0 P.M.	North end of North trench, .	337° 22′ 49″
	Axis of East-north-east trench, .	53 48 26
	South end of South trench, . .	157 22 21
	North end of North trench, .	337 22 32
6 43 ..	Pole-star, ...	336 4 36
6 51 ..	,, ...	336 4 24
6 58 ..	,, ...	336 4 20
7 2 ..	,, ...	336 4 18
7 8 ..	,, ...	336 4 24

Hence azimuth angle of north-north-east trench, from north end of axis of north and south trenches, towards the east, is

$$54° 52' - 30° 19' 30'' = 24° 32' 30''$$

and azimuth of east-north-east trench from north end of axis of north and south trenches,

$$= 413° 48' 26'' - 337° 22' 34'' = 76° 25' 52''$$

But the east-north-east and north-north-east trenches being more accurately cut, or better preserved than the others,—should have their azimuths compared also with the line of the sockets defining the east side of the Pyramid's base, which may be accomplished thus,—

The Pole-star readings taken above, include the greatest elongation west for that evening, computed at 1° 37′ 30″; therefore 336° 4′ 18″ + 1° 37′ 30″ = 337° 41′ 48″; or place of celestial pole, when north end of axial line of north and south trenches reads 337° 22′ 34″. And, as the circle readings increase in going round west, north, east,—said axial line of north and south trenches is at its north end, 19′ 14″ west of the north point on the horizon.

But, by observations presently to appear,—the line of the sockets on the east side of Great Pyramid, deviates at its northern end 4′ 44″ west of the true north point. Whence, line of north and south trenches points 14′ 30″ west at its north end, of the similar trending of socket line: and the *inclined* trenches have a less inclination from socket line, than from north and south trenches line; thus—

Azimuth angle of	From North end of		Mean.
	North and South trench line.	Socket line on East side of Great Pyramid.	
N.N.E. trench, . .	24° 32′ 30″	24° 18′ 0″	24° 25′ 15″
E.N.E. trench, . .	76 25 52	76 11 22	76 18 37
E.N.E. − N.N.E. trench, ...			51° 53′ 22″
$\frac{76° 25′ 52″}{2} - 90$, ...			51 47 4
$\frac{76° 11′ 22″}{2} - 90$, ...			51 54 19
		Mean, =	51° 51′ 35″

AZIMUTH OF ENTRANCE-PASSAGE OF GREAT PYRAMID.

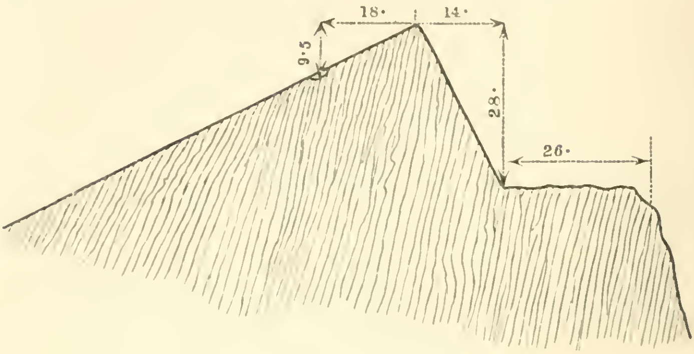
April 3, 7, 1865.

The signal observed on April 3d was a lamp, placed on a box upon the sand-heap under the granite portcullis, about 1000 inches down the entrance passage; and viewed through a 0·3-inch hole, with bevelled edges, in a board fastened to same box; the hole being placed by measure—

25·9	inches from	floor.
25·9	,,	roof.
21·4	,,	east wall.
and 21·4	,,	west wall.

The lamp flame was behind or southward, and rather below this hole,—in order to make said hole appear well illuminated when viewed from above and northward; *i.e.*, from the position of the instrument, at the top of passage, or rather of the basement sheet,—as this extends beyond either walls or roof.

A vertical meridian section of the upper end of the basement-sheet appears thus—



A special tripod-stand was therefore prepared for the Playfair alt-azimuth instrument, having two legs 29 inches long, and one 10·5 inches long, with a breadth of 33 inches at the top. And, by shifting that stand about, it was finally so placed, that the centre of the telescope of the Playfair instrument, was considered to be in the line of the axis of the entrance passage produced outwards,—to within 0·2 inch. The following observations were then obtained for the azimuth, after others for the dip of the passage had been secured :—

Time per watch.	Object observed.	Microscope A.	Micro-scope B.	Mean of both azimuthal microscopes.
April 3. h. m. s.				
6 13 0 P.M.	Signal lamp in passage,	57° 38′ 50″	39′ 34″	57° 39′ 12″
6 23 50	Polaris,	236 7 33	7 42	236 7 38
6 32 10	......	236 7 26	7 40	236 7 33
6 41 15	......	236 8 14	8 24	236 8 19
	Signal lamp,	57 38 58	39 38	57 39 18
6 53 0 P.M.	Signal lamp,	237 38 46	39 56	237 39 51
7 7 5	Polaris, .	56 9 40	10 7	56 9 54
7 15 0	Signal lamp,	237 39 + x.	...	......

the following being the steps of computation :—

Illumined end of telescope axis.	Object observed.	Azimuth angle.	Reduction to a North meridian	Pole of passage and pole of sky.
East ? h. m. s. 7 21 37 Sid. time	Lamp signal, south	57° 39′ 15″	180° 0′ 0″	237° 39′ 15″
	Polaris, .	236 7 50	1 37 20	237 45 10
West ? h. m. s. 7 56 42 Sid. time	Lamp-signal	237 39 51	180 0 0	57 39 51
	Polaris, .	56 9 54	1 35 11	57 45 5

Hence in one way of the illuminated end of the telescope axis, the north pole of the Pyramid entrance passage is 5′ 55″, and in the other 5′ 14″, west of the pole of the sky; or, on the mean = 5′ 34″ west.

April 7, 6 P.M.—On this day a new lamp-signal was duly centred in the entrance passage, under the granite portcullis, and observed with the Playfair alt-azimuth from above and northward as before,—

Time by watch. h. m. s.	Object observed.	Microscope A.	Microscope B.	Mean of both azimuthal microscopes.
	Lamp-signal,	177° 36′ 21″	36′ 46″	177° 36′ 34″
	Telescope reversed, .	357 36 52	37 36	357 37 14
6 48 0	Polaris, .	356 5 30	6 18	356 5 54
6 54 20	......	176 6 18	6 32	176 6 25
7 1 40	......	356 7 0	7 34	356 7 17
	Lamp-signal,	357 36 56	37 36	357 37 16

the following being the steps of computation, separating the observations with illumined end of axis east or west :—

Sidereal time.	Object.	Azimuth angle.	Reduction to North meridian.	Pole of passage, and Pole of sky.
	Lamp South,	177° 36′ 34″	180° 0′ 0″	357° 36′ 34″
h. m. s. 7 53 20	Polaris,	356 5 54	1 35 30	357 41 24
8 7 0	...	356 7 17	1 34 8	357 41 25
	Lamp South,	357 37 15	180 0 0	177 37 15
7 59 40	Polaris,	176 6 25	1 34 54	177 41 19

Hence, in the two ways of the telescope, the pole of the passage is shown to be west of the pole of the sky, by 4′ 50″, and 4′ 4″ ; mean = 4′ 27″.

But result of April 3d, said 5′ 34″ ; therefore mean of both days = **5′ 0′**, for azimuthal deviations of pole of entrance passage west of pole of sky.

AZIMUTH OF PYRAMID CORNER SOCKETS.

EAST SIDE OF GREAT PYRAMID.

April 26, 27, 1865.—After preliminary trials on April 25, the Playfair instrument was taken on the 26th to a nick cut out in side of rubbish-heap on eastern flank of Great Pyramid, and made there to observe, azimuthally, signals which had been duly centred over the outer corners of the north-east and south-east basal sockets,—a similar observation being afterwards made of the Polar star. After several trials and adjustments of the stand, to bring it into the vertical plane between the two signals, the instrument was well levelled, and the following observations were taken; the change of readings by 180° for the same object, showing when the telescope was reversed, and the opposite half of the azimuthal circle brought into play :—

Time per watch.	Object observed.	Microscope A.	Microscope B.	Mean of both azimuthal microscopes.
	South socket,	350° 6′ 52″	6′ 64″	350° 6′ 58″
	North ,,	170 8 26	8 31	170 8 28
	South ,,	170 7 20	7 24	170 7 22
h. m. s.	North ,,	350 9 14	9 0	350 9 7
6 50 45	Polaris, .	168 49 10	49 10	168 49 10
6 56 25	...	348 50 0	50 14	348 50 7
7 1 30	...	168 51 28	51 20	168 51 24

Applying then the correction + 2h. 20m. 0s. to reduce the watch time to sidereal time,—and computing for the time thus found, or 2h. 9m. 51s. after the greatest elongation west, that the reduction of the Pole star to the north meridian was = + 1° 22′ 29″,—the polar pointing, or trending of the line of the two socket corners on east side of Pyramid, is, 4′ 44″ west of the polar point of the sky, referred to the north horizon.

NORTH SIDE OF GREAT PYRAMID.

At 4h. 30m. P.M. placed the Playfair alt-azimuth instrument on eastern half of northern rubbish-heap, where a nick had been prepared during the day,—expected in the vertical plane joining the outer corners of north-east and north-west sockets. The position was very difficult to attain in any way, on account of the steepness and looseness of the rubbish-heap, which owes its present compound shape and extra steepness of slope—to the excavations made by Colonel Howard Vyse on the original rubbish-heap; for that heap was previously of the same simple form, as those still to be seen on the other three sides of the Pyramid. The wind was violent, and the air often so filled with sand and limestone-dust, that I could seldom open my eyes with impunity, though holding them as close as I could to the telescope or microscope eyepiece. My right hand, by continual overtasking during the several last days, had become so sprained, that the Playfair instrument had to be lifted for me by Mr. Inglis, in placing it on its stand. He likewise adjusted the observing signals over the outer corners of the two sockets; at the north-east socket, a camera-stand; and at the north-west socket, finally, an 18-inch rod, which he held vertical by hand.

Not until close upon seven o'clock, when daylight had almost entirely vanished, had we obtained a place where the instrument was sufficiently in the line of the two signals, and could see them both,—so extensive and troublesome were found the necessary diggings into the side of the steep hill of loose rubbish and dust.

At length, after various trials, the instrument and its stand were erected in a new hole; hastily levelled; and the following observations obtained with single microscope—

	West signal,	= 256° 35′,	and	East signal,	76° 37′
Again,	,,	= 256 37	and	,,	76 37

Now these notes show a discrepance of 2′ somewhere, and though I turned to the west signal immediately, the growing darkness prevented my seeing it again; while the east signal, on being looked for, was found to have been blown down in the interval. Directing therefore immediately to Polaris, the following observations were taken:—

	h. m. s.		
At	7 2 0	per watch, azimuth of Polaris, .	= 165°20′ 0″
	7 4 50	,, ,, .	= 165 21 0
	7 6 30	,, ,, .	= 165 21 30
Means,	= 7 4 37,	or 9h. 28m. 12s. sidereal time,	= 165°20′50″

The reduction to the meridian for the above sidereal time, or 2h. 21m. 50s. after time of greatest elongation of Polaris west, = 1° 19′ 40″: making reading for celestial pole = 166° 40′ 30″ referred to north horizon.

And if we take a mean of the signal measures just as they stand, adding 90° to the degree-reading for the west end,—we obtain 166° 36′ 30″, for the azimuth of the polar direction of the Pyramid deduced from its north side, as defined by the terminal sockets' outer corners there,—indicating that such line, is

4′ 0″ West of celestial pole.

I need hardly remark that this observation requires repetition, and would have been repeated by me, but that another night was not possible.

SECTION IV.—HEAT MEASURES.

INTRODUCTION.

The instruments employed in these measures, including the meteorological, were—

1. An aneroid barometer, by T. Cooke and Son; compared by J. Hartnup, Esq., Director of the Liverpool Observatory, through 0·692-inch of barometer range, and through 25·5° of temperature, with the result—that it is correct to ·001-inch at 83·0° temperature; but has a thermal correction of 0·00243-inch for one degree of Fahrenheit, + above, and − below the temperature of 83·0°.

2. Thermometer, 'Casella 0,' a mercurial travelling thermometer, scale engraved on glass tube, compared at the Liverpool Observatory on June 1, 1865, and found by three observations to be 0·1° too high, at or near 62°.

Therefore the correction to be applied to its readings is − 0·1°.

3. Thermometer, 'Casella 1500,' a mercurial, Phillips'-maximum thermometer, scale engraved on glass tube, and found to have top of *unbroken*

mercurial column, 10·1° distant from top of broken part,—when this is being driven along slowly by expansion.

Adding therefore 10·1° to any reading of the column part, its readings are then found 0·3° too high; hence the correction for such readings is −0·3°, at or near 62°.

4. Thermometer, 'Casella 1499,' a mercurial, Phillips'-maximum. Column correction = + 9·6°; with which added, the final correction on the Liverpool standard is − 0·2°, at or near 62°.

5. Thermometer, 'Casella 1834,' a spirit minimum thermometer, for whose corrections see Meteorological Journal.

6. Ayrton's Fastre's dry-bulb; a mercurial thermometer, scale Centigrade, and engraved on the glass tube; it reads too high, and requires a correction to its readings of −1·1° Fahrenheit.

7. Ayrton's Fastre's wet-bulb; a mercurial thermometer, Centigrade scale engraved on the glass tube; it reads too high, and requires a correction to its readings of − 0·9° Fahrenheit. Both of these thermometers were of exquisite manufacture, and were kindly lent me by Mr. Ayrton for Pyramid observations.

METEOROLOGICAL STATION.

This was established in our dining-room tomb, at East Tombs. Said tomb was very shallow in depth and large in opening,—not very different from two-thirds of a sphere, worked out in the middle of the cliff, and towards the east-north-east. The sun only shone into it early in the morning, for a short time ; and then the thermometer-box, of mahogany, with louvre-boarded sides, was always carefully placed in the shade. Every facility was given through the day, for the wind to blow freely on the thermometer bulbs ; but I am afraid that at night, the minimum thermometer may possibly have been rather too well protected by the roof of the tomb or cavern ; for, on the only night when we had simultaneous observations on the summit of the Pyramid and at East Tombs,—the depression of temperature at the former was much more than it should have been for the height ; or, assuming the summit observations true, the minimum temperature at East Tombs was abnormally high.

Otherwise the station was a respectable one for its purposes, and in locality may be described as follows :—

EAST TOMBS METEOROLOGICAL STATION.

Latitude,		=	29° 58′ 45″ North.	
Longitude, approximate,		=	2h. 5m. East of Greenwich.	
Height, above the sea,		=	1600	inches.
,,	well-water,	=	800	,,
,,	neighbouring plain,	=	520	,,
Depth, below	neighbouring hill-top,	=	250	,,
,,	Great Pyramid pavement,	=	980	,,
,,	King's chamber floor,	=	2668	,,
,,	outcrop of air-channels,	=	4210	,,
,,	present Pyramid summit,	=	6420	,,

Distance direct from Red Sea, . . .	=	87	miles.
,, ,, Mediterranean, . .	=	110	,,
Distance from Mediterranean along the course of the Nile, ...	=	150	,,
Distance from cultivated land, about, . .	=	0·5	,,
Distance from Great Pyramid, about, . .	=	0·2	,,

See also Map in Plate II. vol. i.

WELL TEMPERATURES NEAR CAIRO.

THE wells, the temperature of whose water is here alluded to, are frequent in and about the city of Cairo,—sometimes single, and sometimes in a cluster of three,—but always fitted up with a sakeeah or water-raising apparatus turned by bullock, donkey, or other animal power,—and consisting chiefly of a vertical wheel, raising one side of an endless band garnished with earthen water-pots. The observations for temperature, were usually made in the stream of water flowing out of the basin into which the water-pots emptied their supply. But if the machine was not at work at the moment, I raised the water for myself with a glass tumbler and string,—measuring only the third or fourth tumblerful drawn up ; and no temperature-difference between the two methods at the same well, could be detected,—though there was much difference, and apparently constant, between one well and another. The reason of this variation I could not make out, for there was very little difference generally in the depth of the wells ; the country was flat on the surface ; and it was to be presumed that all the wells drew upon the same subterranean sheet of water.

Wells near Cairo.

Date.	Hour.	Name of Well.	Temperature of Air.	Temperature of Water.	Depth of Well approximately.
1864.	h. m.				inches.
Dec. 21.	9 15 A.M.	White well, Boolak road,	61·0°	71·2°	400
,, ,,	9 30 ,,	Coppersmith's well, do., .	58·5	70·0	500
,, ,,	11 30 ,,	,, ,,	68·0	70·1	...
,, 28.	3 0 P.M.	East side of Usbekeeah, .	67·0	68·0	400
,, 29.	9 30 A.M.	At Casr Nuzha, . .	60·1	67·3	350
,, ,,	10 30 ,,	Beyond Casr Nuzha, .	66·5	69·9	400
,, 30.	9 30 A.M.	White well, . . .	64·0	71·0	400
,, ,,	9 50 ,,	Coppersmith's well, .	63·0	70·2	500
,, 31.	4 30 P.M.	Coppersmith's well, .	64·0	69·6	500
1865.					
Jan. 4.	6 55 A.M.	White well, . . .	49·0	71·0	400
May 3.	8 0 ,,	At Casr Nuzha, . .	68·0	69·4	350
,, ,,	8 15 ,,	Beyond Casr Nuzha, .	68·0	70·8	400

Open water in the Nile, near middle of Stream.

Date.	Hour.	Where.	Temperature of Air.	Temperature of Water.
1864. Dec. 31.	h. m. 4 0 P.M.	Between Boolak and Gezireh, . . .	65·0°	58·3
1865. Jan. 2.	6 55 A.M.	,, ,,	64·0	58·8

WELL TEMPERATURES NEAR THE PYRAMID.

Date.	Hour.	Name of Well.	Temperature.		Depth to surface of water.
			Air.	Water.	
1865.	h. m.				inches.
Jan. 26.	4 0 P.M.	King Shafre's well, .	69·5°	63·5°	105
" "	4 10 "	" " .	68·5	63·3	...
Feb. 15.	11 10 A.M.	King Shafre's well; this temperature appears low, but has noted under it in the observing-book that it was *exactly* measured.	68·0	61·0	...
April 23.	4 50 P.M.	King Shafre's well, .	88·2	66·3	105
" "	4 55 "	Sand near well, = 89,	...	66·7	...
" "	5 15 "	Abdallah's well in field,	...	66·9	130?
" "	" "	A similar well, a few feet further North, .	...	68·0	...
" "	" "	Another, . . .	...	69·3	...
" "	" "	Another, . . .	...	69·7	...
" "	" "	Another, . . .	...	71·1	...
" "	" "	Another, . . .	...	70·2	...
" "	" "	Another, . . .	...	69·3	...
" "	" "	Another, . . .	...	68·8	...
" "	" "	Another, . . .	...	70·3	...
" "	6 0 "	Abdallah's well returned to,	...	67·3	...
" "	6 34 P.M.	King Shafre's well, .	...	66·8	105

Of these wells near the Pyramid, the most remarkable one by far is that called King Shafre's, being a square, masonried, sepulchral-looking shaft, —105 inches deep from the alabaster floor to the water-surface, and with a depth of water of 70 inches below that again,—in the eastern room of the recently-discovered and excavated building called King Shafre's Palace or Tomb, south-east of the Sphinx; and in which well, was found by Mariette Bey, the broken, life-sized statue of King Shafre , in diorite. Hence this well has really some claim to show, what the temperature of a water-well in the Great Pyramid *would* be.

All the rest of the wells noted under this heading, were agricultural wells in the alluvial flat east of the Pyramid hills. With reference to the observations of April 23, the following note appears in the observing-book :—

April 23.—No wind; dull hazy evening: sun coloured of an unwholesome primrose yellow; locusts appearing from the south-west. The water to be examined was drawn always from the wells in a small tin kettle at the end of a rope; and only after said kettle had been kept plunging in and out for some minutes, and then depressed for as long, to near bottom of well. The temperature was taken both by *fall and rise;* that is, the air being warmer than the water, the thermometer was plunged into the fluid, and kept in until it ceased to fall; then being taken out, evaporation lowered the bulb below its previous lowest, — in which state it was again plunged into the water, and rose up to, or very nearly to, what it had reached at first when descending from the warmer air.

The reason of the different temperatures of the waters of the different wells in the alluvial plain, we could not discover at the time, or since: for their construction and situation seemed all so very similar; viz., circular holes eight to twelve feet broad, and fifteen to twenty deep, lined about their lower parts with Indian-corn stalks. The last four northward wells were being worked by the villagers with the shadoof: the first five, were not being worked in any way. In some of the extreme cases of anomalous temperatures, the kettleful of water experimented on was emptied upon the ground, and a new haul taken,—but in no case was the numerical result of the first experiment thereby sensibly altered, for *that* well.

Date.	Time.	Subject.	Dry bulb.	Wet bulb.
1865. January 19.	h. h. m. 10 to 10 35 A.M.	In dust under coffer in King's chamber,	75·0°	...
,,	,, ,,	In air, at intervals of five minutes, by Mr. Ayrton's Fastre's thermometers, corrected for index-errors, .	75·7 75·4 75·2	65·8° 65·8 65·8
,,	,, ,,	In dust on floor in Queen's chamber,	74·3	...
,,	,, ,,	Again, . . .	74·3	...

N.B.—Temperature of Queen's lower than that of King's chamber, though latter is more elevated.

Date.	Time.	Subject.	Temperature by Casella 0.
1865. January 26.	h. m. 10 27 A.M.	Floor of King's chamber in temperature, . .	75·5° Fah.
,,	10 44 A.M.	Floor of Queen's chamber in temperature, . .	74·3° Fah.

Temperature of Queen's, again lower than of King's, chamber.

Date.	Time.	Subject.	Temperature by Casella 0.
1865. March 20.	h. m. 10 50 A.M.	South air-channel in King's chamber, .	75·2°
,,	1 0 P.M.	Do. do.	75·2
March 21.	10 37 A.M.	North air-channel in King's chamber, .	75·0
,,	0 0 P.M.	Do. do.	75·0
March 23.	9 0 A.M.	North air-channel in King's chamber, .	75·0
,,	11 0 A.M.	Do. do.	75·0
March 25.	9 30 A.M.	In dust at descent into well from Grand Gallery, . . .	73·2
,,	9 50 A.M.	In dust in hole of floor of Queen's chamber, . .	74·5
,,	10 13 A.M.	In dust of well-mouth of Grand Gallery repeated, . . .	73·2
,,	10 45 A.M.	South air-channel in King's chamber, .	75·1
,,	10 57 A.M.	North air-channel in King's chamber, .	74·9
,,	11 25 A.M.	Do., but meanwhile two travellers and their Arabs had entered and gone again, . . .	75·3
,,	0 15 P.M.	Still in same place, .	75·2
,,	0 20 P.M.	In further part of north air-channel, outside King's chamber, where it is entered by a forced passage from the antechamber, .	74·7
March 29.	10 A.M. to 1 P.M.	In King's chamber, .	75·0

NORTH AIR-CHANNEL.

On March 30, 1865, had six buckets of water poured in quickly one after the other at top of north air-channel,—where it crops out on the exterior of the Pyramid,—expecting that they would run through, carrying the mean-temperature with them,--and down to the excavated cross-passage, which meets said air-channel from north end of antechamber. But no water came through; the shaft being evidently plugged up somewhere,—as it was in Colonel Howard Vyse's day, before he cleared it. Meanwhile I was waiting at said cross-passage with a candle, two thermometers, and a tin mug,—and observed the following rise of temperature in the air of that confined locality, evidently from the effect of my own, and the candle's, heat. At—

h. m.					
9 15 A.M.,	temperature	by Casella 0 =	74·6°,	by spirit min. Th. =	74·6°
9 30	,,	,,	75·0	,,	75·0
9 45	,,	,,	77·8	,,	...
10 0	,,	,,	78·2	,,	...
10 15	,,	,,	78·1	,,	77·0
10 30	,,	,,	77·6	,,	77·5
10 45	,,	,,	77·8	,,	77·4
11 0	,,	,,	76·8	,,	76·8
11 15	,,	,,	77·8	,,	77·5
11 30	,,	,,	77·6	,,	77·4
11 45	,,	,,	77·2	,,	76·8

SOUTH AIR-CHANNEL.

On April 1, at 10.45 A.M., six buckets of water were poured down the open, upper, outer end of south air-channel; and in half an hour afterwards it began to trickle, but only to trickle, through the south air-channel mouth in the King's chamber, and on to the floor. At 11h. 27m. A.M., I began to catch it, as it thus came out of the mouth of the hole, in a one-ounce glass; and tested the temperatures of successive fillings, as follows—

First,	=	74·5°
Second,	=	73·5
Third,	=	74·2
Fourth,	=	74·5

When the thermometer, wet with any previous experiment, was held in the air while the glass cup was refilling, its column went down to 72° and 71°, pretty quickly; and with more time would go down as low as 66·3°. But this was an effect of evaporation; and the true temperature of the water, which went on trickling for more than half an hour through the air-channel hole—was close to 74·5°, as shown by the thermometer immersed in it, and kept there, on each occasion, upwards of one minute.

SUMMIT OF GREAT PYRAMID.

April 10, 1865.—Observed the following temperatures by 'Casella 0,' placed temporarily in windy, but shaded from sky, places,—

	h. m.					
At	8 45 P.M.	appar. solar time,	temperature,	=	60·0°	Fahr.
	8 54	,,	,,	=	57·3	,,
	9 8	,,	,,	=	56·0	,,
	9 14	,,	,,	=	55·4	,,
April 11,	0 25 A.M.	,,	,,	=	54·3	,,
	0 47	,,	,,	=	53·9	,,
	0 58	,,	,,	=	54·3	,,
	Day-break,	,,	,,	=	50·0	,,
	Sunrise,	,,	,,	=	49·0	,,
N.B.—Spirit minimum at day-break was at				=	51·0	,,

METEOROLOGICAL JOURNAL AT EAST TOMBS,

January 1865. Day.	Hour, App. Solar time.	Air Pressure at Station.	Air Shade-Temperature: Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♄ 14th,	11 A.M.	30·25	58·4	57·6	51·4	(55·5)	...	3·4
	1 P.M.	30·20	59·9	59·8	53·0	...	...	3·6
	2 ,,	30·18	62·1	62·0	53·6	...	...	3·5
	3 ,,	30·16	60·4	60·0	51·9	62·3	59·2	3·2
	4 ,,	30·16	61·6	62·0	51·1	...	(6·1)	3·0
	7 ,,	30·15	60·6	60·0	52·6	...	...	3·4
☉ 15th,	8 A.M.	30·13	57·9	57·3	51·1	(57·0)	...	3·3
	10 ,,	30·11	61·9	61·5	55·6	...	...	4·1
	0 P.M.	30·10	66·9	66·5	55·6	...	...	3·5
	3 ,,	30·06	64·1	63·5	55·6	67·3	61·6	3·8
	7 ,,	30·10	61·1	60·3	56·1	...	(11·5)	4·3
☾ 16th,	8 A.M.	30·14	56·0	55·5	51·3	(54·7)	...	3·6
	10 ,,	30·18	59·3	59·2	53·6	...	...	3·8
	0 P.M.	30·13	62·3	62·0	53·6	...	...	3·5
	3 ,,	30·12	63·3	63·0	51·8	...	...	3·0
	7 ,,	30·15	61·0	60·8	54·9	67·5	59·3 (16·4)	4·0
♂ 17th,	7 A.M.	30·21	48·4	48·2	43·8	(47·5)	...	2·7
	9 ,,	30·24	57·3	57·0	50·0	...	...	3.2
	0 P.M.	30·17	64·3	63·2	54·0	...	...	3·4
	3 ,,	30·16	64·3	64·0	55·0	...	...	3·6
	7 ,,	30·18	60·3	60·0	51·6	65·5	58·0 (15·0)	3·2

GREAT PYRAMID HILL, IN THE YEAR 1865.

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
61	2·1	3	Cirro-cumuli,	2	N.	Heavy smoky haze over Cairo.
62	2·2	6	Cirrus, . .	1	N.	
56	2·7	5	Cirrus and cirro-cumuli,	0	0	
56	2·6	4	Cirrus, . .	1	N.	
49	3·2	6	Cirrus, . .	1	N.	Ibraheem and Smyne near Thermometer-box.
58	2·5	10	Cirro-strati, .	0	0	
62	2·0	10	Cirro-strati and nimbus,	0	0	Blue, hazy, half fog half rain effect in distance.
66	2·1	10	Cirro-strati and cirrus,	0	0	Slight shower of rain about 9 A.M.
48	3·8	7	Cirro-strati, .	0	0	
57	2·8	10	Cirro-strati and cirrus,	1	N.W.	Clouds look very watery.
72	1·7	10	Nimbus, .	8	N.W.	Occasional rain dropping.
72	1·4	0	0	0	0	
68	1·8	0	0	1	N.	Smoke hanging over Cairo.
56	2·8	0	0	0	0	Smoke still hangs over Cairo.
46	3·5	0	0	0	0	
66	2·0	0	0	0	0	A few stars shining brightly.
70	1·2	5	Cirrus, . .	0	0	
60	2·1	5	Cirrus, . .	0	0	☉ rose by compass S. 65 E. over S. end of Masara Hill. Visited Sphinx, and found it looking straight East, ridge of its back also East and West.
50	3·3	3	Cirrus, . .	2	S.	
54	3·1	0	0	1	S.	
56	2·7	0	0	0	0	Bright star-light.

January 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☿ 18th,	7 A.M.	30·21	55·1	54·3	46·2	(53·5)	...	2·5
	8 ,,	30·21	57·6	57·3	48·3	...	...	2·7
	9 ,,	30·21	57·9	57·5	48·4	...	...	2·7
	0 P.M.	30·14	65·1	65·0	53·6	...	...	3·2
	7 ,,	30·14	63·3	62·8	54·6	66·0	60·6 (10·8)	3·6
♃ 19th,	8 A.M.	30·21	59·1	58·5	48·6	(56·9)	...	2·7
	0 P.M.	30·18	66·3	66·0	53·8	...	...	3·1
	3 ,,	30·19	70·1	70·0	54·6	...	...	3·0
	7 ,,	30·24	65·5	65·2	54·2	70·0	63·0 (14·0)	3·3
♀ 20th,	7 A.M.	30·25	55·6	55·5	47·6	(55·0)	...	2·8
	10 ,,	30·26	64·2	63·3	53·6	...	...	3·3
	0 P.M.	30·21	70·9	69·8	53·4	...	...	2·7
	3 ,,	30·15	72·9	72·4	55·1	...	...	2·9
	7 ,,	30·19	63·5	63·2	56·0	73·0	64·3 (17·5)	4·0
♄ 21st,	7 A.M.	30·15	56·3	56·3	52·8	...	...	4·0
	9 ,,	30·18	57·1	57·0	53·8	(56·0)	...	4·1
	0 P.M.	30·12	63·1	63·0	58·6	...	...	4·8
	3 ,,	30·10	66·1	65·5	60·4	...	...	4·9
	7 ,,	30·11	63·5	63·1	60·4	66·3	61·4 (9·9)	5·3
⊙ 22d,	8 A.M.	30·15	58·3	58·1	55·8	(56·9)	...	4·6
	9 ,,	30·17	60·0	59·3	57·0	...	...	4·7
	0 P.M.	30·13	64·4	64·0	58·6	...	...	4·6
	3 ,,	30·10	68·7	68·2	59·0	...	...	4·1
	7 ,,	30·13	64·3	63·8	57·6	69·5	62·8 (13·5)	4·3

and Moisture.		Clouds.		Wind.		
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	Remarks.
	Grains.					
52	2·4	1	Cirrus, . .	1	S.	Smoke and haze level over Cairo; the green plain also with much mist lying upon it.
52	2·6	1	Cirrus, . .	1	S.	
52	2·6	1	Cirrus and cirro-strati,	1	S.	
46	3·6	5	Cirrus and cirro-cumuli,	0	0	
56	2·9	10	Cirro-cumuli,	1	N.	Visited the third Pyramid, and at 3 P.M. was in the interior of the Great Pyramid.
48	2·9	0	0	0	0	Haze level over Cairo.
44	4·0	0	0	1	S.	Took Aneroid levels at Great Pyramid. (See Journal.)
37	5·0	0	0	1	N.W.	Smoke haze clearing away over Cairo before North-west wind.
47	3·6	0	0	1	N.E.	
56	2·2	0	0	0	0	Dense level haze over Cairo, and along Nile.
49	3·3	0	0	1	N.	The same dense haze continues.
33	5·6	0	0	3	N.E.	Haze clearing away.
32	5·8	1	Cirrus, . .	4	N.E.	Haze almost gone.
61	2·6	3	Cirrus, . .	2	N.E.	A few stars shining.
78	1·0	4	Cirrus and fog,	0	0	Heavy fog before sunrise, and still over central line of Nile valley.
79	1·1	10	Fog, . .	0	0	Fog driving from North to South.
75	1·6	8	Cirro-cumuli,	1	N.	Fog almost concealing the last green of the valley.
70	2·1	9	Cirro-cumuli,	1	N.	The plain visible, but fog over Cairo and Nile valley. At 4 P.M. Maasara Hill visible.
82	1·2	4	Cirrus, . .	2	N.	Stars shining out.
84	0·9	10	Cirro-strati, .	1	N.E.	
82	1·1	10	Cirro-strati, .	2	N.E.	Haze fog in distance.
68	2·1	0	0	3	N.E.	Haze all gone. ☉ shines brightly.
53	3·6	0	0	3	N.E.	
64	2·3	1	Cirrus, . .	1	N.	

January 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
Day.	Hour, App. Solar time.		Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 23d,	8 A.M.	30·14	55·3	55·2	54·1	...	...	4·5
	9 ,,	30·15	59·1	59·0	57·1	(55·0)	...	4·9
	0 P.M.	30·13	65·1	65·0	60·6	...	...	5·1
	3 ,,	30·08	67·7	67·5	61·6	...	...	5·0
	8 ,,	30·13	62·8	62·4	58·0	68·5	62·2 (12·7)	4·6
♂ 24th,	7 A.M.	30·16	59·6	59·2	56·1	...	...	4·5
	8 ,,	30·17	57·3	57·0	55·5	...	...	4·6
	9 ,,	30·19	60·1	59·8	57·2	(56·7)	...	4·8
	0 P.M.	30·16	65·1	65·0	56·8	...	...	4·0
	3 P.M.	30·12	65·3	65·0	55·6	...	...	3·6
	5·5 ,,	30·11	63·3	63·0	53·6	65·3	59·8	3·4
	8 ,,	30·12	62·3	61·6	53·7	...	(10·9)	3·5
☿ 25th,	7 A.M.	30·15	52·6	52·4	48·5	...	...	3·3
	9 ,,	30·16	60·1	60·0	50·8	(52·2)	...	3·1
	0 P.M.	30·12	67·1	66·5	54·6	...	...	3·2
	3 ,,	30·10	66·0	65·6	56·6	...	...	3·8
	7 ,,	30·13	63·6	63·2	56·0	67·2	58·7 (15·1)	3·9
♃ 26th,	7 A.M.	30·11	52·3	52·6	49·5	...	...	3·6
	9 ,,	30·13	61·1	61·0	53·8	(52·0)	...	3·6
	0 P.M.	30·08	66·3	66·2	56·2	...	...	3·7
	3 ,,	30·08	68·3	68·2	57·1	...	...	3·7
	7 ,,	30·10	65·3	64·8	58·0	68·5	61·8 (13·3)	4·3
♀ 27th,	7 A.M.	30·16	59·0	58·6	55·6	...	...	4·5
	9 ,,	30·18	65·1	64·8	59·6	(58·5)	...	4·8

and Moisture.		Clouds.		Wind.		
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	Remarks.
	Grains.					
92	0·4	10	Fog, . .	3	N.	Dense fog.
88	0·7	8	Cirrus, . .	2	N.	Fog decreasing.
76	1·7	6	Cirrus, . .	2	N.	
68	2·4	5	Cirro-strati, .	4	N.	
73	1·7	2	Cirrus, , .	2	N.	
80	1·2	3	Fog, . .	1	N.	Fog over Nile valley to ground.
88	0·6	10	Fog, . .	0	0	Fog over hill, and heavy on central Nile valley.
83	1·0	10	Fog, . .	0	0	Fog beginning to lift up.
58	2·9	5	Cumulus and cirro-strati,	1	N.	Fog disappeared.
52	3·2	2	Cirrus, . .	1	N.	Very bright, with light cirrus clouds flying about.
52	3·1	4	Cirrus, . .	1	N.	Brilliant rosy sky after sunset.
56	2·8	2	Cirrus, . .	1	N.	
74	1·2	3	Cirro-cumuli,	0	0	
53	2·8	2	Cirro-cumuli,	2	S.	Haze gathering over Cairo.
44	4·1	3	Cirro-cumuli,	2	S.	Haze increasing in density over Cairo.
54	3·2	5	Upper cirro-cumuli and lower cirro-strati, .	1	N.	Remarkably clear towards South and West
61	2·6	7	Cirro-strati, .	0	0	
82	0·8	2	Cirrus, . .	0	0	
61	2·4	0	0	0	0	Aneroid levels taken to-day between East Tombs and interior of Pyramid.
52	3·4	1	Cirrus and cumulus, .	0	0	
48	3·9	2	Cirro-strati, .	2	N.	Gust of wind blew sand into East Tombs.
62	2·6	8	Cirro-strati, .	2	W.	
80	1·1	2	Cirro-cumuli,	0	0	Thin mist over line of Nile.
71	2·0	1	Cirro-cumuli,	0	0	

January 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 27th,	0 P.M.	30·16	66·1	65·5	59·6	...	...	4·7
	3 ,,	30·13	66·6	66·0	57·0	...	...	3·8
	7 ,,	30·17	63·6	63·0	56·0	67·3	62·0 (10·5)	3·9
♄ 28th,	7 A.M.	30·19	55·8	55·4	50·6	...	...	3·5
	8 ,,	30·20	57·8	57·2	52·5	(55·2)	...	3·7
	9 ,,	30·21	61·3	60·4	55·0	...	...	4·0
	10 ,,	30·22	64·3	64·1	56·6	...	...	4·0
	11 ,,	30·20	66·6	65·8	56·6	...	...	3·8
	0 P.M.	30·16	67·1	66·2	57·4	...	...	3·9
	1 ,,	30·13	67·3	67·0	58·6	...	...	4·2
	2 ,,	30·13	66·5	65·8	58·0	...	...	4·2
	3 ,,	30·12	67·3	67·0	58·5	...	...	4·2
	4 ,,	30·12	68·4	68·2	58·8	69·0	61·6	4·1
	5 ,,	30·12	66·6	66·5	58·4	...	(14·9)	4·3
	6 ,,	30·13	66·0	65·5	57·7	...	...	4·1
	7 ,,	30·15	64·7	64·4	57·2	...	...	4·1
	8 ,,	30·16	63·2	62·5	55·6	...	...	3·9
	9 ,,	30·16	62·0	62·1	55·8	...	...	4·1
	10 ,,	30·16	60·0	59·7	54·3	...	...	3·9
	11 ,,	30·17	60·2	59·8	54·6	...	...	4·0
☉ 29th,	5 A.M.	30·16	53·5	53·2	50·0	(53·0)	...	3·6
	7 ,,	30·18	55·3	55·0	50·0	...	...	3·4
	8 ,,	30·19	59·3	58·3	53·8	...	...	3·9
	9 ,,	30·20	62·1	61·8	54·6	...	...	3·8
	0 P.M.	30·16	68·6	67·8	58·5	...	...	4·0
	3 ,,	30·13	71·1	71·0	59·6	...	...	4·1
	7 ,,	30·15	64·0	63·8	55·6	73·0	62·8 (20·4)	3·8
☾ 30th,	7 A.M.	30·11	54·1	53·4	48·5	(52·3)	...	3·1
	9 ,,	30·13	60·1	59·8	56·6	...	...	4·6
	0 P.M.	30·09	66·3	66·0	59·1	...	...	4·5
	3 ,,	30·04	70·3	70·0	56·1	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
66	2·4	5	Cirro-cumuli,	2	N.	
54	3·3	3	Cumulus, .	1	N.	
61	2·6	0	0	0	0	
69	1·5	0	0	0	0	Low thin white haze over all the Nile land.
69	1·6	0	0	0	0	Said haze clearing, and leaving smoke stratum over Cairo.
66	2·1	0	0	1	S.	
60	2·6	0	0	0	0	Smoke from chimneys in Cairo rising straight up.
53	3·4	0	0	1	S.	
53	3·4	0	0	1	S.	Dense smoke-haze over Cairo.
57	3·1	2	Cirro-strati, .	0	0	
58	3·0	1	Cumulus, .	0	0	
57	3·1	1	Cumulus, .	0	0	
54	3·5	0	0	0	0	
60	2·9	0	0	1	N.	Smoke-haze blowing off Cairo to the South.
59	2·9	0	0	0	0	
61	2·6	0	0	0	0	Stars very bright.
61	2·6	0	0	0	0	
66	2·1	0	0	2	N.	
68	1·9	0	0	2	N.	
68	1·9	0	0	2	N.	
77	1·0	0	0	1	N.	
68	1·6	0	0	0	0	Low level haze over line of Nile.
69	1·8	0	0	0	0	
60	2·4	0	0	0	0	
52	3·6	0	0	1	N.E.	
49	4·2	0	0	2	N.E.	
57	2·8	0	0	3	N.E.	
66	1·6	3	Cirrus, . .	0	0	Dense white haze over Nile line.
79	1·2	2	Cirrus, . .	0	0	
63	2·6	1	Cirrus, . .	0	0	Smoke from chimneys in Cairo rising straight.
41	4·8	1	Cirro-cumuli,	0	0	Smoke from two great chimneys in Cairo blowing *towards* each other.

January 1865.		Air Pressure at Station.	Air-Shade Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 30th,	8 P.M.	30·05	65·4	65·1	54·6	70·4	62·3 (16·2)	3·4
♂ 31st,	7 A.M.	29·97	57·0	56·8	49·4	(56·1)	...	3·1
	9 ,,	29·98	66·8	66·0	55·8	...	...	3·6
	0 P.M.	29·95	69·3	69·0	56·8	...	...	3·5
	3 ,,	29·89	76·2	76·0	58·1	...	...	3·3
	7 ,,	29·90	71·1	70·8	56·7	76·8	66·4 (20·5)	3·3
February ☿ 1st,	7 A.M.	29·98	57·4	57·1	48·2	(56·0)	...	2·7
	9 ,,	29·98	66·1	65·8	53·6	...	...	3·1
	0 P.M.	29·97	69·1	69·0	55·8	...	...	3·4
	3 ,,	29·86	69·6	69·5	55·6	...	...	3·3
	7 ,,	29·84	64·2	63·7	52·0	76·5	66·0 (21·0)	3·0
♃ 2d,	7 A.M.	29·87	55·0	54·8	48·5	...	...	3·0
	9 ,,	29·88	63·3	63·0	53·1	(55·0)	...	3·3
	0 P.M.	29·84	67·1	66·5	54·1	...	...	3·1
	3 ,,	29·77	68·1	67·3	55·1	...	...	3·2
	7 ,,	29·71	64·3	64·0	51·5	68·1	62·1 (12·0)	2·9
	9 ,,	29·70	...	...	...	...		...
♀ 3d,	6 A.M.	29·69	57·3	57·3	50·0	...	...	3·2
	7 ,,	29·70	58·5	58·2	50·9	(57·2)	...	3·2
	8 ,,	29·71	58·6	58·3	51·2	...	...	3·3
	9 ,,	29·74	61·4	61·0	52·0	...	...	3·2
	10 ,,	29·75	...	...	...	...	...	...
	11 ,,	29·77	63·5	63·0	53·5	...	...	3·4
	0 P.M.	29·76	65·1	64·8	54·0	...	...	3·3
	1 ,,	29·76	64·6	64·1	53·6	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
49	3·5	0	0	0	0	A visitor prevented 7 P.M. observation.
59	2·1	1	Cirro-strati, .	0	0	Dense but distant cloud-bank on S.E. horizon.
49	3·7	0	0	1	S.	
46	4·3	0	0	3	S.	
34	6·5	0	0	5	S.	
40	5·0	0	0	4	S.	Moon and stars very bright, and making sharp shadows on the desert sand.
53	2·6	0	0	0	0	Rather hazy horizon.
44	3·9	0	0	3	S.	
43	4·5	1	Cirrus, . .	2	S.	Maximum probably in error, by + 6°.
41	4·7	9	Cirro-strati and nimbus,	5	S.	Clouds, cirro-strati, and nimbus.
44	3·7	3	Cirrus, . .	5	S.S.W.	Atmosphere becoming more clear.
62	1·9	5	Cirrus and cirro-cumuli,	4	S.	Dry sand haze on Eastern side of Nile.
51	3·2	1	Cirrus, . .	13	S.	Cairo enveloped in a sand haze; occasional drifting of sand in the desert.
43	4·2	2	Cirrus and cirro-cumuli,	15	S.S.W.	Everything in our tombs getting covered with fine sand.
43	4·3	3	Cirro-strati, .	20	S.S.W.	Sand haze all round.
43	3·8	4	Cirrus, . .	15	S.W.	A sand storm.
...	...	7	Cirro-strati, .	15	S.W.	
60	2·1	1	Cirro-strati, .	14	S.W.	Sand haze obscuring all the distance.
59	2·3	3	Cirrus and nimbus, .	20	S.W.	Colouring very pale.
60	2·2	4	Cirro-strati, .	20	S.W.	Sand in constant motion.
53	2·9	5	Cirrus and nimbus, .	20	S.W.	
...	...	7	Sand haze, .	20	S.W.	
52	3·2	10	Sand haze, .	20	S.W.	Sun shining pale through the sand haze.
48	3·5	10	Sand haze, .	20	S.W.	Pyramids very indistinct through the hazy air.
48	3·5	10	Sand haze, .	20	S.W.	Sand haze evidently thicker, and air darker.

February 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
Day.	Hour, App Solar time.		Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 3d,	2 ,,	29·76	65·6	65·0	55·0	...	...	3·4
	3 ,,	29·77	65·4	65·0	54·6	...	...	3·4
	5 ,,	29·82	65·4	65·0	54·6	...	...	3·4
	7 ,,	29·89	65·0	64·3	55·5	66·3	61·5	3·6
	9 ,,	29·93	63·0	62·5	54·7	...	(9·6)	3·6
♄ 4th,	6 A.M.	30·01	56·7	56·2	50·0	...	...	3·2
	7 ,,	30·02	58·2	57·8	51·8	(56·2)	...	3·5
	9 ,,	30·04	64·8	64·5	56·1	...	...	3·8
	0 P.M.	30·04	68·1	67·8	56·2	...	...	3·5
	3 ,,	30·00	69·1	69·0	56·4	...	...	3·5
	7 P.M.	30·04	64·1	64·0	54·6	69·2	61·6	3·5
	9 ,,	30·05	63·2	63·0	53·5	...	(15·3)	3·4
☉ 5th,	6 A.M.	30·12	52·0	52·0	45·0	(51·6)	...	2·6
	7 ,,	30·13	54·5	54·0	47·8	...	...	2·9
	9 ,,	30·17	62·3	62·0	51·6	...	...	3·0
	0 P.M.	...	...	...	...	...	...	...
	3 ,,	30·08	73·1	72·7	57·9	...	...	3·5
	7 ,,	30·11	67·0	66·8	56·5	73·6	63·7 (19·8)	3·7
☾ 6th,	6 A.M.	30·12	56·5	56·1	50·5	(56·0)	...	3·4
	7 ,,	30·13	57·8	57·2	50·2	...	...	3·2
	8 ,,	30·14	61·3	60·5	52·6	...	...	3·4
	9 ,,	30·14	64·1	64·0	54·0	...	...	3·4
	10 ,,	30·13	68·3	68·0	54·4	...	...	3·1
	11 ,,	30·10	70·3	70·0	54·8	...	...	3·0
	0 P.M.	30·09	73·3	73·0	56·4	...	...	3·2
	1 ,,	30·06	74·3	74·0	56·6	...	...	3·1
	2 ,,	30·05	75·3	75·0	57·0	...	...	3·1
	3 ,,	30·03	75·5	75·0	56·9	...	...	3·1
	4 ,,	30·02	74·8	74·5	56·8	...	...	3·1
	5 ,,	30·02	72·3	72·0	56·4	...	...	3·2
	6 ,,	30·03	71·0	70·4	55·3	76·0	67·5 (17·0)	3·1

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
49	3·5	10	Sand haze, .	20	S.W.	Visitors entering.
49	3·5	10	Sand haze, .	15	S.W.	
49	3·5	9	Stratus, .	10	W.S.W.	Break in the clouds.
53	3·2	8	Cirro-strati, .	7	W.	A little blue sky.
58	2·8	5	Cirro-strati, .	10	W.	
62	1·9	1	Cirro-strati, .	6	W.	Distant banks of cirro-strati on East horizon, air clear of sand, and Eastern hills clearly visible.
64	1·9	1	Cirro-strati, .	4	W.	
56	2·9	0	0	3	W.	Haze coming over Cairo and the Nile.
46	4·0	2	Cirro-cumuli, .	3	W.	Haze decreasing.
45	4·4	1	Cirro-strati, .	2	W.	Haze merely on horizon.
53	3·1	0	0	0	0	Moon and stars very bright.
52	3·1	0	0	0	0	
59	1·8	0	0	2	S.W.	
61	1·9	0	0	2	S.W.	
48	3·3	0	0	3	S.	
...	...	...	......	...	...	Absent from East Tombs at noon.
40	5·4	3	Cirrus, . .	4	S.W.	
50	3·6	3	Cirrus, . .	2	S.W.	
66	1·8	2	Cirrus, . .	0	0	
59	2·2	2	Cirrus, . .	0	0	
56	2·7	3	Cirrus, . .	0	0	
51	3·2	4	Cirrus, . .	2	S.	
40	4·5	1	Cirrus, . .	2	S.	
37	5·1	1	Cirrus, . .	2	S.	
35	5·7	1	Cirrus, . .	2	S.	
34	6·1	1	Cirrus, . .	2	S.	
32	6·4	3	Cirrus, . .	1	S.	
32	6·5	7	Cirrus and cirro-cumuli,	2	S.	
33	6·3	7	Cirrus and cirro-cumuli,	0	0	
37	5·4	7	Cirro-strati and cirro-cumuli, .	1	S.	
37	5·2	10	Cirro-strati, .	0	0	

February 1865.		Air Pressure at Station.	Dry-bulb.		Wet-bulb.	Air Shade-Temperature		Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.		Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 6th,	7 P.M.	30·02	70·0	69·8	54·8	...	...	3·1
	8 ,,	30·02	68·7	68·3	54·0	...	...	3·0
	9 ,,	30·03	68·0	67·4	54·0	...	...	3·0
	10 ,,	30·04	67·4	66·8	53·7	...	...	3·0
	11 ,,	30·02	67·3	67·0	53·9	...	...	3·0
	0 A.M.	30·02	66·8	66·2	53·6	...	...	3·0
♂ 7th,	6 A.M.	29·99	62·6	...	49·5	...	...	2·5
	9 ,,	30·01	66·1	66·0	54·6	(62·0)	...	3.1
	0 P.M.	30·01	72·1	72·0	61·6	...	...	4·6
	3 ,,	29·98	72·5	71·9	58·7	...	...	3·7
	7 ,,	29·99	63·1	62·5	49·5	72·5	65·5 (14·0)	2·5
☿ 8th,	7 A.M.	30·11	55·5	54·8	45·6	(55·0)	...	2·4
	9 ,,	30·13	63·5	62·5	51·0	...	...	2·8
	0 P.M.	30·08	67·3	66·6	51·6	...	...	2·6
	3 ,,	30·04	67·4	67·0	52·6	...	...	2·8
	7 ,,	30·04	60·4	60·0	48·6	68·0	61·0 (14·1)	2·6
♃ 9th,	7 A.M.	30·06	52·8	52·0	43·3	...	...	2·2
	9 ,,	30·07	61·1	60·8	47·4	(52·8)	...	2·3
	0 P.M.	30·04	68·1	67·6	50·1	...	...	2·3
	3 ,,	30·02	68·4	68·0	51·6	...	...	2 6
	7 ,,	30·08	62·1	62·0	49·6	68·0	59·8 (16·4)	2·6
♀ 10th,	7 A.M.	30·19	51·8	51·0	44·6	...	...	2·5
	9 ,,	30·25	58·4	57·6	47·9	(50·3)	...	2·6
	0 P.M.	30·21	66·1	65·5	53·4	...	...	3·1
	3 ,,	30·16	65·3	65·1	50·6	...	...	2·6
	7 ,,	30·16	63·1	62·5	49·6	66·5	58·2 (16·6)	2·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
38	4·9	8	Cirro-strati, .	1	S.	
38	4·7	4	Cirro-cumuli, .	1	S.	
40	4·5	5	Cirrus, . .	1	S.	
41	4·4	9	Cirrus and cirro-strati,	1	S.	
42	4·3	9	Cirrus and cirro-strati,	1	S.	
42	4·2	9	Cirro-cumuli, .	0	0	
41	3·8	3	Cirro-strati and cirro-cumuli, .	2	S.	
44	3·9	1	Cirro-strati, .	2	S.	Error of 5° in dry-bulb.
52	4·0	0	0	4	W.	Haze enveloping Cairo and Nile valley.
43	5·0	0	0	2	N.W.	Haze less dense than at noon.
39	3·9	0	0	1	N.W.	Haze much decreased, stars shining.
49	2·6	0	0	0	0	Haze on horizon.
43	3·7	0	0	0	0	Haze coming over the valley.
35	4·8	0	0	1	S.	Haze continues in the distance.
38	4·6	0	0	1	S.W.	Still hazy over the valley.
44	3·3	0	0	0	0	Haze decreased; very bright moonlight.
49	2·3	0	0	0	0	Hazy under sun.
39	3·7	0	0	2	S.	Very cold morning, haze over Cairo and Nile valley.
31	5·2	0	0	3	S.	Sand haze and sand-drift for about an hour.
33	5·1	1	Cirrus, . .	2	S.W.	
43	3·6	0	0	1	W.	
58	1·8	0	0	0	0	Hazy and dull-coloured eastward.
48	2·8	3	Cirro-cumuli,	3	S.	
43	4·0	0	0	2	S.W.	Haze much increased since 9 A.M.
37	4·3	1	Cirrus, . .	2	S.W.	Haze decreased.
40	3·9	0	0	1	S.	Clear moonlight night.

February 1865. Day.	Hour, App. Solar time.	Air Pressure at Station.	Air Shade-Temperature: Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♄ 11th,	6 A.M.	30·19	49·8	49·6	40·4	(49·5)	...	1·9
	7 ,,	30·20	51·6	51·0	43·0	...	...	2·2
	8 ,,	30·20	56·8	56·2	45·2	...	...	2·2
	9 ,,	30·19	60·8	60·6	46·6	...	...	2·2
	10 ,,	30·19	62·3	62·2	47·0	...	...	2·2
	11 ,,	30·15	64·8	64·6	48·0	...	...	2·2
	0 P.M.	30·11	66·1	66·0	49·0	...	...	2·3
	1 ,,	30·08	66·8	66·7	49·2	...	...	2·2
	2 ,,	30·05	67·9	67·4	50·5	...	...	2·4
	3 ,,	30·03	68·4	68·2	51·0	...	...	2·5
	4 ,,	...	...	...	...	...	...	...
	5 ,,	...	...	...	...	...	...	...
	6 ,,	30·01	64·0	63·8	50·0	68·5	59·4	2·6
	7 ,,	30·02	63·1	63·0	50·0	...	(18·3)	2·6
	8 ,,	30·04	59·7	59·5	49·6	...	...	2·8
	9 ,,	30·03	59·8	59·4	49·0	...	...	2·7
	10 ,,	30·01	59·6	59·2	47·6	...	...	2·5
☉ 12th,	6 A.M.	30·07	58·3	58·0	47·5	...	...	2·6
	9 ,,	30·06	60·3	60·0	48·1	(51·0)	...	2·5
	0 P.M.	30·12	65·4	65·0	50·8	...	...	2·6
	3 ,,	30·10	65·2	64·3	50·8	...	...	2·6
	7 ,,	30·15	61·4	61·0	47·8	66·5	57·7 (17·7)	2·3
☾ 13th,	6 A.M.	30·22	47·0	46·8	39·6	...	...	2·0
	7 ,,	30·23	50·8	50·4	41·0	(46·5)	...	1·9
	9 ,,	30·27	59·0	58·8	42·8	...	...	1·8
	0 P.M.	30·25	64·4	64·2	48·1	...	...	2·2
	3 ,,	30·22	64·6	64·5	53·4	...	...	3·2
	7 ,,	30·27	62·1	61·8	45·8	65·2	57·1 (16·2)	2·0
♂ 14th,	6 A.M.	30·35	52·7	52·3	46·5	...	...	2·8
	9 ,,	30·38	59·9	59·7	51·6	(51·5)	...	3·3
	0 P.M.	30·36	64·0	63·8	52·6	...	...	3·1
	3 ,,	30·31	65·1	65·0	50·8	...	...	2·6
	7 ,,	30·34	62·1	62·0	50·1	65·3	58·6	2·7
	9 ,,	30·36	59·4	59·2	52·0	...	(13·4)	3·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
47	2·2	0	0	0	0	Fine clear morning.
52	2·1	0	0	0	0	
42	2·9	0	0	2	S.	
37	3·8	0	0	1	S.	
34	4·1	0	0	2	S.	
31	4·6	0	0	3	S.	
32	4·7	0	0	3	S.	
31	5·0	0	0	3	S.	
31	5·1	0	0	2	S.	
32	5·1	0	0	2	S.	
...	...	...	...	...	...	Out photographing at King Shafre's tomb.
...	...	...	...	...	...	
39	4·0	0	0	2	S.	Remarkably clear night.
41	3·8	4	Cirrus, . .	1	S.	Full moon shining brightly.
49	2·9	3	Cirrus, . .	0	0	
47	3·0	1	Cirrus, . .	1	S.	
43	3·3	0	0	2	S.	
47	2·9	10	Fog, . .	5	W.	
42	3·4	10	Fog, . .	4	W.	
38	4·3	0	0	3	W.	Fog gone from the desert, but still hangs over Cairo.
38	4·2	0	0	5	W.	Horizon hazy.
40	3·7	8	Fog, . .	4	W.	
54	1·7	0	0	1	N.	Haze along horizon.
47	2·3	0	0	1	N.	
31	3·8	1	Cirrus, . .	1	N.	
32	4·5	0	0	2	N.W.	
47	3·5	0	0	3	W.	
31	4·2	0	0	3	W.	
64	1·6	0	0	0	0	
56	2·5	0	0	0	0	
47	3·5	0	0	1	S.W.	
38	4·2	0	0	1	W.	
44	3·5	0	0	1	N.	Stars very bright.
59	2·2	0	0	1	N.N.E.	

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
15th,	6 A.M.	30·33	53·0	52·6	48·2	...	...	3·2
	7 ,,	30·34	55·6	55·0	51·0	(52·3)	...	3·6
	9 ,,	30·37	62·4	61·9	53·5	...	...	3·5
	0 P.M.	...	...	...	...	...	...	...
	3 ,,	30·25	66·8	66·4	55·1	...	...	3·4
	7 ,,	30·24	65·3	64·8	54·8	67·0	59·9	3·4
	9 ,,	30·23	63·3	63·0	54·0	...	(14·2)	3·5
♃ 16th,	6 A.M.	30·20	54·1	53·5	46·9	...	...	2·8
	7 ,,	30·21	58·4	57·8	51·4	(53·3)	...	3·4
	9 ,,	30·23	63·1	62·9	53·6	...	...	3·4
	0 P.M.	30·17	71·1	70·9	55·4	...	...	3·1
	3 ,,	30·10	73·2	72·9	55·6	...	...	3·0
	7 ,,	30·10	69·2	69·0	54·6	73·3	65·3 (16·8)	3·1
	10 ,,	30·11	67·5	67·2	54·8	...	...	3·2
♀ 17th,	6 A.M.	30·05	61·5	61·2	51·0	...	...	3·0
	7 ,,	30·06	61·5	61·3	51·0	(60·5)	...	3·0
	9 ,,	30·07	65·3	65·1	52·4	...	...	3·0
	0 P.M.	30·02	74·1	74·0	54·8	...	...	2·8
	3 ,,	29·95	74·5	74·1	55·0	...	...	2·8
	7 ,,	29·99	71·2	71·0	54·6	75·2	68·1	2·9
	9 ,,	30·02	65·5	65·2	56·6	...	(14·2)	3·9
♄ 18th,	7 A.M.	30·05	61·7	61·5	57·5	...	...	4·6
	9 ,,	30·08	66·0	65·8	59·1	(61·6)	...	4·5
	0 P.M.	30·03	70·2	70·0	59·6	...	...	4·2
	3 ,,	29·97	70·7	70·5	57·6	...	...	3·6

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
70	1·3	0	0	0	0	
72	1·3	0	0	0	0	Level smoke over Cairo. Clear morning.
55	2·8	0	0	0	0	
...	...	...	...	...	...	Photographing, and observing the ☉ for true noon, and measuring levels in King Shafre's tomb.
46	3·9	0	0	2	N.E.	
50	3·4	0	0	1	N.E.	
54	3·0	0	0	1	N.E.	
58	2·0	3	Cirrus and cirro-cumuli,	0	0	
61	2·1	3	Cirrus and cirro-cumuli,	0	0	
53	3·0	3	Cirrus and cirro-cumuli,	0	0	
37	5·2	1	Cirrus, . .	0	0	
33	5·9	3	Cirrus and cirro-cumuli,	0	0	
39	4·7	5	Cirrus and cirro-cumuli,	0	0	
44	4·2	6	Cirrus and cirro-cumuli,	0	0	
48	3·2	10	Cirrus and cirro-strati,	0	0	
48	3·2	8	Cirrus and cirro-strati,	0	0	
43	3·9	8	Cirro-cumuli, .	3	S.E.	
30	6·4	5	Cirro-cumuli, .	3	S.	
30	6·5	2	Cirro-cumuli and cumulus,	2	W.	Appearance of thunder and lightning.
35	5·4	0	0	1	W.	
55	3·0	0	0	1	W.	
76	1·5	4	Cirro-strati, .	0	0	
64	2·5	8	Cirro-strati, .	0	0	
51	3·9	1	Cirro-strati, .	0	0	
44	4·6	1	Cirro-cumuli, .	1	N.	Clear over Cairo and Mokattam Hills.

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♄ 18th,	7 P.M.	29·99	68·2	68·0	56·6	...	...	3·6
	9 ,,	30·01	65·8	65·5	58·2	72·2	66·4 (11·6)	4·3
☉ 19th,	7 A.M.	29·93	62·6	62·3	57·5	(59·7)	...	4·5
	9 ,,	29·97	66·7	66·3	60·2	...	...	4·8
	0 P.M.	29·95	69·2	68·8	59·7	...	...	4·3
	3 ,,	29·92	69·6	69·4	57·6	...	...	3·7
	7 ,,	30·00	65·3	65·0	52·8	70·6	63·0	3·0
	9 ,,	30·02	64·1	63·4	53·0	...	(15·2)	3·2
☾ 20th,	6 A.M.	30·07	52·4	51·8	46·0	...	...	2·8
	7 ,,	30·08	56·4	55·5	49·5	(51·3)	...	3·2
	8 ,,	30·08	58·3	57·8	49·8	...	...	3·0
	9 ,,	30·09	60·6	60·4	51·0	...	...	3·0
	10 ,,	30·12	62·1	61·9	51·6	...	...	3·0
	11 ,,	30·11	63·3	63·0	52·6	...	...	3·2
	0 P.M.	30·09	64·8	64·5	52·5	...	...	3·0
	1 ,,	30·08	65·1	64·9	52·1	...	...	2·9
	2 ,,	30·08	66·0	65·5	53·2	...	...	3·0
	3 ,,	30·08	65·5	65·2	52·6	...	...	3·0
	4 ,,	30·11	63·8	63·5	52·1	...	...	3·0
	5 ,,	30·12	63·2	63·0	52·8	67·4	60·2 (14·5)	3·2
	6 ,,	30·13	62·4	62·2	52·6	...		3·2
	7 ,,	30·15	62·9	62·4	53·1	...	...	3·3
	8 ,,	30·17	62·5	62·2	53·0	...	...	3·4
	9 ,,	30·18	61·3	60·6	53·0	...	...	3·5
	10 ,,	30·19	61·0	60·4	53·8	...	...	3·7
♂ 21st,	6 A.M.	30·25	55·1	54·8	48·4	...	...	3·0
	7 ,,	30·27	57·2	56·7	50·6	...	...	3·3
	9 ,,	30·30	64·6	64·3	54·0	(54·5)	...	3·3
	0 P.M.	30·24	67·3	67·0	54·2	...	...	3·1
	3 ,,	30·22	67·5	67·2	54·1	...	...	3·1
	7 ,,	30·26	65·3	65·0	53·9	69·0	61·8 (14·5)	3·2

and Moisture.		Clouds.		Wind.		
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	Remarks.
	Grains.					
47	4·0	0	0	0	0	Stars very bright.
61	2·7	0	0	2	N.W.	
72	1·8	4	Cirrus and cirro-cumuli,	2	S.W.	
66	2·4	3	Cirrus and cirro-cumuli,	5	S.W.	A little gust of wind from N.E., and two showers of rain during the night.
54	3·6	2	Cirro-cumuli, .	1	S.W.	
47	4·2	3	Cirro-cumuli, .	4	W.	
44	3·8	0	0	3	W.	Fog over the level valley of the Nile.
48	3·4	2	Stratus, . .	2	W.	
62	1·7	3	Cirro-strati, .	0	0	Heavy bank of cirro-strati eastward.
61	1·9	2	Cirrus, . .	3	S.	
55	2·4	2	Cirrus, . .	2	S.	
52	2·9	8	Cirrus, . .	10	W.	Sand-drift and dense haze.
48	3·2	6	Cirrus, . .	10	W.	
49	3·3	6	Cirrus, . .	8	W.	Less of sand-drift, but haze very dense.
44	3·7	10	Fog, . .	8	W.	Haze still more dense.
42	3·9	10	Fog, . .	9	W.	
43	4·0	10	Fog, . .	12	W.	Haze and fog.
43	3·9	10	Fog, . .	15	W.	Haze and fog increasing, with little whirlwinds of sand.
45	3·5	10	Fog, . .	10	W.	Foggy haze.
50	3·2	10	Fog, . .	12	W.	Fog haze becoming more and more dense.
51	3·0	10	Fog, . .	7	W.	
52	3·0	10	Fog, . .	3	W.	
52	3·0	7	Cirro-strati. .	3	W.	A few stars shining over head.
57	2·6	3	Cirro-strati, .	2	W.	
61	2·3	9	Cirro-strati, .	1	W.	
62	1·9	1	Cirro-strati, .	0	0	
63	1·9	1	Cirro-strati, .	0	0	
49	3·4	1	Cirrus, . .	1	N.W.	
43	4·2	2	Cirro-strati, .	1	N.W.	
42	4·3	4	Cirro-strati, .	0	0	
47	3·6	0	0	2	W.	

February 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	
Day.	Hour, App Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☿ 22d,	6 A.M.	30·21	56·5	56·3	47·0	...	...	2·6
	9 ,,	30·20	63·5	63·2	49·1	(54·5)	...	2·4
	0 P.M.	30·14	71·1	71·0	52·6	...	...	2·6
	3 ,,	30·05	73·8	73·4	53·5	...	...	2·5
	7 ,,	30·03	70·1	70·0	55·6	74·0	66·2	3·2
	10 ,,	30·07	68·0	67·5	53·0	...	(15·5)	2·8
♃ 23d,	6 A.M.	30·15	63·0	62·5	56·8	...	...	4·2
	7 ,,	30·15	64·3	64·1	57·0	(62·5)	...	4·1
	9 ,,	30·22	67·2	67·0	59·1	...	...	4·4
	0 P.M.	30·23	69·2	69·0	55·6	...	...	3·3
	3 ,,	30·21	62·1	62·0	54·1	...	...	3·6
	7 ,,	30·27	60·1	60·0	51·6	69·5	62·0 (15·0)	3·2
♀ 24th,	6 A.M.	30·29	48·0	47·2	42·8	...	...	2·6
	9 ,,	30·32	54·3	54·1	45·1	(46·5)	...	2·4
	0 P.M.	30·30	62·2	62·0	48·4	...	...	2·4
	3 ,,	30·26	62·1	61·8	49·7	...	...	2·6
	7 ,,	30·27	59·1	59·0	49·6	62·5	55·2	2·9
	9 ,,	30·27	57·5	57·2	48·6	...	(14·7)	2·8
♄ 25th,	7 A.M.	30·22	52·5	52·1	44·5	...	...	2·4
	9 ,,	30·24	55·1	55·0	46·6	(49·0)	...	2·6
	0 P.M.	30·22	58·5	58·3	46·6	...	...	2·4
	3 ,,	30·16	61·1	60·9	49·0	...	...	2·6
	7 ,,	30·13	58·0	57·8	47·1	61·4	55·6	2·5
	9 ,,	30·16	54·5	54·3	46·0	...	(11·6)	2·6
☉ 26th,	8 A.M.	30·23	55·2	55·0	47·6	(50·5)	...	2·8
	9 ,,	30·25	57·7	57·3	49·0	...	...	2·9
	0 P.M.	30·22	62·4	62·0	51·0	...	...	2·9
	3 ,,	30·19	62·5	62·0	49·6	...	...	2·6
	7 ,,	30·24	60·0	59·8	51·5	63·0	57·4	3·2
	10 ,,	30·29	57·8	57·5	51·0	...	(11·2) ...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
50	2·6	4	Cirrus and cirro-strati,	0	0	
37	4·1	2	Cirro-strati, .	15	S.	
31	5·8	4	Cirro-strati, .	20	S.	Sand drift; haze over Cairo.
28	6·5	3	Cirrus and cirro-cumuli,	12	S.	
40	4·8	4	Cirro-cumuli,	12	S.	
37	4·7	5	Cirrus, . .	1	S.	
66	2·2	4	Cirro-strati, .	0	0	A very little rain fell during the night.
62	2·5	5	Cirro-cumuli,	0	0	
60	3·0	8	Cirro-strati, .	0	0	
42	4·5	9	Cirro-cumuli,	0	0	
58	2·6	9	Cirro-strati and nimbus,	0	0	A few drops of rain now falling.
56	2·6	8	Cirro-strati and nimbus,	0	0	
66	1·2	2	Cirrus, . .	0	0	
50	2·4	3	Cirro-strati, .	3	S.	
39	3·8	1	Cirrus, . .	12	S.W.	
43	3·6	2	Cirrus, . .	10	W.	
51	2·7	2	Cirrus, . .	6	N.W.	Stars very bright.
53	2·5	0	0	0	0	
54	2·0	9	Cirro-strati, .	0	0	
54	2·3	9	Cirro-strati, .	1	W.	
43	3·1	9	Cirro-strati, .	1	W.	
44	3·4	1	Cirro-cumuli,	1	W.	
46	2·9	0	0	0	0	
54	2·2	0	0	0	0	
58	2·1	0	0	6	W.	Strong wind blew during the night.
54	2·4	0	0	4	W.	
46	3·4	4	Cirrus, . .	2	W.	
41	3·7	5	Cirrus and cirro-cumuli,	2	W.	
56	2·6	9	Cirro-strati and cumulus,	2	W.	
62	2·0	7	Cirro-strati, .	1	W.	

February 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 27th,	7 A.M.	30·27	53·6	53·0	48·0	...	...	3·0
	9 ,,	30·29	64·2	64·0	50·7	(53·0)	...	2·7
	0 P.M.	30·23	66·3	66·0	51·1	...	...	2·6
	3 ,,	30·16	63·3	63·0	51·1	...	...	2·8
	7 ,,	30·16	61·2	61·0	49·6	66·3	58·0 (14·7)	2·7
♂ 28th	7 A.M.	30·10	53·4	52·8	46·5	(50·2)	...	2·8
	8 ,,	30·11	56·4	55·7	47·5	...	...	2·7
	9 ,,	30·12	59·2	59·0	49·0	...	...	2·8
	10 ,,	30·10	64·0	63·8	50·5	...	...	2·7
	0 P.M.	30·09	66·0	65·9	51·6	...	...	2·7
	3 ,,	30·05	67·8	67·0	52·4	...	...	2·7
	7 ,,	30·10	64·1	63·5	49·6	68·2	60·0	2·5
	10 ,,	30·13	61·3	61·0	49·8	...	(16·5)	2·7
March ☿ 1st,	6 A.M.	30·20	54·0	53·4	49·4	...	...	3·4
	7 ,,	30·23	57·2	56·4	52·1	(53·2)	...	3·7
	8 ,,	30·25	59·2	58·6	52·6	...	...	3·6
	9 ,,	30·27	62·1	61·5	54·1	...	...	3·6
	10 ,,	30·26	63·2	62·6	55·1	...	...	3·7
	11 ,,	30·24	65·1	64·8	55·6	...	...	3·7
	0 P.M.	30·24	66·0	65·6	55·8	...	...	3·6
	1 ,,	30·21	65·6	65·2	54·8	...	...	3·4
	2 ,,	30·18	66·7	66·2	54·0	...	...	3·1
	3 ,,	30·18	66·1	65·7	53·5	67·3	60·2	3·1
	4 ,,	30·18	65·1	64·5	53·1	...	(14·2)	3·1
	5 ,,	30·20	64·3	64·0	52·6	...	...	3·1
	6 ,,	30·22	63·0	62·5	52·4	...	...	3·1
	7 ,,	30·24	62·0	61·5	51·3	...	...	3·0
	8 ,,	30·26	61·1	60·5	52·6	...	...	3·4
	9 ,,	30·27	60·1	59·6	51·6	...	...	3·2
	10 ,,	30·28	59·0	58·8	51·6	...	...	3·4
♃ 2d,	6 A.M.	30·31	53·5	53·0	48·4	...	...	3·2
	7 ,,	30·32	54·8	54·0	49·6	(53·0)	...	3·3
	8 ,,	30·33	58·6	58·1	52·3	...	...	3·6

and Moisture.		Clouds.		Wind.		Remarks.
Computed.						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
66	1·6	3	Cirrus, . .	0	0	Thin haze and stratus on Nile valley.
41	3·9	5	Cirrus, . .	0	0	
37	4·5	5	Cirrus, . .	2	N.E.	
44	3·6	2	Cirrus, . .	1	N.E.	
45	3·3	0	0	0	0	Bright stars and new moon.
60	1·8	0	0	0	0	Eastern hills clear and dark.
53	2·4	0	0	0	0	
48	2·9	1	Cirrus, . .	2	S.	
40	3·9	0	0	2	S.	
39	4·3	0	0	0	0	
36	4·8	2	Cirro-strati, .	3	S.	
38	4·1	0	0	2	S.	
46	3·3	0	0	1	S.	
71	1·3	0	0	1	S.	
70	1·5	0	0	0	0	
63	2·0	2	Cirrus, . .	0	0	
58	2·6	2	Cirrus, . .	0	0	
59	2·7	4	Cirro-cumuli, .	2	S.	
53	3·2	8	Cirro-strati and cumulus,	2	S.	
51	3·4	7	Cirro-strati and cumulus,	3	S.	
49	3·5	8	Cirro-strati and cumulus,	4	W.	
43	4·1	7	Cumulus, .	5	N.W.	
43	3·9	5	Cumulus, .	5	W.N.W.	
45	3·7	6	Cirro-cumuli,	4	W.N.W.	
46	3·6	6	Cirro-strati, .	5	W.N.W.	
49	3·3	4	Cirro-strati, .	4	N.W.	
48	3·2	2	Cirrus, . .	3	W.	
56	2·6	0	0	1	W.	
56	2·6	0	0	2	W.	
59	2·2	0	0	3	N.W.	
68	1·4	2	Cirrus, . .	0	0	
68	1·5	4	Cirrus, . .	0	0	
65	1·9	3	Cirrus, . .	0	0	

March 1865. Day.	Hour, App. Solar time.	Air Pressure at Station.	Air Shade-Temperature: Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♃ 2d,	9 A.M.	30·34	61·2	60·9	54·1	...	...	3·7
	0 P.M.	30·29	64·3	64·0	55·6	...	...	3·8
	2 ,,	30·25	65·4	65·0	54·0	...	...	3·3
	3 ,,	...	...	...	...	...	...	...
	7 ,,	30·28	62·4	61·8	53·2	67·4	60·4	3·4
	9 ,,	30·30	61·1	60·8	53·0	...	(13·9)	3·5
♀ 3d,	6 A.M.	30·27	55·0	54·8	49·6	...	...	3.3
	7 ,,	30·28	55·8	55·1	50·3	...	...	3·4
	9 ,,	30·28	62·8	62·5	52·1	(54·0)	...	3·0
	0 P.M.	30·21	68·4	68·0	53·6	...	...	2·9
	2 ,,	30·17	68·6	68·4	54·1	...	...	3·0
	3 ,,	...	...	...	...	...	...	...
	7 ,,	30·20	63·4	63·0	51·5	68·5	61·2	2·9
	11 ,,	30·23	61·2	60·5	51·0	...	(14·7)	3·0
♄ 4th,	7 A.M.	30·23	55·3	55·0	45·6	(53·6)	...	2·4
	9 ,,	...	...	...	...	...	...	...
	10 ,,	30·23	65·0	64·6	52·1	...	...	2·9
	0 P.M.	30·19	69·3	69·0	54·6	...	...	3·1
	3 ,,	30·13	69·0	68·6	54·7	...	...	3·1
	7 ,,	30·14	65·9	65·4	53·6	69·6	62·4	3·1
	11 ,,	30·18	61·2	60·4	54·5	...	(14·3)	3·8
⊙ 5th,	7 A.M.	30·16	60·1	59·6	54·1	(57·0)	...	3·8
	9 ,,	30·17	64·6	64·4	55·2	...	...	3·6
	0 P.M.	30·13	70·8	70·5	56·7	...	...	3·4
	3 ,,	...	...	...	...	...	...	...
	4 ,,	30·06	70·7	70·2	56·2	71·8	64·7	3·3
	7 ,,	30·06	68·0	67·7	53·5	...	(14·3)	2·9
	9 ,,	30·05	64·6	64·2	53·0	...	...	3·1
☾ 6th,	6 A.M.	30·17	58·9	58·3	50·6	...	...	3·1
	9 ,,	30·20	65·5	65·1	52·6	58·0	...	3·0

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
62	2·3	2	Cirrus, . .	0	0	
56	2·9	6	Cirro-cumuli, .	0	0	
47	3·6	5	Cirro-cumuli,	0	0	
...	...	...	...	...	...	Absent at the second Pyramid at 3 P.M.
55	2·9	6	Cirro-strati, .	0	0	
58	2·5	3	Cirro-strati, .	0	0	
68	1·6	3	Cirrus and cirro-strati, .	0	0	
68	1·6	0	0	0	0	
48	3·3	0	0	0	0	
38	4·7	0	0	2	S.	
38	4·7	0	0	0	0	Occasional little whirlwinds sending up the sand.
...	...	...	...	...	...	Absent at 3 P.M. visiting the Fossil-shell hill, about three miles distant.
45	3·6	0	0	0	0	
49	3·1	0	0	0	0	
50	2·5	0	0	0	0	Light haze over Nile valley, hill tops clear.
...	...	...	...	...	...	Neglected 9 o'clock observation.
42	3·9	0	0	0	0	
39	4·8	1	Cirro-strati, .	2	S.	
40	4·7	0	0	0	0	
44	3·8	2	Cirro-strati, .	0	0	Sky very deep blue, and stars very bright.
64	2·2	5	Cirro-strati, .	4	N.W.	
66	2·0	2	Cirrus and cirro-strati,	0	0	Low level haze over the Nile.
54	3·1	1	Cirrus, . .	1	S.	
42	4·9	1	Cirrus, . .	0	0	
...	...	...	...	...	...	Absent at 3 P.M.
40	4·9	1	Cirrus, . .	2	S.	
38	4·6	0	0	5	S.W.	
46	3·6	0	0	5	S.W.	
56	2·4	0	0	0	0	
43	3·9	0	0	0	0	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
Day.	Hour, App. Solar time.		Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 6th,	0 P.M.	30·21	68·3	68·0	52·6	...	...	2·7
	3 ,,	30·18	67·8	67·2	52·0	72·0	64·5	2·6
	7 ,,	30·24	64·2	63·4	53·5	...	(15·2) ...	3·3
	9 ,,	30·28	60·5	60·1	52·0	...	...	3·2
♂ 7th,	6 A.M.	30·33	56·5	56·2	50·5	...	...	3·4
	7 ,,	30·35	60·0	59·0	53·2	...	...	3·6
	9 ,,	30·39	65·1	64·8	55·6	56·0	...	3·7
	0 P.M.	30·35	68·1	67·9	55·1	...	...	3·2
	3 ,,	0·32	67·2	67·0	54·6	72·0	63·3	3·2
	7 ,,	0·35	63·2	63·0	52·6	...	(17·3)	3·2
	10 ,,	0·39	59·5	59·0	52·0	...	...	3·4
☿ 8th,	6 A.M.	30·35	54·5	54·0	49·6	...	...	3·4
	8 ,,	30·35	59·5	59·0	53·5	53·4	...	3·8
	9 ,,	30·35	62·2	62·0	53·8	...	...	3·5
	10 ,,	30·34	63·9	63·5	54·3	...	...	3·5
	11 ,,	30·32	64·8	64·3	54·2	...	...	3·4
	0 P.M.	30·26	66·3	66·0	54·8	...	...	3·3
	1 ,,	30·24	68·8	68·6	54·1	...	...	3·0
	2 ,,	30·22	68·5	68·0	53·8	69·2	61·0	3·0
	3 ,,	30·19	68·3	68·0	53·2	...	(16·5)	2·8
	4 ,,	30·17	68·2	67·8	54·3	...	...	3·1
	5 ,,	30·17	67·4	67·1	53·6	...	...	3·0
	6 ,,	30·15	66·3	66·0	53·8	...	...	3·1
	7 ,,	30·17	64·3	63·9	52·4	...	...	3·0
	8 ,,	30·17	63·2	63·0	51·6	...	...	2·9
	9 ,,	30·18	60·1	59·5	52·5	...	...	3·4
	10 ,,	30·18	59·8	59·5	53·0	...	...	3·6
♃ 9th,	6 A.M.	30·13	52·8	52·4	49·0	...	...	3·4

and Moisture.		Clouds.		Wind.		
Computed						Remarks.
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
35	4·9	0	0	0	0	
35	4·8	0	0	2	W.	
49	3·4	0	0	2	N.W.	A brilliant shooting star passed from S.W. to N.E. at 7 h. 13 m. P.M.
56	2·6	0	0	2	N.W.	
66	1·8	0	0	1	N.	
63	2·2	0	0	0	0	
53	3·2	2	Cirrus, . .	0	0	
43	4·3	3	Cirrus and cirro-cumuli,	2	N.	
44	4·1	4	Cirrus and cirro-cumuli,	5	N.	
49	3·3	0	0	4	N.	
59	2·2	0	0	5	N.W.	
70	1·4	0	0	0	0	Haze over Cairo and Nile valley.
66	1·9	0	0	1	N.E.	
57	2·7	0	0	5	E.	Haze quite blown away.
54	3·1	0	0	10	E.	The sand, which for weeks past has been permanently ribbed N.E. and S.W., is this morning flattening itself into a broad general jaugle.
49	3·4	0	0	10	E.	
46	3·8	0	0	10	E.	
38	4·7	0	0	8	E.	Occasional severe gusts of wind.
38	4·7	0	0	8	N.E.	Wind still coming in gusts.
37	4·8	0	0	6	N.E.	Gusts of wind less strong.
40	4·5	0	0	7	N.E.	
41	4·4	0	0	7	N.E.	
44	4·0	0	0	8	N.E.	
45	3·6	0	0	8	N.E.	
45	3·5	0	0	8	N.E.	
60	2·4	0	0	7	N.E.	
63	2·1	0	0	7	N.E.	
76	1·1	0	0	2	N.	Distant hills remarkably clear.

March 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of Air.
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♃ 9th,	9 A.M.	30·12	62·3	62·0	54·6	52·0	...	3·8
	0 P.M.	30·08	71·5	71·3	55·1	...	...	3·0
	3 ,,	30·03	72·5	72·2	55·4	73·3	63·8	3·0
	7 ,,	30·06	69·1	68·6	53·6	...	(18·9)	2·9
	10 ,,	30·10	65·5	65·2	56·0	...	...	3·8
♀ 10th,	7 A.M.	30·15	62·1	61·8	56·6	56·9	...	4·3
	9 ,,	30·17	64·8	64·5	58·1	...	...	4·4
	0 P.M.	30·15	71·5	71·2	65·9	...	...	6·0
	3 ,,	30·10	74·1	74·0	59·3	74·5	66·4	3·7
	7 ,,	30·11	71·2	70·7	58·0	...	(16·1)	3·7
	10 ,,	30·13	68·5	68·0	57·6	...	...	3·8
♄ 11th,	7 A.M.	30·17	62·3	62·0	52·0	60·0	...	3·1
	9 ,,	30·19	68·0	67·5	56·5	...	...	3·6
	0 P.M.	30·13	80·5	80·0	58·5	...	...	3·0
	3 ,,	30·08	80·5	80·2	58·5	81·0	71·9	3·0
	7 ,,	30·07	75·4	75·0	55·6	...	(18·2)	2·8
	10 ,,	30·10	71·2	70·8	56·0	...	...	3·2
	0 A.M.	30·08	68·5	68·2	53·0	...	...	2·8
☉ 12th,	8 A.M.	30·06	73·0	72·5	54·4	65·5	...	2·8
	9 ,,	30·06	76·2	75·4	57·0	...	...	3·1
	0 P.M.	30·00	86·8	86·0	60·4	...	...	2·7
	3 ,,	29·97	87·5	87·1	60·1	88·0	75·5	2·4
	6 ,,	30·07	75·0	74·6	62·0	...	(24·8) ...	4·3
	9 ,,	30·17	67·5	67·4	58·8	...	...	4·3
	10 ,,	30·20	67·2	66·7	59·0	...	...	4·4
☾ 13th,	6 A.M.	30·23	61·2	60·8	56·5	...	...	4·4
	7 ,,	30·24	62·8	62·3	56·8	...	...	4·3
	9 ,,	30·28	66·5	66·2	58·1	61·0	...	4·2
	0 P.M.	30·24	71·1	71·0	58·6	...	...	3·8
	4 ,,	30·16	72·4	72·3	58·6	...	..	3·7
	7 ,,	30·18	67·6	67·2	57·0	72·5	65·8	3·7
	10 ,,	30·18	65·0	64·8	55·0	...	(13·5)	3·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
59	2·5	0	0	0	0	Smoke haze over Cairo.
35	5·4	0	0	0	0	
34	5·7	0	0	0	0	
37	4·9	0	0	0	0	
53	3·2	0	0	1	N.E.	
70	2·0	0	0	0	0	Fog haze over Nile valley, tops of the hills clear.
64	2·4	0	0	0	0	
71	2·4	0	0	0	0	
41	5·4	0	0	2	N.E.	
44	4·7	0	0	0	0	
49	3·8	0	0	0	0	
49	3·2	8	Cirrus, . .	0	0	Level haze over the Nile valley, hill tops clear.
48	3·9	8	Cirro-strati, .	0	0	
28	8·1	2	Cirrus, . .	0	0	Haze quite cleared away.
28	8·1	1	Cirrus, . .	0	0	
30	6·7	0	0	0	0	
38	5·2	0	0	1	W.	
36	4·8	3	Cirrus, . .	1	W.	
31	6·0	1	Cirrus, . .	0	0	
32	6·7	1	Cirrus, . .	0	0	
19	10·4	0	0	15	S.	Sand flying along in haze dust.
17	10·8	2	Cirrus, . .	10	S.	Sand-drift ceased, atmosphere clear.
46	5·1	10	Sand fog, .	12	N.W.	From 4.30 P.M. a severe gale from N.W., with sand drift.
57	3·1	8	Haze, . .	5	N.	
59	3·0	4	Cirrus, . .	2	N.	
74	1·6	3	Cirrus, . .	2	N.	Hazy horizon.
68	2·1	2	Cirrus, . .	3	N.	
59	3·0	0	0	5	N.	
46	4·5	0	0	3	N.	
43	4·9	0	0	5	N.	Absent at 3 P.M.
50	3·7	2	Cirrus, . .	2	N.	
51	3·3	3	Cirrus, . .	3	N.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♂ 14th,	7 A.M.	30·12	59·7	59·5	54·4	57·0	...	4·0
	9 ,,	30·14	66·3	66·0	58·6	...	...	4·4
	0 P.M.	...	...	...	...	...	...	...
	3 ,,	30·08	71·1	71·0	62·8	...	...	5·0
	4 ,,	30·06	72·3	72·0	63·1	72·5	66·5	5·0
	7 ,,	30·08	71·4	71·0	63·5	...	(12·0)	5·2
	9 ,,	30·09	69·7	69·3	61·4	...	...	4·8
☿ 15th,	7 A.M.	30.08	67·1	66·8	58·6	64·0	...	4·3
	9 ,,	30·08	72·2	72·0	62·1	...	...	4·7
	0 P.M.	30·04	80·2	80·0	64·0	...	...	4·3
	3 ,,	29·97	84·0	83·4	64·2	...	...	4·0
	7 ,,	29·98	80·6	80·0	63·6	84·3	75·2	4·2
	10 ,,	30·00	78·0	77·8	63·5	...	(18·3)	4·4
♃ 16th,	7 A.M.	29·95	78·2	78·0	64·1	68·0	...	4·5
	9 ,,	29·96	81·1	80·8	62·2	...	...	3·8
	0 P.M.	29·91	93·0	92·5	65·9	...	...	3·7
	3 ,,	29·85	94·3	94·0	66·0	...	...	3·7
	4 ,,	29·78	93·6	93·1	65·2	...	...	3·4
	5 ,,	29·79	92·0	91·7	64·6	...	...	3·3
	7 ,,	29·88	89·6	89·2	65·0	96·1	83·5	3·7
	11 ,,	29·90	88·0	87·5	65·0	...	(25·3)	3·8
♀ 17th,	6 A.M.	29·97	74·5	74·0	62·5	...	...	4·5
	7 ,,	30·00	75·8	75·2	63·0	73·7	...	4·5
	8 ,,	30·04	77·8	77·2	63·5	...	...	4·4
	9 ,,	30·04	77·3	76·7	64·0	...	...	4·6
	10 ,,	30·04	77·4	76·8	64·6	...	...	4·7
	11 ,,	30·03	79·8	79·0	66·0	...	...	4·9
	0 P.M.	30·02	79·4	78·8	65·0	...	...	4·7
	1 ,,	29·99	80·2	79·7	64·2	...	...	4·3
	2 ,,	29·98	80·6	80·0	64·5	...	...	4·4
	3 ,,	29·98	80·7	80·1	65·5	...	...	4·7

and Moisture.		Clouds.		Wind.		
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	Remarks.
	Grains.					
70	1·8	1	Cirrus, . .	5	N.	Haze over Nile valley.
62	2·7	1	Cirrus, . .	5	N.W.	Sand in plain now ribbed in direction transverse to the N.W.
...	...	...	...	...	...	Absent in the interior of the Pyramid.
60	3·3	5	Cirro-strati and nimbus,	0	0	Rain in Cairo; wind towards E. of S., a few drops fell in the desert.
56	3·6	7	Cirro-strati, .	0	0	
62	3·2	9	Cirro-strati, .	0	0	
59	3·2	9	Cirro-strati, .	0	0	
58	3·0	2	Cirrus, . .	0	0	Low level haze on Nile valley; hill tops clear.
54	3·8	1	Cirrus, . .	0	0	
39	6·8	1	Cirrus, . .	0	0	
32	8·4	7	Cirrus, . .	0	0	
37	7·0	3	Cirrus, . .	0	0	
42	5·9	4	Cirro-cumuli,	0	0	
44	5·8	8	Cirro-cumuli,	0	0	
33	7·6	9	Cirro-strati and nimbus,	1	S.	
21	12·4	10	Sand haze, .	4	S.	Sand-drift since 10 A.M., air quite filled with sand.
21	13·2	10	Sand haze, .	15	S.	Sand-drift increasing in density and quantity.
19	12·4	10	Sand haze, .	15	S.	
18	12·2	10	Sand haze, .	10	S.	
26	10·9	8	Haze, . .	5	S.	
27	10·2	10	Haze, . .	5	S.	
48	4·8	4	Haze, . .	5	W.	
47	5·1	3	Cirrus and haze,	4	W.	
44	5·9	4	Cirrus and haze,	4	N.W.	
46	5·5	7	Cirrus and haze,	2	N.	
48	5·4	10	Haze, . .	2	N.	
45	6·0	7	Cirrus and haze,	2	N.	
43	6·1	7	Cirrus and haze,	2	N.	
39	6·7	7	Cirrus and haze,	3	N.W.	
39	6·8	9	Cirrus and haze,	5	N.W.	
41	6·5	10	Haze, . .	5	N.W.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of air.
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 17th,	4 P.M.	30·00	80·0	79·5	65·7	81·1	75·0	4·8
	5 ,,	30·03	77·6	77·1	64·6	...	(12·3)	4·7
	6 ,,	30·06	76·0	75·5	63·8	...	...	4·7
	7 ,,	...	...	...	...	...	...	...
	8 ,,	30·12	73·6	73·2	60·0	...	...	3·9
	9 ,,	30·12	72·3	72·0	59·2	...	...	3·8
	10 ,,	30·13	71·0	70·8	58·6	...	...	3·8
	11 ,,	30·12	70·3	69·8	58·2	...	...	3·8
♄ 18th,	7 A.M.	30·20	65·3	65·0	57·1	64·0	...	4·0
	9 ,,	30·23	70·1	70·0	59·9	...	...	4·3
	0 P.M.	30·19	73·2	73·0	60·1	...	...	4·0
	3 ,,	30·15	74·6	74·3	58·6	75·0	68·3	3·5
	7 ,,	30·18	68·0	67·6	55·6	...	(13·4)	3·4
☉ 19th,	8 A.M.	30·22	67·9	67·5	57·6	59·2	...	3·9
	9 ,,	30·22	69·2	69·0	58·6	...	...	4·0
	0 P.M.	30·18	70·3	70·0	58·1	...	...	3·8
	3 ,,	30·13	71·4	71·0	59·2	...	...	3·9
	7 ,,	30·17	67·0	66·7	55·5	72·6	66·1	3·4
	9 ,,	30·21	63·5	63·2	56·0	...	(13·0)	4·0
☾ 20th,	6 A.M.	30·28	61·2	60·8	54·6	...	...	3·9
	9 ,,	30·32	68·0	67·7	57·6	60·0	...	3·9
	0 P.M.	30·27	70·3	70·0	58·0	...	...	3·8
	3 ,,	30·24	71·2	71·0	58·6	...	...	3·8
	7 ,,	30·29	66·8	66·3	56·5	71·4	64·8	3·7
	9 ,,	30·33	64·0	63·8	54·6	...	(13·2)	3·5
♂ 21st,	6 A.M.	30·35	57·5	56·9	52·0	...	...	3·6
	7 ,,	30·36	60·5	60·0	53·6	56·5	...	3·7
	8 ,,	30·37	62·3	62·0	55·6	...	...	4·0
	9 ,,	30·38	65·1	64·9	55·9	...	...	3·8
	10 ,,	30·36	67·3	67·0	55·6	...	...	3·4
	11 ,,	30·34	69·1	68·8	56·6	...	...	3·5
	0 P.M.	30·30	70·2	70·0	57·4	...	...	3·6
	1 ,,	30·29	71·8	71·2	56·9	...	...	3·3
	2 ,,	30·27	73·3	73·0	57·2	...	...	3·3

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
43	6·2	10	Haze, . .	5	N.W.	
48	5·5	10	Haze, . .	4	N.W.	A few drops of rain.
48	5·0	9	Cirrus and haze,	4	N.W.	
...	...	...	...	...	...	
44	5·0	9	Cirro-strati, .	2	N by E	
45	4·8	9	Cirro-strati, .	2	N.N.E.	
46	4·5	8	Cirro-strati, .	2	N.N.E.	
47	4·3	6	Cirro-strati, .	3	N.N.E.	
58	2·9	9	Haze, . .	0	0	Dense haze over Nile valley.
52	3·8	0	0	2	N.	
45	4·9	0	0	3	N.	
38	5·8	0	0	2	N.	
45	4·1	0	0	2	N.W.	
51	3·6	3	Cirrus, . .	0	0	Haze on horizon.
51	3·8	2	Cirrus, . .	1	N.	
46	4·3	5	Cirro-strati, .	3	N.	
47	4·5	3	Cirro-strati, .	2	N.	
48	3·8	0	0	1	N.	
61	2·6	0	0	2	N.	
64	2·2	0	0	0	0	
51	3·6	0	0	0	0	
46	4·3	0	0	2	N.	
45	4·5	0	0	3	N.E.	
52	3·5	0	0	0	0	
53	3·1	0	0	3	N.N.E.	
68	1·6	0	0	1	N.E.	Haze over the line of the Nile.
62	2·2	0	0	1	N.E.	Haze all along the east horizon.
64	2·3	0	0	1	N.E.	
54	3·1	0	0	5	N.E.	
47	3·9	0	0	10	N.E.	
46	4·3	0	0	15	N.E.	
45	4·5	0	0	10	N.E.	
39	5·2	0	0	10	N.E.	
37	5·6	0	0	9	N.E.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum.)	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♂ 21st,	3 P.M.	30·25	73·0	72·5	57·0	...	...	3·3
	4 ,,	30·24	73·2	72·8	56·5	...	...	3·2
	5 ,,	30·24	73·5	73·1	56·1	74·0	63·9	3·1
	6 ,,	30·27	71·3	71·0	54·6	...	(20·2)	2·9
	7 ,,	30·27	69·7	69·3	56·8	...	...	3·5
	8 ,,	30·28	67·4	67·2	55·5	...	...	3·4
	9 ,,	30·30	64·5	64·3	56·3	...	...	3·9
	10 ,,	30·31	63·3	63·0	56·2	...	...	4·0
☿ 22d,	8 A.M.	30·24	59·9	59·5	54·6	51·0	...	4·0
	9 ,,	30·23	64·1	63·8	56·0	...	...	3·9
	0 P.M.	30·27	74·0	73·7	59·7	...	...	3·8
	3 ,,	30·11	80·1	79·5	68·6	...	...	5·7
	7 ,,	30·07	74·0	73·5	63·5	80·6	68·8	4·8
	9 ,,	30·06	69·0	68·5	60·2	...	(23·6)	4·5
♃ 23d,	7 A.M.	29·96	68·1	67·8	53·6	63·0	...	2·9
	9 ,,	29·96	78·4	78·0	56·6	...	...	2·8
	0 P.M.	29·94	91·8	91·6	61·6	...	...	2·5
	3 ,,	29·85	92·5	91·8	61·5	...	...	2·3
	7 ,,	29·82	84·5	84·0	61·6	92·5	80·4	3·4
	9 ,,	29·89	80·8	80·6	60·0	...	(24·2)	3·3
♀ 24th,	7 A.M.	29·90	77·4	77·0	56·1	73·6	...	2·8
	9 ,,	29·93	85·5	85·0	60·1	...	...	3·0
	0 ,,	29·92	87·8	87·4	63·1	...	...	3·3
	3 ,,	29·89	87·8	87·2	65·3	...	...	3·9
	7 ,,	30·02	75·0	74·6	63·2	...	...	4·7
	9 ,,	30·08	71·4	70·8	63·2	89·4	78·8	5·1
							(21·1)	
♄ 25th,	7 A.M.	30·05	65·5	64·8	59·4	(63·0)	...	4·7
	9 ,,	30·07	69·1	69·0	60·1	...	...	4·4
	0 P.M.	30·07	75·8	75·5	60·1	...	...	3·7
	3.5 ,,	29·99	77·1	76·7	59·0	...	...	3·4
	7 ,,	30·02	70·7	70·2	58·6	77·8	70·7	3·8
	9 ,,	30·05	67·5	67·0	56·2	...	(14·2)	3·6

and Moisture.		Clouds.		Wind.		
Computed						Remarks.
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
37	5·5	0	0	9	N.E.	
36	5·7	2	Cirrus, . .	10	N.E.	
34	5·9	3	Cirrus, . .	10	N.E.	
35	5·5	9	Cirro-strati, .	6	N.W.	Query wind's direction.
44	4·4	5	Cirrus, . .	6	N.E.	
46	4·0	0	0	6	N.E.	
58	2·8	2	Cirrus, . .	6	N.E.	
63	2·4	3	Cirrus, . .	6	N.E.	
70	1·8	1	Cirrus, . .	2	N.E.	Haze over the line of the Nile.
59	2·7	1	Cirrus, . .	2	N.E.	
42	5·3	0	0	3	N.E.	
52	5·4	0	0	3	N.E.	
54	4·2	2	Cirrus, . .	2	N.E.	
57	3·3	3	Cirrus, . .	0	0	
38	4·6	1	Cirrus, . .	0	0	Haze over the line of the Nile; hill-tops remarkably clear.
27	7·6	0	0	2	S.W.	
14	13·0	9	Cirrus, . .	8	S.W.	Sand-drift, and sand haze in the distance like mist
12	13·8	7	Cirrus, . .	12	S.	Sand-drift abating.
27	9·2	4	Cirrus, . .	0	0	
30	7·9	3	Cirrus, . .	0	0	
28	7·3	0	0	0	0	Haze on the horizon.
24	10·0	0	0	0	0	
24	10·5	0	0	0	0	Haze all round, but clear at the Pyramids.
29	10·0	0	0	10	N.W.	
50	4·7	0	0	12	N.W.	
61	3·3	4	Cirrus, . .	7	N.W.	
68	2·2	2	Cirrus, . .	2	N.E.	Dense haze.
56	3·4	8	Cirrus, . .	12	N.E.	
39	5·9	10	Haze, . .	20	N.E.	
34	6·6	10	Haze, . .	20	N.E.	Sand-drift.
47	4·4	10	Haze, . .	20	N.E.	
48	3·8	10	Haze, . .	15	N.E.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☉ 26th,	8 A.M.	29·99	65·4	64·9	59·3	(64·1)	...	4·6
	9 ,,	30·02	69·8	69·2	61·5	...	...	4·8
	0 P.M.	29·98	75·1	74·8	64·1	...	...	4·9
	3 ,,	29·97	76·8	76·3	63·0	77·0	69·5	4·4
	7 ,,	30·01	72·4	72·0	62·2	...	(15·0)	4·7
☾ 27th,	8 A.M.	30·18	64·0	63·5	58·2	(60·0)	...	4·6
	9 ,,	30·18	66·6	66·2	60·2	...	...	4·8
	0 P.M.	30·16	76·4	76·0	60·1	...	...	3·7
	3 ,,	30·12	79·4	79·0	58·6	80·0	69·2	3·1
	7 ,,	30·16	72·8	72·4	57·6	...	(21·5)	3·5
♂ 28th,	7 A.M.	30·26	61·5	61·0	54·8	(57·0)	...	3·9
	9 ,,	30·28	65·6	65·2	57·6	...	...	4·1
	0 P.M.	30·20	71·4	71·0	58·6	...	...	3·8
	3 ,,	30·13	74·2	73·9	56·6	75·0	65·9	3·1
	7 ,,	30·14	70·0	69·5	56·6	...	(18·2)	3·4
☿ 29th,	7 A.M.	30·19	60·5	60·0	54·1	(56·5)	...	3·8
	9 ,,	30·17	66·5	66·0	56·6	...	...	3·8
	0 P.M.	30·13	74·3	74·0	57·1	...	...	3·2
	3 ,,	30·04	79·2	79·0	56·4	...	...	2·7
	7 ,,	30·05	74·3	73·8	57·6	80·0	70·6	3·3
	9 ,,	30·09	71·6	71·1	55·7	...	(18·8)	3·1
♃ 30th,	7 A.M.	30·06	67·5	67·0	53·1	(66·0)	...	2·9
	9 ,,	...	...	...	...	...	...	...
	0 P.M.	30·08	82·3	81·5	64·0	...	...	4·0
	3 ,,	30·03	83·3	82·8	63·8	...	...	3·9
	7 ,,	30·12	72·5	72·2	63·5	83·4	74·2 (18·4)	5·1
♀ 31st,	6 A.M.	30·13	65·1	64·8	60·2	...	...	5·0
	7 ,,	30·15	66·1	65·8	61·2	64·0	...	5·2

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
68	2·2	9	Nimbus and cirro-cumuli,	10	N.N.W.	
59	3·2	9	Cirro-strati, .	10	N N.W.	
52	4·5	9	Nimbus and cirro-cumuli,	10	N.N.W.	
44	5·5	0	0	7	N.	
54	3·9	0	0	5	N.	
68	2·0	9	Cirro-strati, .	0	0	Haze over Nile valley, and hills obscured.
67	2·4	3	Cirro-strati, .	2	N.	
37	6·1	0	0	15	N.E.	
29	7·6	0	0	20	N.E.	
39	5·3	0	0	8	N.N.W.	
64	2·2	0	0	0	0	Light haze all round, but clear on the Pyramid hill.
59	2·8	2	Cirro-cumuli, .	2	N.E.	
45	4·6	0	0	0	0	
34	6·1	0	0	2	N.E.	
43	4·6	0	0	0	0	
64	2·1	6	Cirrus, . .	0	0	Light haze over Nile valley.
53	3·4	2	Cirro-strati, .	4	N.E.	
35	6·0	6	Cirrus, . .	3	N.E.	
25	7·9	8	Cirro-strati, .	2	E.	
36	5·9	3	Cirrus, . .	4	W.	
36	5·3	0	0	5	W.	
39	4·5	8	Cirro-strati, .	0	0	
...	...	...	...	...	...	Absent at the Pyramid.
34	7·7	8	Cirro-strati, .	0	0	
33	8·2	6	Cirro-strati, .	0	0	
58	3·6	13	Cirrus and cirro-strati,	18	N.W.	
74	1·8	10	Nimbus and cirro-strati,	4	N.E.	
74	1·9	10	Nimbus and cirro-strati,	3	N.E.	

March 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 31st,	8 A.M.	30·15	67·1	66·6	62·0	...	...	5·3
	9 ,,	30·16	68·8	68·4	62·6	...	...	5·3
	10 ,,	30·16	71·6	71·2	63·5	...	...	5·2
	11 ,,	30·14	72·4	71·8	63·5	...	...	5·1
	0 P.M.	30·12	74·3	73·8	63·1	...	...	4·7
	1 ,,	30·10	75·3	74·9	63·5	...	...	4·7
	2 ,,	30·10	74·6	74·2	62·8	...	...	4·6
	3 ,,	30·04	75·2	75·0	61·1	...	...	4·0
	4 ,,	30·08	74·2	73·8	60·0	...	...	3·9
	5 ,,	30·08	72·9	72·6	60·1	...	...	4·0
	6 ,,	30·07	71·4	71·0	59·6	75·8	69·4 (12·8)	4·0
	7 ,,	30·08	70·3	70·0	57·6	...		3·6
	8 ,,	30·09	69·3	69·0	58·5	...	...	4·0
April ♄ 1st,	7 A.M.	30·01	64·3	64·0	59·1	(62·0)	...	4·8
	9 ,,	29·98	69·0	68·3	61·2	...	...	4·8
	0 P.M.	29·89	81·0	80·6	64·8	...	...	4·4
	3 ,,	29·86	84·6	84·3	65·1	...	...	4·2
	7 ,,	29·97	73·0	72·4	64·0	85·2	74·4 (21·5)	5·1
	9 ,,	30·02	71·0	70·6	62·5	...	...	4·9
☉ 2d,	8 A.M.	30·21	70·1	69·7	61·2	(65·4)	...	4·6
	9 ,,	30·23	71·2	70·4	60·0	...	...	4·2
	0 P.M.	30·24	72·3	71·7	57·6	...	...	3·5
	3 ,,	30·24	73·4	73·0	58·6	...	...	3·6
	7 ,,	30·26	68·2	67·8	54·6	74·0	68·4 (11·3)	3·1

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
72	2·0	9	Nimbus and cirro-strati,	3	N.E.	
67	2·4	9	Cirro-strati, .	10	N.E.	
61	3·2	9	Cirro-strati, .	12	N.E.	
58	3·5	8	Cirro-strati, .	7	N.E.	
51	4·5	9	Cirro-strati, .	8	N.E.	
50	4·8	10	Cirro-strati, .	15	N.E.	
49	4·7	9	Cirro-strati, .	15	N.E.	
43	5·4	9	Cirro-strati, .	20	N.E.	
43	5·3	7	Cirrus and cirro-strati,	18	N.E.	
46	4·7	7	Cirrus and cirro-strati,	20	N.E.	
48	4·3	8	Cirrus and cirro-strati,	12	N.E.	Clouds moving from s.w.
45	4·4	7	Cirro-cumuli,	10	N.E.	
51	3·9	10	Cirro-strati, .	10	N.E.	
71	1·9	9	Cirrus and cirro-strati,	3	N.E.	
61	3·0	9	Cirro-cumuli and cirro-strati, .	7	N.E.	
39	6·9	8	Cirro-cumuli and cirro-strati,	0	0	
33	8·5	9	Cirro-cumuli,	8	N.	
58	3·7	7	Cirrus and cirro-cumuli,	7	N.	
59	3·4	3	Cirrus, . .	5	W.	
58	3·4	8	Cirrus and cirro-cumuli,	10	N.W.	
50	4·2	8	Cirro-strati, .	12	N.W.	Whirls of sand-drift.
40	5·1	10	Cirro-strati, .	2	W.	
40	5·3	4	Cirro-strati, .	0	0	
41	4·4	7	Cirrus and cirro-cumuli,	4	N.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☉ 2d,	8 P.M.	30·32	66·2	65·7	54·6	...	...	3·3
☾ 3d,	8 A.M.	30·42	65·4	65·0	54·1	(60·0)	...	3·3
	9 "	30·44	70·0	69·4	56·5	...	...	3·4
	0 P.M.	30·43	72·5	72·2	55·6	...	...	3·0
	3 "	30·48	73·0	72·6	56·6	...	...	3·2
	7 "	...	...	...	...	...	...	...
	9 "	30·47	66·0	65·3	57·0	73·4	66·2 (14·4)	3·9
♂ 4th,	7 A.M.	30·49	63·0	62·5	55·8	(58·0)	...	3·9
	9 "	30·50	66·2	65·3	56·4	...	...	3·8
	0 P.M.	30·47	69·7	69·5	56·6	...	...	3·4
	3 "	30·40	71·6	71·4	57·6	...	...	3·5
	7 "	30·43	68·0	67·6	56·0	72·2	64·1 (16·2)	3·5
☿ 5th,	8 A.M.	30·45	61·8	61·4	53·6	(54·0)	...	3·5
	9 "	30·46	64·4	64·0	54·3	...	...	3·4
	0 P.M.	30·41	69·4	69·0	56·8	...	...	3·5
	3 "	30·31	72·0	71·6	58·0	...	...	3·6
	8 "	30·35	66·7	66·3	57·2	72·0	63·6 (16·7)	3·9
♃ 6th,	7 A.M.	30·38	61·6	61·2	54·1	(56·6)	...	3·7
	9 "	30·40	64·4	64·0	54·6	...	...	3·5
	0 P.M.	30·35	70·4	70·0	56·9	...	...	3·4
	3 "	30·28	73·0	72·6	57·6	73·5	65·8 (15·5)	3·4
	7 "	...	...	...	...	...		...
	9 "	30·35	64·4	63·8	54·8	...	...	3·5

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
46	3·8	6	Cirrus, . .	3	N.	The chief consequences of the rise of the barometer, which might have been marked in other countries by a cessation of rain, have developed themselves here in an increase of the wet and dry bulbs' difference, and an increase of the transparency of the air, and vividness of solar illumination.
47	3·6	3	Cirrus, . .	2	W.	
42	4·6	2	Cirrus, . .	4	W.	
34	5·6	3	Cirrus, . .	2	W.	
36	5·6	5	Cirrus, . .	5	W.	
...	...	...	...	...	...	Absent at the Pyramid.
56	3·1	3	Cirrus, . .	10	N.W.	Cirrus and a halo round the moon.
62	2·5	0	0	1	N.	Dense haze over Nile valley.
53	3·3	7	Cumulus, .	12	E.N.E.	
44	4·5	1	Cumulus, .	15	E.N.E.	
42	4·9	3	Cirrus, . .	7	N.E.	
46	4·0	1	Cirrus, . .	12	N.E.	Between 5 and 6 o'clock a long cloud of locusts, like a fall of snow in a strong wind, went past from N. to S.
57	2·6	1	Cirrus, . .	6	N.E.	
51	3·3	2	Cirrus, . .	12	N.E.	
45	4·4	3	Cirrus, . .	15	N.E.	
42	4·9	1	Cirrus, . .	7	N.E.	A few locusts seen flying variously from 1 to 2 P.M.
55	3·3	0	0	12	N.	
60	2·4	8	Cirro-strati and cirro-cumuli, .	2	N.	
52	3·2	8	Cirro-cumuli,	10	N.	
43	4·7	0	0	10	N.	
39	5·4	0	0	5	N.	
...	...	...	...	...	...	Absent at the second Pyramid.
53	3·2	2	Cirro-strati, .	4	N.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App. Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 7th,	7 A.M.	30·30	63·4	63·0	58·1	(59·5)	...	4·6
	9 ,,	30·32	68·0	67·6	59·2	...	...	4·3
	0 P.M.	30·27	72·6	72·2	58·6	...	...	3·7
	3 ,,	30·19	79·1	78·8	58·6	...	...	3·1
	7 ,,	...	...	...	...	...	...	...
	9 ,,	30·26	66·3	66·0	60·8	79·2	66·9 (14·6)	5·0
♄ 8th,	7 A.M.	30·22	65·3	65·0	57·6	(59·8)	...	4·2
	9 ,,	30·22	69·8	69·3	58·1	...	...	3·8
	0 P.M.	30·17	74·0	73·4	56·5	...	...	3·1
	3 ,,	30·12	74·9	74·6	56·1	...	...	2·9
	7 ,,	30·12	69·8	69·5	55·6	75·3	67·0 (16·7)	3·2
☉ 9th,	8 A.M.	30·26	62·4	62·0	58·1	(57·5)	...	4·7
	9 ,,	30·25	64·3	64·0	57·6	...	...	4·3
	0 P.M.	30·20	69·0	68·5	55·3	...	...	3·3
	3 ,,	30·16	71·8	71·5	54·6	...	...	2·8
	8 ,,	30·25	64·5	63·0	53·0	71·8	64·3 (15·0)	3·2
☾ 10th,	7 A.M.	30·31	62·2	61·9	56·6	(56·0)	...	4·3
	9 ,,	30·31	65·0	64·3	53·2	...	...	3·1
	0 P.M.	30·29	68·1	67·8	54·6	...	...	3·1
	3 ,,	30·22	70·3	70·0	54·6	72·3	64·4 (15·8)	3·0
	4 ,,	...	...	...	...	...	...	...
♂ 11th,	7 A.M.	...	...	...	...	...	...	...
	9 ,,	...	...	...	...	...	...	...
	0 P.M.	30·23	71·4	71·0	57·6	...	...	3·5
	3 ,,	30·17	71·0	70·3	60·6	...	...	4·3
	7 ,,	30·20	66·3	65·4	58·7	...	...	4·4
☿ 12th,	7 A.M.	30·31	63·4	62·5	56·5	(57·4)	...	4·1
	9 ,,	30·35	67·3	67·0	57·6	...	...	4·0
	0 P.M.	30·33	70·6	70·2	58·6	...	...	3·9

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat. = 100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
71	1·9	0	0	0	0	Haze over Nile valley.
57	3·2	4	Cumulus, .	0	0	
43	5·0	0	0	0	0	
29	7·5	0	0	1	N.	
...	...	...	...	...	...	Absent at the Great Pyramid.
71	2·1	0	0	0	0	
60	2·7	0	0	0	0	
48	4·1	0	0	0	0	
34	6·0	0	0	0	0	
31	6·4	2	Cirrus, . .	0	0	
40	4·7	0	0	7	N.E.	
76	1·6	1	Cirrus, . .	2	N.E.	
64	2·3	5	Cirrus, . .	6	N.E.	
42	4·5	1	Cirrus, . .	8	N.E.	
34	5·6	1	Cirrus, . .	3	N.E.	
46	3·6	0	0	10	N.E.	
69	2·0	0	0	0	0	Whirlwinds of sand frequent over Cairo and in the Nile valley.
46	3·7	5	Cumulus, .	2	N.E.	
42	4·4	4	Cumulus, .	2	N.E.	
37	5·1	6	Cumulus, .	3	N.E.	
...	...	...	...	...	...	Start at 4 P.M. to spend the night on the top of the Great Pyramid.
...	...	...	...	...	...	Thermometer on the top of the Great Pyramid at the lowest, 49°.
...	...	...	...	...	...	Began to descend the Great Pyramid at 9 A.M.
42	4·8	5	Cumulus, .	0	0	
52	4·0	8	Cumulus, .	2	W.	Min. Ther. not set at East Tombs, but found at 56°, temperature had not been lower there. A little rain fell between 6 and 7 P.M.
62	2·7	8	Cumulus and nimbus, .	0	0	
63	2·4	0	0	0	0	
53	3·4	2	Cumulus, .	0	0	
47	4·3	6	Cumulus, .	0	0	

April 1865. Day.	April 1865. Hour, App. Solar time.	Air Pressure at Station.	Air Shade-Temperature: Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☿ 12th,	3 P.M.	30·31	71·5	71·1	57·4	...	...	3·5
	7 ,,	30·35	67·6	67·2	56·1	72·5	64·6 (15·9)	3·6
♃ 13th,	7 A.M.	30·47	64·0	63·5	56·6	(55·8)	...	4·1
	9 ,,	30·48	67·3	67·0	57·6	...	...	4·0
	0 P.M.	30·45	70·5	70·0	56·6	...	...	3·4
	3 ,,	30·39	71·5	71·3	56·1	...	...	3·2
	8 ,,	30·40	68·0	67·5	57·0	72·4	64·2	3·7
	9 ,,	30·45	65·0	64·5	54·3	...	(16·5)	3·4
♀ 14th,	6 A.M.	30·45	58·2	57·5	52·0	...	...	3·6
	7 ,,	30·46	60·5	60·0	54·1	(56·0)	...	3·8
	8 ,,	30·46	63·7	63·0	55·2	...	...	3·7
	9 ,,	30·45	66·1	65·6	55·6	...	...	3·6
	10 ,,	30·44	68·1	67·8	56·4	...	...	3·6
	11 ,,	30·43	69·4	69·0	56·6	...	...	3·5
	0 P.M.	30·39	71·4	71·0	57·1	...	...	3·4
	1 ,,	30·36	72·5	72·0	58·6	...	...	3·7
	2 ,,	30·34	73·3	73·0	56·8	...	...	3·2
	3 ,,	30·31	73·0	72·3	56·5	74·0	65·6	3·2
	4 ,,	30·30	72·6	72·0	55·8	...	(16·7)	3·1
	5 ,,	30·29	72·1	71·8	55·6	...	...	3·0
	6 ,,	30·32	70·3	70·0	57·1	...	...	3·5
	7 ,,	30·34	68·0	67·5	58·5	...	...	4·1
	8 ,,	30·37	65·8	65·4	57·6	...	...	4·1
	9 ,,	30·38	64·6	64·2	58·0	...	...	4·4
♄ 15th,	7 A.M.	30·37	63·3	63·0	57·6	(58·6)	...	4·4
	9 ,,	30·37	68.0	67·4	57·6	...	...	3·9
	0 P.M.	30·32	74·0	73·6	58·0	...	...	3·4
	3 ,,	30·27	76·0	75·5	58·9	...	...	3·5
	7 ,,	30·30	68·0	67·3	59·2	76·2	67·4	4·3
	9 ,,	30·35	66·5	66·0	57·5	...	(17·5)	4·0
☉ 16th,	8 A.M.	30·37	66·0	65·4	58·5	(58·8)	...	4·4
	9 ,,	30·38	67·1	66·8	59·6	...	...	4·6
	0 P.M.	30·33	73·6	73·2	60·6	...	...	4·1
	3 ,,	30·35	76·0	75·8	58·6	...	...	3·4
	7 ,,	30·30	71·0	70·5	59·0	76·2	67·7 (17·0)	3·9

and Moisture.		Clouds.		Wind.		
Computed						Remarks.
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
41	4·9	7	Cumulus, .	0	0	
48	3·9	4	Cirro-strati, .	2	N.	
61	2·5	0	0	0	0	Light haze on the horizon; very lovely effect.
53	3·4	2	Cumulus, .	2	S.	
42	4·8	1	Cumulus, .	1	N.	
37	5·2	1	Cumulus, .	8	N.	
49	3·8	1	Cirrus, . .	10	N.E.	
49	3·4	3	Cirrus, . .	7	N.E.	
66	1·9	4	Cirro-strati, .	1	N.E.	
64	2·1	2	Cirro-strati, .	5	N.E.	
57	2·8	4	Cirrus, . .	4	N.E.	
49	3·5	3	Cirrus, . .	5	N.E.	
47	4·0	5	Cirrus, . .	7	N.	
45	4·4	2	Cirrus, . .	7	N.	
40	5·0	2	Cirrus, . .	9	N.	
43	5·0	1	Cirrus, . .	12	N.	
36	5·7	2	Cirrus, . .	12	N.	
36	5·6	5	Cirrus, , .	12	N.	
34	5·6	1	Cirrus, . .	15	N.	
35	5·5	1	Cirrus, . .	15	N.	
44	4·6	2	Cirrus, . .	20	N.	
54	3·3	0	0	10	N.	
58	2·9	0	0	10	N.	
65	2·3	0	0	10	N.	
69	2·0	0	0	0	0	Haze over Nile valley.
51	3·6	0	0	7	N.	
37	5·7	0	0	4	N.	
36	6·2	5	Cumulus, .	2	N.	
51	3·2	0	0	5	N.	
56	3·2	0	0	3	N.	
62	2·6	6	Cirro-strati, .	0	0	Haze over Nile valley.
62	2·8	6	Cumulus, .	0	0	
46	4·9	2	Cumulus, .	0	0	
35	6·3	2	Cirrus, . .	2	N.	
47	4·4	5	Cumulus, .	12	N.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					
			Dry-bulb.		Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Computed
Day.	Hour, App Solar time.		By Max. Th.	By Min. Th.				Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
☾ 17th,	7 A.M.	30·34	65·5	65·0	57·6	(59·5)	...	4·1
	9 ,,	30·33	68·8	68·3	57·6	...	...	3·8
	0 P.M.	30·28	74·0	73·5	56·1	...	...	3·0
	3 ,,	30·21	75·8	75·4	57·0	...	...	3·1
	7 ,,	30·20	72·6	72·2	58·5	78·8	69·0	3·6
	8 ,,	30·22	70·0	69·5	57·5	...	(19·6)	3·6
♂ 18th,	5 A.M.	30·22	60·2	59·5	55·4	(59·0)	...	4·2
	9 ,,	...	...	...	...	...	...	...
	0 P.M.	30·21	74·3	73·7	58·8	...	...	3·5
	3 ,,	30·15	76·5	76·0	56·6	...	...	3·0
	8 ,,	30·25	70·0	69·7	58·5	76·6	68·6 (15·9)	3·9
☿ 19th,	7 A.M.	30·36	65·1	64·8	58·6	(62·5)	...	4·5
	9 ,,	30·38	68·0	67·5	60·0	...	...	4·5
	0 ,,	30·35	74·1	73·8	60·2	...	...	3·9
	4 ,,	30·28	75·4	75·0	56·6	...	...	3·0
	8 ,,	30·33	70·6	70·2	57·3	76·0	68·6	3·5
	10 ,,	30·39	67·0	66·5	57·7	...	(14·8)	4·0
♃ 20th,	6 A.M.	30·36	61·8	61·3	56·5	(60·0)	...	4·3
	10 ,,	30·37	69·0	68·5	58·1	...	...	3·9
	0 P.M.	30·33	72·4	72·0	57·0	...	...	3·3
	3 ,,	30·26	72·0	71·7	56·7	...	...	3·2
	8 ,,	30·31	66·7	66·4	56·5	72·7	65·2 (15·1)	3·7
♀ 21st,	6 A.M.	30·34	58·0	57·3	51·0	(55·2)	...	3·3
	7 ,,	30·34	60·0	59·5	52·1	...	...	3·3
	8 ,,	30·33	62·5	62·0	52·6	...	...	3·2
	9 ,,	30·33	65·1	64·8	52·8	...	...	3·0
	10 ,,	30·33	67·1	65·8	53·6	...	...	3·0
	11 ,,	30·29	68·4	67·6	54·2	...	...	3·0
	0 P.M.	30·27	70·0	69·5	54·6	...	...	3·0
	1 ,,	30·25	71·4	71·0	55·4	...	...	3·0
	2 ,,	30·23	71·6	71·2	56·1	...	...	3·2
	3 ,,	30·21	71·4	70·9	57·5	...	...	3·5
	4 ,,	30·21	71·5	70·8	57·5	...	...	3·5
	5 ,,	30·21	71·0	70·5	55·1	72·5	64·6	3·0
	6 ,,	30·24	69·6	69·1	55·0	...	(17·1)	3·1

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
59	2·8	0	0	0	0	Haze on horizon.
48	3·9	0	0	0	0	
33	6·1	0	0	0	0	
31	6·5	2	Cirrus, . .	0	0	
42	5·0	0	0	0	0	
46	4·4	0	0	0	0	
72	1·6	0	0	0	0	Preparing to start for the interior of the Great Pyramid.
...	...	...	...	...	...	
39	5·7	0	0	0	0	Returned to East Tombs at 11.30 A.M.
31	6·9	0	0	0	0	
48	4·1	0	0	0	0	
66	2·4	10	Cumulo-strati,	0	0	
60	3·0	8	Cumulo-strati,	0	0	
43	5·2	4	Cumulo-strati,	0	0	
32	6·5	0	0	0	0	
44	4·6	3	Cirrus, . .	7	W.	
55	3·3	3	Cirrus, . .	5	W.	
70	1·9	10	Cumulo-strati,	2	N.	
50	3·9	6	Cumulo-strati,	4	N.	
38	5·3	4	Cirrus, . .	6	N.	
38	5·3	0	0	8	N.E.	
52	3·5	0	0	15	N.E.	
61	2·1	0	0	2	N.E.	
58	2·5	0	0	1	N.E.	
51	3·1	0	0	2	N.E.	
45	3·8	0	0	10	N.E.	Whirlwinds of sand frequent.
42	4·3	0	0	15	N.E.	
39	4·6	0	0	20	N.E.	
37	5·0	0	0	20	N.E.	
36	5·3	0	0	20	N.E.	
38	5·3	0	0	20	N.E.	
42	4·9	0	0	18	N.E.	
42	4·9	0	0	15	N.E.	
36	5·3	0	0	13	N.E.	
39	4·8	2	Cirrus, . .	12	N.E.	

April 1865.		Air Pressure at Station.	Air Shade-Temperature					Computed
Day.	Hour, App. Solar time.		Dry-bulb. By Max. Th.	Dry-bulb. By Min. Th.	Wet-bulb.	Self-Registering Maximum and (Minimum).	Mean Temperature and (Daily Range) from Self-Registering Therms.	Weight of Vapour *in* cubic foot of Air.
		Inches.	° Fah.	° Fah.	° Fah.	° Fah.	° Fah.	Grains.
♀ 21st,	7.4 P.M.	30·29	67·4	67·0	54·2	...	...	3·1
	8 ,,	30·32	65·5	65·0	54·2	...	...	3·3
	9 ,,	30·35	63·6	62·8	53·1	...	...	3·3
♄ 22d,	8 A.M.	30·32	64·6	64·2	54·6	(55·5)	...	3·5
	9 ,,	30·34	66·6	66·2	54·6	...	...	3·3
	6 P.M.	30·28	74·0	73·8	56·1	...	...	3·0
	7 ,,	30·28	71·0	70·4	57·2	74·5	65·0	3·5
							(19·1)	
☉ 23d,	7 A.M.	30·28	62·0	61·5	56·0	55·4	...	4·1
	9 ,,	30·28	71·6	71·2	59·0	...	...	3·8
	4 P.M.	30·10	83·5	82·8	62·0	84·2	71·4	3·6
							(25·5)	
☾ 24th,	6 A.M.	30·05	72·6	72·2	59·6	(62·0)	...	3·9
	9 ,,	30·08	85·5	85·0	63·6	...	...	3·7
	0 P.M.	30·06	88·5	88·0	67·6	...	...	4·4
	3 ,,	30·03	88·5	88·0	68·1	89·0	75·5	4·6
							(27·0)	
♂ 25th,	8 A.M.	30·26	67·3	66·9	58·6	(62·0)	...	4·2
	0 P.M.	30·23	75·6	75·2	59·6	...	...	3·7
	3 ,,	30·17	79·0	78·5	61·0	79·0	70·2	3·7
							(17·5)	
☿ 26th,	7 A.M.	30·34	64·5	64·0	57·6	(61·0)	...	4·3
	9 ,,	30·34	69·5	69·0	59·0	...	...	4·0
	3 P.M.	30·32	80·2	80·0	61·8	...	...	3·7
	9 ,,	30·34	72·7	72·0	61·0	81·0	71·0	4·3
							(20·0)	
♃ 27th,	7 A.M.	30·40	64·6	64·1	57·6	(61·0)	...	4·3
	0 P.M.	30·36	77·0	76·5	59·6	...	...	3·5
	9 ,,	30·40	70·3	70·0	59·1	80·5	70·8	4·0
							(19.5)	
♀ 28th,	7 A.M.	30·46	66·1	65·8	58·0	(61·0)	...	4·2
	3 P.M.	30·33	78·1	77·8	57·6	...	...	3·0

and Moisture.		Clouds.		Wind.		Remarks.
Computed						
Humidity relative Sat.=100.	Weight of Vapour *required to saturate* a cubic foot of Air.	Quantity 0—10.	Quality.	Velocity in miles per hour.	Direction.	
	Grains.					
42	4·3	3	0	12	N.E.	
47	3·6	0	0	12	N.E.	
50	3·3	0	0	10	N.E.	
52	3·3	0	0	6	N.E.	
45	3·9	0	0	10	N.E.	
33	6·1	4	Cirrus, . .	8	E.N.E.	
42	4·8	5	Cirrus, . .	12	E.N.E.	
67	2·1	0	0	5	N.E.	Hazy sky, white about sun.
46	4·6	0	0	2	N.E.	
30	8·6	4	Cirrus, . .	0	0	Hazy.
45	4·8	0	0	0	0	Hazy sky, and white about sun.
29	9·3	0	0	0	0	
32	9·8	0	0	0	0	Atmospheric light bad.
33	9·6	0	0	0	0	
57	3·1	1	Cirrus, . .	4	N.E.	Haze all about.
38	5·9	0	0	6	N.E.	Atmospheric light improved.
35	6·9	0	0	4	N.E.	
63	2·4	0	0	0	0	Haze over Nile valley.
52	3·8	2	Cirrus, . .	3	N.E.	
34	7·3	2	Cirrus, . .	4	N.E.	Atmospheric light good.
49	4·4	0	0	15	N.E.	
63	2·5	1	Cirrus, . .	2	N.E.	Haze over Nile valley.
35	6·5	0	0	4	N.E.	
49	4·1	0	0	4	N.E.	
60	2·8	0	0	2	N.E.	Haze over Nile valley.
29	7·3	0	0	1	N.E.	Air all day pleasant and balmy.

CYCLE OF A DAY.

From the hourly observations of the various meteorological elements, taken throughout a day, generally once a week,—mean representations for every hour observed, have been deduced for each month; and from such monthly means, the means for the whole four months have been obtained and inserted in the following table prepared for each hour throughout the twenty-four. Some of the hours—as those from 11 P.M. to 5 A.M.—have been supplied by an interpolating curve prepared from the rest of the observations.

The complete day thus instrumentally described at twenty-four equidistant points along its circumference, will represent an average day in Egypt, between February and March; a period at and about which many travellers and invalids may desire to know the vicissitudes they will have to undergo; or, by referring their own observations there at the instant to a normal statement, to ascertain when any of the Egyptian meteorological elements are in an abnormal condition, and some changes of weather, possibly a severe sand-storm, may be looked for.

N.B.—The mean barometrical height is not to be looked on with much confidence, as the instrument employed, experienced an injury on the return, preventing its due comparison with a standard barometer.

METEOROLOGY OF A MEAN DAY AT EAST TOMBS, PYRAMID HILL, DURING THE MONTHS OF JANUARY, FEBRUARY, MARCH, AND APRIL (THE HOURS FROM 11 P.M. TO 5 A.M. INCLUSIVE, BEING SUPPLIED FROM AN INTERPOLATING CURVE).

Hour.	Barometrical Pressure.	Correction to Mean of 24 hours.	Temperature in shade, (Fahr.)	Correction to Mean of 24 hours.	Temperature of evaporation.	Correction to Mean of 24 hours.	Difference between dry and wet bulb.	Computed			
								Elasticity of vapour.	Weight of vapour in cubic foot of air.	Weight of vapour required to saturate the same.	Relative humidity, saturation =100.
	Inches.	Inches.						Inches.	Grains.	Grains.	
0 A.M.	30·18	o	59·8°	+3.6°	52·6°	+1.2°	7·2°	0·31	3·5	2·2	62·
1 ,,	3·18	o	58·5	4.9	51·8	2.0	6·7	·31	3·4	2·0	62·
2 ,,	·17	+.01	57·2	6.2	51·0	2.8	6·2	·30	3·4	1·9	64·
3 ,,	·17	+.01	56·2	7.2	50·0	3.8	6·2	·29	3·3	1·8	64·
4 ,,	·18	.o	55·6	7.8	49·4	4.4	6·2	·28	3·2	1·8	64·
5 ,,	·20	−.02	55·3	8.1	49·2	4.6	6·1	·28	3·1	1·8	65·
6 ,,	·22	−.04	56·5	6.9	50·2	3.6	6·3	·29	3·3	1·8	64·
7 ,,	·23	−.05	58·6	4.8	51·9	1.9	6·7	·31	3·5	2·0	63·
8 ,,	·23	−.05	61·2	+2.2	53·3	+0.5	7·9	·31	3·5	2·5	58·
9 ,,	·23	−.05	64·0	−0.6	54·5	−0.7	9·5	·32	3·5	3·1	53·
10 ,,	·23	−.05	66·2	−2.8	55·3	−1.5	10·9	·31	3·4	3·6	48·
11 ,,	·22	−.04	68·0	−4.6	55·7	−1.9	12·3	·31	3·4	4·1	45·
0 P.M.	·19	−.01	69·3	−5.9	56·3	−2.5	13·0	·31	3·4	4·7	42·
1 ,,	·16	+.02	70·1	−6.7	56·7	−2.9	13·4	·31	3·4	4·6	42·
2 ,,	·14	.04	70·3	−6.9	56·6	−2.8	13.7	·31	3·4	4·7	41·
3 ,,	·11	.07	70·5	−7.1	56·8	−3.0	13·7	·31	3·4	4·8	42·
4 ,,	·11	.07	70·3	−6.9	56·6	−2.8	13·7	·31	3·4	4·8	41·
5 ,,	·11	.07	69·1	−5.7	56·1	−2.3	13·0	·31	3·4	4·4	44·
6 ,,	·13	.05	67·8	−4.4	55·8	−2.0	12·0	·32	3·5	4·0	46·
7 ,,	·16	+.02	66·4	−3.0	55·6	−1.8	10·8	·32	3·5	3·6	48·
8 ,,	·18	.o	64·8	−1.4	54·8	−1.0	10·0	·32	3·5	3·3	51·
9 ,,	·19	−.01	63·4	0.0	54·7	−0.9	8·7	·32	3·5	2·9	55·
10 ,,	·19	−.01	62·2	+1.2	54·1	−0.3	8·1	·32	3·6	2·6	58·
11 ,,	·19	−.01	61·0	+2.4	53·4	+0.4	7·6	·32	3·6	2·4	60·
Mean of 24 hours,	Inches. 30·28	...	63·4°	...	53·8°	...	9·6°	...	...	...	...

METEOROLOGY OF THE MONTHS.

In the following table, both the means and extremes from all the daily meteorological observations are entered for each month separately, and successively, to show the weather history for the time.

The chief anomaly will then be seen to consist in the extra heat and drought of the month of March. For heat, the temperature of 96·1° Fahrenheit, sufficiently realizes that element; while for drought, the most instructive return to look at, is probably that of 'the weight of vapour required to 'saturate a cubic foot of air,'—for such return expresses so closely, in its variations, the actual effects experienced on the human skin. Now in Scotland, the mean amount required in the same month of March, was 0·5 grain; and in June, the dryest month of the whole year, it was 1·1 grain; but at East Tombs, Great Pyramid hill, in March, the the mean quantity required there was 3·8 grains; and the maximum quantity, on one special occasion, was no less than 13·8 grains.

Hence there are peculiar effects produced by Egyptian heat, on account of its accompanying dryness: while even in the element of heat alone, it may be interesting to point out, as respecting medical climatology, that the coldest months, or January and February, at the Great Pyramid, were

3° warmer than the warmest months,—July and September of the same year,—proved to be in Scotland. But to enable the reader to judge more particularly of the differences between the two climates, a table of the Scottish meteorology is introduced on page 264.

EAST TOMBS, LAT. 29° 59′ N.

METEOROLOGICAL ABSTRACT OF EACH MONTH OBSERVED IN 1865.

Subjects. General.	Subjects. Particular.	Jan.	Feb.	March.	April.
		Inches.	Inches.	Inches.	Inches.
Barometrical Pressure,	Mean height, ...	30·13	30·11	30·14	30·29
	Greatest height on any occasion, .	30·26	30·38	30·39	30·50
	Least height on any occasion, . .	29·89	29·69	29·78	29·86
	Extreme monthly range, . . .	0·37	0·69	0·61	0·64
	Mean semi-daily range, . . .	0·05	0·07	0·08	0·08
		° Fah.	° Fah.	° Fah.	° Fah.
Temperature in shade,	Mean temperature, ...	61·2	61·4	68·5	67·5
	Highest temperature on any occasion,	76·8	76·5	96·1	89·0
	Lowest temperature on any occasion,	47·5	46·5	51·0	54·0
	Extreme monthly range, . . .	29·3	30·0	45·1	35·0
	Mean semi-daily range, . . .	6·9	7·5	8·5	8·7
Moisture in shade,	Mean weight of vapour, in grains, .	3·7	3·0	3·8	3·8
	Mean humidity relative, . . .	60·0	49·0	50·0	49·0
	Mean required vapour, in grains, .	2·4	3·1	3·8	3·7
	Greatest weight vapour on any occasion, in grs.,	5·3	4·8	6·0	5·1
	Greatest humidity ,, .	92·0	76·0	76·0	76·0
	Least required vapour ,, in grs.,	0·4	1·2	1·1	1·5
	Least weight of vapour on any occasion, in grs.,	2·7	1·8	2·3	2·9
	Least humidity ,, .	32·0	28·0	12·0	29·0
	Greatest required vapour ,, in grs.,	5·8	6·6	13·8	9·8
Cloud,	Quantity of 0—10, ...	3·6	2·9	3·0	2·4
Wind,	Mean velocity in miles per hour, .	1·6	4·6	5·2	5·4
	Mean direction, ...	N.	S.W.	N.	N.N.E.
Rain,	Number of days on which it fell, .	1	1	1	0
	Depth fallen ; insensible, . .	0	0	0	0

SCOTLAND, LAT. 56° 30′ N.

ELEVATION ABOVE SEA = 3072 INCHES.

METEOROLOGICAL ABSTRACT OF EACH MONTH, FROM THE SCHEDULES OF THE METEOROLOGICAL SOCIETY OF SCOTLAND IN 1865.

Subjects. General	Subjects. Particular.	Jan.	Feb.	March.	April.
		Inches.	Inches.	Inches.	Inches.
Barometrical Pressure,	Mean height, reduced to the sea level,	29·41	29·80	29·89	30·11
	Greatest height on any occasion ? .	30·27	30·66	30·48	30·45
	Least height on any occasion ? . .	28·55	28·94	29·30	29·77
	Extreme monthly range, . . .	1·71	1·72	1·18	0·68
	Mean semi-daily range, . . .	...	...	...	...
		° Fah.	° Fah.	° Fah.	° Fah.
Temperature in shade,	Mean temperature,* . . .	34·6	33·9	37·3	46·5
	Highest temperature on any occasion,	57·5	52·1	58·8	77·0
	Lowest temperature on any occasion,	−4·0	−1·1	14·7	23·0
	Extreme monthly range, . . .	34·7	33·9	28·6	39·4
	Mean semi-daily range, . . .	4·6	4·6	5·4	8·0
Moisture in shade,	Mean weight of vapour, grains, .	2·1	2·1	2·1	3·0
	Mean humidity relative, . . .	87·0	88·0	85·0	83·0
	Mean required vapour, grains, . .	0·2	0·2	0·5	0·6
Cloud,	Quantity of 0—10, ...	6·2	7·1	6·4	5·9
Wind,	Mean velocity in miles per hour ? .	20·0	16·0	18·0	15·0
	Mean direction, ...	W.	S.E.	N.W.	S.W.
Rain,	Number of days on which it fell, .	17	14	15	8
	Depth in inches, ...	3·73	2·91	2·05	0·94

	June.	July.	August.	Sept.
	° Fah.	° Fah.	° Fah.	° Fah.
* The mean temperatures of the four warmest months of the year 1865 were as follows :—	57·1	58·4	56·1	58·0
And the mean weight of vapour in cubic foot of air, in grains, ...	4·1	4·4	4·4	4·5
Mean humidity relative, ...	81·0	82·0	87·0	86·0
And mean required vapour to saturate a cubic foot of air, in grains, ...	1·1	1·0	0·6	0·7

MEAN DAILY TEMPERATURE, IN THE SHADE.

In extracting the numbers for this return from the Meteorological Journal, first, as given by the self-registering thermometers only,—the simple precaution has been observed, of comparing each day's maximum temperature—not with the low temperature of the previous night alone, or the following night—but with the mean of the two nights. The range thus obtained has been divided by two, in order to present the quantity, the simple addition or subtraction of which will at once give either the maximum or minimum temperature.

Day of Month.	January.		February.		March.		April.	
	Mean temperature.	Semi-daily range.	Mean temperature.	Semi-daily range.	Mean temperature.	Semi-daily range.	Mean temperature.	Semi-daily range.
1	...	...	66·0°	10·5°	60·2°	7·1°	74·4°	10·8°
2	...	...	62·1	6·0	60·4	7·0	68·4	5·6
3	...	...	61·5	4·8	61·2	7·4	66·2	7·2
4	...	...	61·6	7·6	62·4	7·2	64·1	8·1
5	...	...	63·7	9·9	64·7	7·2	63·6	8·4
6	...	...	67·5	8·5	64·5	7·6	65·8	7·8
7	...	...	65·5	7·0	63·3	8·6	66·9	7·3
8	...	...	61·0	7·0	61·0	8·2	67·0	8·4
9	...	...	59·8	8·2	63·8	9·4	64·3	7·5
10	...	...	58·2	8·3	66·4	8·0	64·4	7·9
11	...	...	59·4	9·2	71·9	9·1	...	...
12	...	...	57·7	8·8	75·6	12·4	64·6	7·9
13	...	...	57·1	8·1	65·8	6·8	64·2	8·2
14	59·2°	3·1°	58·6	6·7	66·5	6·0	65·6	8·4
15	61·6	5·8	59·9	7·1	75·2	9·2	67·4	8·8
16	59·3	8·2	65·3	8·4	83·5	12·6	67·7	8·5
17	58·0	7·5	68·1	7·1	75·0	6·2	69·0	9·8
18	60·6	5·4	66·4	5·8	68·3	6·7	68·6	8·0
19	63·0	7·0	63·0	7·6	66·1	6·5	68·6	7·4
20	64·3	8·8	60·2	7·2	64·8	6·6	65·2	7·6
21	61·4	5·0	61·8	7·2	63·9	10·1	64·0	8·6
22	62·8	6·8	66·2	7·8	68·8	11·8	65·0	9·6
23	62·2	6·4	62·0	7·5	80·4	12·1	71·4	12·8
24	59·8	5·4	55·2	7·4	78·8	10·6	75·5	13·5
25	58·7	7·6	55·6	5·8	70·7	7·1	70·2	8·8
26	61·8	6·6	57·4	5·6	69·5	7·5	71·9	10·0
27	62·0	5·2	58·0	7·4	69·2	10·8	70·8	9·8
28	61·6	7·4	60·0	8·2	65·9	9·1	...	...
29	62·8	10·2	...	...	70·6	9·4	...	...
30	62·3	8·1	...	...	74·2	9·2	...	...
31	66·4	10·4	...	...	69·4	6·4	...	...
	61·2°	6·9°	61·4°	7·5°	68·5°	8·5°	67·5°	8·7°

The mean temperature for the whole of the four months observed in, appears to be from the preceding returns = 64·6°. But there are some causes which may make this result rather too high; first, that the minimum thermometer being of alcohol, and large-bulbed, is more sluggish than the mercurial maximum, and does not equally give the extremes of its curve; and second, that the stone shelf in the dining-room tomb, where the minimum was placed at night, was perhaps rather farther within solid stone protections than it ought to have been, with due regard to fine scientific requirements: points which were better attended to with the ordinary observations of temperature at the instant. There is the further uncertainty too with this method, that it is by no means necessary that the mean of the two extremes of the daily curve, should give the mean for the whole day; and in fact Mr. Glaisher has shown long since that it does not.

Hence the result from the maximum and minimum thermometers, observed every day,—though the popular system,—is probably not so good as that from the simple thermometers observed hourly, about once a week, throughout the same four months; and this latter method gives 63·4.°

Assigning the latter number, therefore, double weight,—perhaps it ought to have more,—the mean of the whole meteorological observations on the atmosphere, for the mean temperature at East Tombs during the months of January, February, March, and April, of the year 1865, = 63·8° Fahr.

SPECIAL STORM.

The severest storm experienced at the Pyramids during the first four months of 1865, was undoubtedly that which culminated on February 3, at 4h A.M. The barometer steadily decreased during four days from 30·16 to 29·69, and then as steadily rose from that point to 30·17 in the course of the three following days. During the sinking of the barometer, the wind veered from south gradually to south-west, and during the rising from south-west to west, the maximum velocity occurring soon after the maximum fall of the barometer. Not a drop of rain fell, but during three days the sky was dark and obscured with sand, which seemed to fill all the air; and the difference between wet and dry-bulb thermometers was occasionally 10°, at a shade-temperature of 65°.

The importance of this storm is not to be judged on European principles by the amount of rain, which was nothing, because the region is a 'rainless region;' nor is it to be judged from the whole fall of the barometer, which was not more than 0·47 inch, because the latitude parallel is one of small barometrical variation; but it is to be compared only with the other weather phenomena of its own locality, and especially is it to be weighed by the long period of uninterrupted fall, and then the almost equally long period of uninterrupted rise of the barometer, lasting altogether for a whole week, —and indicating a wide-spread and truly grand disturbance of the atmosphere. Seeing too, that such disturbances are always of a dynamical or locomotive order, we may ask whence did this storm come to Egypt?

From the southern parts of the North Atlantic, is the first idea; and one still to be tested; for though the admirable daily bulletins of the Imperial Observatory of Paris show little or nothing of it, they may not extend their weather-maps far enough southward, for the earlier history of the storm; as they certainly do not far enough eastward to represent Egypt. The range of those maps is indeed essentially West European, though they have a little of North-west Africa, and some parts of Russia, within their bounds. Still, as most admirable things of their kind, and quite unique,—their indications deserve to be chronicled on the present occasion, though they are only negative: and stand thus:—

During the several last days of January, no noticeable phenomena disturbing the weather.

On February 1, 8 h. A.M., a most serious-looking set of concentric barometric circles over England first, and then Europe; lowest descent of mercurial column = 28·6 inches.

On February 2, 8 h. A.M., more moderate barometric curves, but in nearly similar positions; lowest barometrical height = 29·1 inches; greatest height anywhere, at Gibraltar, and = 30·1 inches. But eastward of Sicily a new, separate, and distinct, centre of barometrical depression is indicated, having for its lowest reading, 29·3 inches.

On February 3, 8h. A.M., less marked curves of the European system, whose centre and lowest point is over France, and reads 29·1 inches. The East-Sicilian system is gone.

On February 4th, 8h. A.M., the weather calm and settled, and all European barometric heights very uniform.

Hence arises the conclusion, that the Egyptian storm was not felt in West Europe; though the centre of barometrical depression, indicated on the morning of February 2 as being eastward of Sicily, may have been connected with it,—when pursuing a path something like east-north-east, or moving against the trade-wind current; and in latitudes between 35° and 25° north, when near 15° of longitude east of Greenwich.

But what of the storm when farther east, supposing such to be its track?

The following observations bearing on this point have been kindly furnished by the Meteorological Society of Scotland from their observer at Jerusalem; and indicate, as well as single daily observations may be expected to do, that the storm culminated there on February 3; was marked by larger and longer continued barometric depression than in Egypt; had similar south-west wind, though of no great strength, accompanying its central position; and was distinguished by nearly two inches of rain, with much thunder and lightning:—

METEOROLOGICAL SOCIETY OF SCOTLAND.

STATION—JERUSALEM.

Latitude, 31° 46′ 45″ N.

Longitude, 35° 13′ East.

Distance from sea = 35 miles.

Height, station above sea = 2400 feet = Bar. corr. + 2·536 inches.

Observer—DR. THOMAS CHAPLIN.

Time of observation = 9 h. A.M.

Date, 1865.	Barometer.	Max. Th	Min. Th.	Dry-bulb.	Wet-bulb.	Wind.		Rain, inches.	Clouds.	Notes.
						Force.	Direction.		0—10.	
JAN.	Inches.	Fahr.	Fahr.	Fahr	Fahr.					
29	27·532	56·9°	42·5°	52·°	49·5°	1	E.	...	0	
30	·492	60·0	44·0	56·	50·0	0	N.E.	...	0	
31	·397	66·5	49·5	54·9	47·0	0	E.	...	10	
FEB.										
1	·322	69·5	50·5	56·0	47·5	1	N.W.	...	0	
2	27·137	67·5	43·5	44·2	41·8	1	S.W.	...	7	
3	26·972*	53·1	44·0	48·0	44·2	3	S.W.	·050	7	Rain began at 3.30 P.M; much lightning and thunder.
4	27·247	51·5	44·0	46·1	46·1	3	S.W.	1·775	10	Numbers of the clouds entered from description partly.—(C. P. S.)
5	·362	56·0	45·0	55·8	47·1	3	S.W.	...	0	
6	·472	58·5	49·0	53·2	51·5	0	N.W.	...	5	
7	·422	61·6	50·0	54·9	48·0	0	N.W.	...	10	

* No other case below 27· inches, all through January and February.

SECTION V.—MISCELLANEOUS AND COMMUNICATED MEASURES.

MEASURES OF THE SECOND PYRAMID.

ANGLE of elevation of each side of the casing near the summit of the second Pyramid, measured approximately from below; *i.e.*, with the sextant horizon from the top of the rubbish-mound in the middle of each side, on April 7 and 8 :—

Angle of East face of casing,	. . . . . .	=	52° 57′
,, South ,,	. . . . . .	=	52 52
,, West ,,	. . . . . .	=	52 49
,, North ,,	. . . . . .	=	52 42
	Mean,	=	52° 50′

SARCOPHAGUS OF SECOND PYRAMID.

Situated near the western end of the grand chamber, which is close to the centre of the base of the Pyramid. Length of this chamber runs east and west; roof, angular; walls, of limestone, apparently excavated in rock of hill, and salt-incrusted.

Floor near sarcophagus, is of granite, much broken up (by Mr. Perring, in his search for an under chamber). Sarcophagus of red granite, with its length placed north and south; sunk originally in floor up to level of brim, quite or nearly; measures, excluding at present particular consideration of the grooves for a lid,—thus on March 2 and 14,—

SARCOPHAGUS OF SECOND PYRAMID.

Part observed at		Outside.			Inside.		
		Length.	Breadth.	Height.	Length.	Breadth.	Depth.
General,	=	Inches. 103·5	41·8	38·0	...	...	...
Lowered part of West side, etc.,	=	...	...	36·4	...	...	...
West side,	=	...	...	...	84·6	...	...
East side,	=	...	...	...	84·6	...	...
North end,	=	...	...	...	...	26·7	...
South end,	=	...	...	...	...	26·7	...
North-East corner,	=	...	...	...	...	...	29·4
Part of West side by reason of groove ledge,	=	...	...	...	...	...	27·8

Transverse thickness of West side, all along, . = 7·6 inches.
,, East ,, below ledge, . = 7·6 ,,
,, North end, below ledge, . = 9·3 ,,
,, South end, ,, . = 9·4 ,,

Had once a cover, still to be seen, which fitted on by sliding from the west, like a sliding-lid of a box. The grooves for such a sliding-lid are cut inside the top of the east side, and north and south ends; while the west side is entirely lowered—to the depth of the groove—all across and along its (the west side's) upper surface,—except a small portion at each end, beyond the limits of the side grooves there.

Vertical depth of this groove,	=	1·6	inch.
Horizontal breadth of its base on East side,	=	0·45	,,
Do. on South end, South-east corner,	=	1·1	,,
Do. do. South-west ,,	=	1·7	,,
Do. on North end, North-east ,,	=	1·1	,,
Do. do. North-west ,,	=	1·9	,,

The outer sides of the grooves overhang towards the top and to the centre of the sarcophagus; so that they may be described as being acute-angled or dovetailed, and, as such, would prevent the cover being pulled off upwards. It was further prevented from being pulled off horizontally westward, by having holes in the top of the west side, into which sliding-pins fell out of the bottom of the lid, when this was pushed on into its right place. There are two of these holes only, each about 1 inch broad, circular, and 1 deep, in the middle of the western side as regards breadth, and 6 inches within the inside ends of the interior of the sarcophagus as regards length.

The lid or cover was found lying amongst the broken stones of the floor; it is very thick; the full length and breadth of the whole vessel; and with a portion only of the under side chiselled into shape, to enter the grooves at the top of the sarcophagus sides. The lid measured 103·7 inches long; 42 inches broad; 8·2 inches thick to the cut-out part, to suit ledge or grooves; and 9·8 inches thick elsewhere.

The temperature of the room was found to be thus, by Casella 0 :—

	h. m.		
At	5 0 P.M.	=	75·0° Fahr.
	5 10 ,,	=	74·5 ,,
	5 20 ,,	=	74·6 ,,
	5 30 ,,	=	74·6 ,,

ENTRANCE PASSAGE OF SECOND PYRAMID.

This entrance passage, on the northern face of the second Pyramid, is merely lined with red granite ; or formed of four sets of granite plates thrust into this very rude general masonry. Of these, the plates or blocks forming the roof and floor, are 112 inches broad, and 35 to 50 inches thick ; while the plates forming the walls are much smaller blocks placed in between these large flat ones to keep them apart, and are each 35 inches broad, 47·3 inches high or thick, and 41·7 inches apart the one from the other at their internal faces, to form the breadth of the passage ; which passage is therefore 41·7 inches broad, and 47·3 inches high transversely to the line of the floor.

Or, by a second measure—

		Inches.
Vertical height of said passage,	=	52·3
Height at right angles to incline,	=	47·2 and 47·4
Breadth at top,	=	41·7
,, bottom,	=	41·6
Distance of beginning of roof is south of the North end of basement,	=	70·0
West wall end from ditto,	=	50·0
East wall end from ditto,	=	8·0

The ends of the granite blocks on the east side and below, are not quite clear of the side rubbish.

ANGLE OF INCLINATION OF ENTRANCE PASSAGE OF SECOND PYRAMID.

On April 5, the Playfair altitude-azimuth instrument was erected over basement beginning, or north end of this passage; and a lamp-signal was placed near bottom, or south end of the same, on a heap of rubbish, about 1250 inches from the instrument, measured on the passage's incline.

Before beginning the angular measures, the lamp-signal was examined and found to be sensibly in the centre of the passage, as regards roof and floor, and east and west wall. The Playfair instrument was also found to be correct between the east and west walls of the passage, but somewhat out in height; an error not measured quite so accurately as it ought to have been, but believed to amount very nearly to 0·8-inch too high; or that the horizontal axis of the vertical circle was 27·0 inches vertically above the floor of the passage, and 25·5 inches vertically below the roof produced optically to the instrument's position.

While taking some of these measures near the top of the passage inside, there was an involuntary testimony to the angle of the floor of the passage being greater than the angle of repose for wood resting on granite, with some sand sprinkled on it too,—by the measuring-rod sliding away of its own accord, and not stopping till it had got to the bottom of the whole passage.

DIP OF ENTRANCE PASSAGE, TO THE SOUTH.

Reversals of circle.	Microscope A.	Microscope B.	Angle with index-error.	Mean angle, corrected for index-error, and position of instrument, as below.
Direct, .	26° 25′ 48″	26′ 2″	26° 25′ 55″	26° 30′ 18″
Complement,	63 20 44	21 5	63 20 55	
Direct, .	26 25 38	25 53	26 25 46	26 30 16
Complement,	63 20 38	20 62	63 20 50	
Direct, .	26 25 44	25 61	26 25 53	26 30 18
Complement,	63 20 41	20 62	63 20 52	
			Mean, =	26° 30′ 17″

The corrections applied for the circle being 0·8-inch too high, on a signal 1250 inches distant, being − 2′ 12″.

AZIMUTH OF ENTRANCE PASSAGE OF SECOND PYRAMID.

Set telescope to Solar focus; lamp-signal, then, a disk of 5′ in diameter, but with a bisectible luminous centre. Relevelled.

Time by watch.	Object observed.	Microscope A.	Microscope B.	Mean of azimuthal microscopes.
h. m. s. 5 55 0 P.M.	Lamp-signal, .	57° 39′ 59″	40′ 18″	57° 40′ 9″
,, ,,	Again, reversing,	237 40 27	40 34	237 40 30
,, ,,	Again, reversing,	57 39 57	40 32	57 40 14
6 14 0 ,,	Polaris, near w. elongation,	236 8 34	8 39	236 8 36
6 21 30 ,,	Do., reversing telescope, .	56 8 12	8 42	56 8 27
6 29 7 ,,	Do., reversing telescope, .	236 8 48	8 55	236 8 52
6 36 0 ,,	Lamp-signal, .	237 40 42	40 39	237 40 40

The following being the steps of computation :—

Lamp-signal, according to telescope reversal, . =	57° 40′ 9″ and 57 40 14	or 237° 40′ 30″ 237 40 40
Lamp-signal, Mean places of, . . . =	57° 40′ 12″	and 237° 40′ 35″
Polaris at 7h. 11m. 22s. sid. time,	236° 8′ 36″	......
,, 7 18 52 ,,	......	56° 8′ 27″
,, 7 26 29 ,,	236 8 52	and 360 0 0
Mean, = 7 18 54 sid. time, =	236° 8′ 44″	or 416° 8′ 27″
Add elongation of star West of Pole computed for time as above, . =	+ 1 37 25	+ 1 37 25
Place of Pole, or North end of Meridian, . . =	237° 46′ 9″	and 417° 45′ 52″
But lamp-readings + 180°, ... =	237° 40′ 12″	and 417° 40′ 35″
Therefore difference shows Pole of Pyramid *West* of Pole of sky by =	+ 5′ 57″	and + 5′ 17″
	Mean, = + 5′ 37″.	

CASING-STONE FRAGMENTS, OF SECOND PYRAMID.

This fragment was picked up amongst the rubbish of the western side of the second Pyramid, and contains portions of three worked surfaces, viz., the base, the bevelled outside, and a vertical side-joint.

The angle of the base with the bevelled surface being measured with the reversing caliper apparatus and circle on March 7, 1866, in Edinburgh,—gave 52° 45′; and on May 10, 1866, without looking at the former return, 52° 52′; mean = 52° 48′.

The angle of the base with the upright side-joint surface was found $= 90° 5'$; and the angle of the bevelled surface with the same side-joint was found $= 91° 10'$; the increase of this angle over the other of 90° nearly, being very marked.

PHOTOGRAPHS.

NEGATIVES.

These photographs were all taken with a view solely to procuring aids in scientific inquiry. Hence they were numerous; often rather peculiar, both in their subjects and stations (though the camera was never *tilted*, but on the contrary levelled by spirit-level), and were always on glass plates. The impressions were moreover '*thin*,' photographically,—as rendering them more suitable to copying and enlarging by a copying camera afterwards,—and small in size, for the sake of portability; one-half of them being taken on dry plates about three inches square, with a lens 4·8 inches in focus; and the other half on wet plates, of the unusually small size of 1 inch square,[1] with a lens by Mr. Dallmeyer, of London, 1·8 inches in solar focus. These smaller pictures were the work of an apparatus specially arranged by myself for the occasion, and with a view to

[1] *i.e.*, the impressed pictures were of that size; the glass plates themselves being three inches long and one broad, or the usual-sized slides for microscopes.

securing several practical advantages as detailed in vol. i. chap. xvi. : but though successful in its objects, I do not burden these pages with an account of it, as the apparatus itself was exhibited (for me) by Mr. J. Nicol, and described by him extremely well, before the Edinburgh Photographical Society on May 16th, 1866 ; besides being reported in the *British Journal of Photography* (No. 318) for June 8th, of the same year.

POSITIVES.

From the above-mentioned negatives,—of which there are, large and small, twelve boxes,—I prepared, with a copying camera, after returning home, a considerable number of positive copies. Occasionally, of the whole subject ; but usually some special portion only, of the original negative, was picked out, and magnified to such an extent as to fill the size of glass plate selected for the positives,—and in that way, exhibit sundry features of structural importance or theoretic interest, in a more striking and easily understandable manner than would otherwise have been possible.

On this principle there were first prepared, copies of sixty subjects,—on glass plates 7·75 by 4·25 inches, —with some idea of converting them into book plates : but the expense of so doing was soon found to be vastly beyond my limited means,—however desirable it might be otherwise, for Pyramid literature to receive so large an accession of accurate pictorial representation.[1]

Afterwards a series of copies was commenced on glass plates 6·75 by 3·25 inches,—as being more suitable to optical examination, micrometric measure, and public exhibition by the oxyhydrogen light,—and carried out to the extent of 166 subjects.

Finally, a series has been commenced on glass plates suitable for the stereoscope. Only fourteen subjects of this series have been realized as yet, and it will probably not extend to more than fifty, as only a portion of the original negatives were taken appropriately in duplicate. In preparing these proofs for the stereoscope, a standard was adopted at the beginning, and will be preserved throughout, of keeping the centres of the two pictures forming a stereoscopic pair 2·7 inches apart. With this distance, no prismatic power is required with the lenses of the stereoscope to enable an average pair of eyes to produce combination of the two subjects without strain on the optic nerves; and it has been possible, therefore, to employ, in some special stereoscopes recently manufactured on purpose, simple achromatic lenses, with much greater magnifying power than is usual; and with such an increased

[1] Of the above collection, thirty were lent to Mr. Mather, of the Magnesium Metal Company, to exhibit at his 'stall' at a conversazione of the British Association for the Promotion of Science, at Birmingham, in 1865; so that they have not been altogether useless to the public; and the rest have been chiefly given away to private friends, interested in the subject of the Pyramid.

extent of realization of the mechanics composing the scene photographed, as to induce a regret now, that *every* subject was not taken in a stereoscopic manner.[1]

Still, such as they are, with numerous imperfections on their heads, the collection has been of invaluable service to me,—in keeping up the memory of the scenes; in furthering some examinations which had only been begun when upon the spot; and in commencing others which had not attracted my attention at the time, but yet had had their elements pictured with accuracy, in views which had been photographed for some other very different purpose. This is indeed one of the special uses of photography to a scientific traveller, viz., that it maps down not only what is required and understood, but everything else far and near, whether appreciated or not; but all with equal fulness, sharpness, and accuracy: wherefore all scientific men, and travellers more especially, are indebted indeed to Fox Talbot and Daguerre for this remarkable instrument of help in their investigations,—and which their fathers knew not.

Deriving so much benefit then myself from having these photographs at my hand when writing the present work, and wishing to make others partakers of the same advantage,—I was much disappointed

[1] Six of the above-mentioned stereographs were exhibited in as many stereoscopes at the meeting of the Royal Society, Edinburgh, April 2, 1866, on occasion of a notice of the recent measures at the Great Pyramid being given at the request of the Council.

to find, as already mentioned, that the expense of preparing good and large-sized paper prints from them for publication, was too expensive for me to contemplate. But I have since then lent many of the lantern series for public exhibition by the oxy-hydrogen light; so that audiences of 800 individuals and upwards at a time, have seen them, and have had each of the original 1-inch square pictures magnified so as to cover square screens from 100 to 300 inches long in the side; or nearly to fill the end of a large hall.

In this manner thirty-six different pictures were shown in Manchester by Mr. Mather in November 1865, to his friends interested in the production of magnesium metal; thirty-six by Mr. Joseph Sidebotham in December, to the Photographic Section of the Philosophical Society in the same city; thirty-six at the Royal Scottish Society of Arts in Edinburgh, on April 23, 1866; forty-eight to a popular meeting of the Edinburgh Photographic Society on May 7; eighteen to an ordinary meeting of the same Society on May 16; fifty to a public conversazione in the Museum of Science and Art in Edinburgh in November; fifty during the same month at a public meeting in the City Hall, Glasgow, in aid of Scottish Church extension in Alexandria, in November also; fifty at Stirling in December, and fifty at Alloa in the same month, before local scientific societies; fifty at Montrose, in aid of working men's lectures, on January 5, 1867;

fifty in the City Hall, Glasgow, in aid of the Alexandrian scheme again, on January 11 ; and fifty in the Queen's Rooms of the same city, on January 15 ; while two more exhibitions are promised in Edinburgh in March before the Philosophical Institution.

On all these occasions, excepting only the two first, the pictures were placed in charge of, and exhibited by, Messrs. Nicol and Slight, of the Edinburgh Photographic Society; who performed their part most efficiently.

Nevertheless, as some of the plates, from being exposed so frequently in close proximity to a powerful oxyhydrogen light, are now beginning to show symptoms of 'roasting,'—it may be inexpedient to exhibit them again in public. I close this department, therefore, with a list which—though containing merely the names and described subjects of the plates—may yet allow of an idea being formed touching the accession to the means of obtaining a knowledge of the Pyramids, furnished on this occasion by photography.

GREAT PYRAMID PHOTOGRAPHS—*in six boxes.*

1. Three Pyramids of Jeezeh from Southern uplands.
2. Two greater Pyramids of Jeezeh from Southern uplands, with Fossil Shells in foreground.
3. Fossil Shells in foreground of No. 2, magnified.
4. Fossil Shells in the more immediate foreground of No. 2, magnified.

5. Bird's-eye View of Great Pyramid and its Sepulchral Hill from an eminence Southward.
6. Great Pyramid, and East Tombs Cliff from Eastern Sand-plain.
7. Great Pyramid and Northern Causeway, from the East.
8. Great Pyramid from the East Tombs Cliff.
9. Great Pyramid from the South-east; a Snake-track in foreground.
10. Great and Second Pyramids, from the Sand-plain North-east.
11. Great Pyramid and the Ancient Rubbish-heaps from the Sand-plain to the North-east.
12. Great and Second Pyramids from Sand-plain on the North.
13. Great Pyramid and Monuments from the South-east.
14. Great Pyramid from hills to the North-west.
15. Great Pyramid, old and recent Rubbish-heaps, and distant Egyptian cultivated fields, from the North-west.
16. Ancient Rubbish-heaps North of Great Pyramid, from the North-west.
17. Masonry of Southern and part Western sides of Great Pyramid.
18. Howard Vyse's Hole, in South face of Great Pyramid.
19. North-east corner of Great Pyramid and Hill.
20. Stone Ranges of Great Pyramid at North-east corner.
21. Slickensides marked Rock, below North-east corner of Great Pyramid.
22. Stone Ranges of Great Pyramid at South-west corner.
23. Masonry of North-east corner of Great Pyramid.
24. Masonry of North-east corner of Great Pyramid, from close by.
25. Large Fragment of a Casing-stone discovered by Alee Dobree in side of Northern Rubbish-heap, February 1865.
26. Nummulite Limestone, South-west corner of Great Pyramid.
27. The North Azimuth Trench, on East side of Great Pyramid.
28. The South Azimuth Trench.
29. The North-north-east Azimuth Trench.
30. East-north-east Azimuth Trench, looking outwards, Figures seated.

31. East-north-east Azimuth Trench, looking outwards, Figures standing.
32. East-north-east Azimuth Trench, looking inwards, Figure in shade.
33. East-north-east Azimuth Trench, looking inwards, Figure in sunlight.
34. Upper part of Great Pyramid from East-north-east Azimuth Trench.
35. Heap of Rubbish on Western side of Great Pyramid, rich in fragments of ancient Casing-stones.
36. South-east corner of Great Pyramid, with parts of Second and Third Pyramids.
37. Terminal Socket of Great Pyramid Casing at North-east corner, uncovered April 1865, by Messrs. Aiton and Inglis.
38. Another edition of No. 37.
39. Socket at North-east corner of Great Pyramid, and Stones of Pyramid.
40. Socket at North-west corner of Great Pyramid, with a building stone found accidentally tumbled within it.
41. South-east corner Socket of Great Pyramid.
42. South-west corner Socket of Great Pyramid.
43. Entrance into North face of Great Pyramid : oblique view.
44. Closer view of No. 43.
45. Entrance into Great Pyramid from the North.
46. Closer view of No. 45.
47. Still closer view of No. 45.
48. View on the Pyramid side, representing one flank of general hole leading down to Entrance Passage of Great Pyramid, showing the finer Mokattam stone composing its walls and floor.
49. Closer view of No. 48.
50. Straightness and fineness of the Joints on one side of the Entrance Passage into the Great Pyramid.
51. Mouth of Entrance Passage into Great Pyramid.
52. Stone above roof of Entrance Passage into Great Pyramid.
53. All the Pyramids of Jeezeh from the South-west.
54. Closer view of No. 53.

55. Still closer view of the tops in No. 53.
56. The Granite Coffer in the King's Chamber of Great Pyramid, by magnesium light.
57. Another edition of the same.
58. Do. do.
59. Do. do.
60. Do. do.
61. Upper North-east corner of Coffer, by magnesium light.
62. Broken South-east corner of Coffer, by magnesium light.
63. Fissures locally formed in South-east corner of King's Chamber, Great Pyramid, by magnesium light.
64. Broken Ramp-stone near Well-mouth, in Grand Gallery of Great Pyramid, by magnesium light.
65. Magnesium and Mealed Gunpowder in North end of Grand Gallery, Great Pyramid.
66. Base of Niche in Queen's Chamber of Great Pyramid, by magnesium light.

SECOND PYRAMID PHOTOGRAPHS—*in two boxes.*

1. Bird's-eye View of Second Pyramid from Southern hill-top.
2. Second and Third Pyramids, from the North-east.
3. Second Pyramid from the North.
4. Second Pyramid from the East-north-east.
5. Second Pyramid from the East.
6. Second Pyramid with Clouds.
7. Second Pyramid and Groups.
8. North-west corner of Second Pyramid, and Third Pyramid.
9. View Northward from North-face heap of Second Pyramid.
10. Northern Enclosure of Second Pyramid : Great Pyramid in distance.
11. Figures on North Enclosure of Second Pyramid.
12. True and False Entrances into North side of Second Pyramid.
13. Western Enclosure of Second Pyramid.
14. Hieroglyphics on West Enclosure of Second Pyramid.

15. Close view of Entrance Passage of Second Pyramid.
16. Ruined Blocks near South face of Second Pyramid.
17. Summit-casing of Second Pyramid.

THIRD PYRAMID—*one box.*

1. Third Pyramid with Clouds.
2. Third Pyramid from North-east : White Stone Coffin in foreground.
3. Third Pyramid of Jeezeh, from the South-east. *N.B.*—Sand-ribbings in the foreground.
4. South-east corner and Southern side of Third Pyramid.
5. Fallen Blocks of Granite-casing on Southern side of Third Pyramid.
6. Fallen Blocks of Granite-casing on Western side of Third Pyramid.
7. Granite Casing-stones *in situ* on North side of Third Pyramid.

SPHINX—*one box.*

1. Head of Sphinx and Sand-hills.
2. Head of Sphinx and Figure from East Tombs.
3. Head of Sphinx and Shafre's Tomb.
4. Near view of Sphinx, Third Pyramid in distance.
5. Near view of Sphinx and Sand-hills.
6. Sphinx from the West.

KING SHAFRE'S TOMB—*two boxes.*

1. King Shafre's Tomb, Sphinx, and Great Pyramid, from South-east.
2. King Shafre's Tomb, Sphinx, and Great Pyramid, from South-east, rather nearer than in No. 1.
3. King Shafre's Tomb, and Second Pyramid.
4. Entrance Passage into King Shafre's Tomb, and Temple before Second Pyramid.

5. King Shafre's Tomb, and Third Pyramid.
6. Western Entrance into King Shafre's Tomb, nearly blocked up by running sand.
7. Entrance Passage into King Shafre's Tomb, inside.
8. Interior Colonnade of King Shafre's Tomb, No. 1.
9. Interior Colonnade of King Shafre's Tomb, No. 2.
10. Interior Colonnade of King Shafre's Tomb, No. 3.
11. Interior Colonnade of King Shafre's Tomb, No. 4.
12. Well Room in King Shafre's Tomb.
13. No. 1 of Sepulchral Chamber in King Shafre's Tomb, tested for orientation, by Sun's shadow, four minutes before noon, apparent solar time.
14. No. 2 of Sepulchral Chamber, tested as in No. 13, at noon.
15. No. 3 of Sepulchral Chamber, tested as in No. 14, four minutes after noon.
16. Red Granite and White Arragonite in King Shafre's Tomb.
17. Closer view of No. 16.

TOMBS NEAR THE PYRAMIDS—*three boxes.*

1. East Tombs Cliff from North-east.
2. East Tombs Cliff from Eastern plain.
3. Day-guards' Tent at East Tombs, No. 1.
4. Day-guards' Tent at East Tombs, No. 2.
5. Day-guards' Tent at East Tombs, No. 3.
6. Day-guards' Tent at East Tombs, No. 4.
7. Base of Cliff at East Tombs, No. 1.
8. Base of Cliff at East Tombs, No. 2.
9. Base of Cliff at East Tombs, No. 3.
10. Interior of Tombs revealed, by breaking away of front of Cliff.
11. Tombs in East Face of Pyramid Hill.
12. Hieroglyphics on a Tomb Door-jamb.
13. Tomb Door and Arab at base of Cliff at East Tombs.
14. Group of Arabs at East Tombs.

15. Tombs on East Face of Pyramid Hill.
16. Tomb Entrance on East Face of Pyramid Hill.
17. No. 16 closer.
18. Tomb Mouth with bones, at East Tombs, Pyramid Hill.
19. Part of No. 18 magnified.
20. Part of No. 18, further magnified.
21. Stone-coffin Figure on Pyramid Hill.
22. Discussion over the Stone-coffin Figure on Pyramid Hill.
23. Utterly broken Tombs on Pyramid Hill.
24. Sarcophagus at bottom of Campbell's Tomb, viewed from above.
25. Shadow of Pyramid extending over Egyptian plain.
26. Sunset Shadow of Pyramid.
27. Ruined Tombs and Hills near the Sphinx.
28. Travellers' Road up East Face of Pyramid Hill.
29. Square Sepulchral Well on Pyramid Hill.

PORTRAITS AT THE PYRAMID—*one box.*

1. Mrs. C. P. S. at East Tombs.
2. Ibraheem,—cook, dragoman, and head-servant.
3. Ibraheem, enjoying his *otium cum dig.*, after the service is over.
4. Alee Dobree on Guard at East Tombs, and dreaming of his own house and date-trees.
5. Alee Dobree annoyed that he was not allowed to desert to a party of Travellers one day, and receive baksheesh.
6. Sheikh Abdul Samud of the northern Pyramid village.
7. Smyne, Ibraheem's help, at East Tombs.
8. Alee, the Day-guard at East Tombs.
9. The Lamb presented by Sheikh Murri.
10. Sheikh Murri, of the southern Pyramid village.
11. Arab Group on roof of Sheikh Abdul Samud's house.
12. Madame Abdul Samud and Family.

PYRAMID MOVING FIGURES—*one box.*

1. Village with Figures on the Sands, south of Pyramid Hill.
2. The Cultivated Land of Egypt from the Sand-plain.
3. The principal Pyramid Village, and the Eastern or Mokattam Hills in the distance.
4. The Northern Pyramid Village.
5. Travellers ascending the Hill towards the Great Pyramid, accompanied by Arabs.
6. No. 5 magnified.
7. Hawk on the wing.
8. The Slave-merchant.
9. Line of Camels.
10. Travellers returning from seeing the Pyramid.
11. Distant view of Pyramids of Abooseer, south from Jeezeh.
12. The Last Man.

NUMBER OF LANTERN PHOTOGRAPHS.

Great Pyramid,	66
Second Pyramid,	17
Third Pyramid,	7
Sphinx,	6
King Shafre's Tomb,	17
Tombs near the Pyramids,	29
Portraits at the Pyramids,	12
Pyramid Moving Figures,	12
Total, =	166

PHOTOGRAPHS PREPARED IN DUPLICATE FOR THE STEREOSCOPE.

1. North-east Socket of Great Pyramid, and Corner of Masonry.
2. North-east Socket and its Excavators.
3. North-west Socket of Great Pyramid, and part of Pavement.
4. South-east Socket of Great Pyramid.

5. Upper part of Great Pyramid, viewed from East-north-east Azimuth Trenches.
6. North Azimuth Trench.
7. Outer end of East-north-east Azimuth Trench.
8. Same repeated.
9. Inner end of East-north-east Azimuth Trench.
10. Coffer in King's Chamber, by magnesium light.
11. Upper North-east corner of Coffer, by magnesium light.
12. Upper South-east corner of Coffer, by magnesium light.
13. Lower part of Niche in Queen's Chamber, by magnesium light.
14. Second and Third Pyramids, with South-east corner of Great Pyramid.

Out of about fifty general subjects.

SPECIMENS BROUGHT HOME.

THESE were almost entirely hand-specimens of the rocks; for if some of them were parts of monuments, they were ancient fragments of them only, trampled under foot for ages, and now picked up off the ground merely to illustrate the material; and show what has been brought to the region by man, and what by nature. The series was as follows:—

1. Nummulite Limestones of the Pyramid Hill.
2. Fossils of various kinds, Gypsum, and Sand, from the neighbourhood of the Second Pyramid, Third Pyramid, and Sphinx.
3. Rock of Fossil-shells from the top of the hill to the south of the Pyramid Hill.
4. Fossil-shells, Echini, etc., from hills about three miles farther south.
5. Nineteen fragments of Casing-stones of the Great Pyramid, picked up out of the rubbish at its foot.
6. One ditto of the Second Pyramid.
7. Cakes of Salt from the Horizontal Passage in the Great Pyramid.
8. Salt Incrustations and a piece of stone from a fissure in the West Wall of the Queen's Chamber.
9. Fragments of Diorite picked up on the northern edge of Pyramid Hill.

10. Fragments of Basalt, Granite, and Arragonite picked up at various parts of the Hill.
11. Fragments of Pottery, Glass-beads, etc., in the rubbish outside many Tombs.
12. Jasper-pebbles, Quartz-pebbles (loose and in their matrix rock), together with portions of Petrified Wood from the neighbouring hills of the Libyan Desert.
13. Various Insects of the Region, including a large, brown, round-bodied Beetle from the Interior of the Great Pyramid, pronounced by W. R. M'Nab, Esq., Jun., to be without eyes, and to be 'a species of *heteromera*, apparently new, but not yet sufficiently examined.'

Examples of all the geological specimens, together with sixteen of the casing-stone fragments, have been presented to the Royal Society, Edinburgh, and are deposited in their Museum.

ANALYSIS OF PYRAMID MATERIALS, by WILLIAM WALLACE, Ph.D., Chemical Laboratory, Mechanics' Institution, 38 Bath Street, Glasgow.

THE following particulars are extracted from two letters by Dr. Wallace in 1866, dated February 2 and March 29, respectively,—after receiving some Pyramid specimens from the author.

1. Granite; small fragments picked up here and there about the Pyramid hill; a darker and duller red granite than that of Scotland, but apparently much more durable under an Egyptian climate.

This appears to be a syenitic granite containing very little mica, and therefore less likely to be affected by extreme changes of temperature than such granites, as the Peterhead. I have taken the specific gravity of various specimens for comparison, using pieces of half a pound to one pound.

From Pyramid neighbourhood,	=	2·731
,, Peterhead (red),	=	2·646
,, Ross of Mull (bright red),	=	2·646
,, Summit of Ben Cruachan (red),	=	2·612

2. Basalt, picked up loose on Pyramid hill. Specific gravity of the following specimens:—

Large-grained basalt,	=	2·863
Medium size grained basalt,	=	2·919
Fine-grained basalt,	=	2·785

I have some doubt about the fine-grained specimen being basalt, and I am not quite satisfied that any of them are basalt. The two first of the above specimens contain a mineral which appears to be glassy felspar, and I am somewhat inclined to think they are syenitic.

3. Diorite ? This stone, of which you state the earliest Egyptian statue is made, appears to me to be a hornblendic quartzite. It consists chiefly of quartz (at least the pieces you sent me), but there is some hornblende and also pearl-spar, clearly pointing out, I think, that it is a metamorphic rock, rather than an igneous one. It is extremely hard —having in fact the hardness of quartz,—and I really cannot suggest the probable means by which it was fashioned into a work of art. Specific gravity = 2·755.

4. Gypsum, picked up loose near the third Pyramid. We have here two specimens, one of selenite and the other of fibrous gypsum. These both consist of hydrated sulphate of lime, $CaO, SO_3 + 2\ HO$, very pure.

5. 'Alabaster or arragonite,' from the interior of King Shafre's tomb, and the neighbourhood of the 'temple' on the east of the second Pyramid. Two pieces, one massive, the other crystalline, both consist of *carbonate of lime* without any sulphate (therefore probably arragonite, and decidedly not alabaster). The crystalline specimen is, I think, calc-spar ; it is too soft for arragonite.

6. Mortar. The white mortar referred to in your note does not appear to have been sent. The pink mortar is exactly the same as that I formerly analysed (see *Chemical News* for April 21st, 1865), consisting chiefly of hydrated sulphate of lime, with a little carbonate.

7. Casing-stone fragments picked up in the rubbish around the Great Pyramid.

I have estimated with great care the specific gravity of this—allowing for absorption while in the water, etc., and find it to be 2·0907 ; weight of a cubic foot = 130·3 lbs. This is not lighter than I would expect such a stone to be. It is a limestone, and contains silica and alumina, 8·489 ; carbonate of magnesia, 5·697 ; the remainder, 85·83, being carbonate of lime. It contains also a minute quantity (not estimated) of oxide of iron, which accounts for the brown coating upon the exterior surface of the casing-stones.

(On being struck sharply by a hammer, a fœtid odour, like that of sulphuretted hydrogen, is elicited ; as Dr. Clarke noticed in 1801.—C. P. S.)

8. Stone of the walls of the Queen's chamber with saline incrustations. I selected a piece of this stone containing no visible salt, and found in it 5·90 per cent. of salt, chiefly common salt.

9. Nummulite rock of the Pyramid hill, nearly white.

This is a limestone containing 0·4 per cent. of common salt, and 1·95 per cent. of sulphate of lime, also 0·15 per cent. of carbonate of magnesia; ·20 per cent. of organic matter; 1·00 per cent. of silica, and 2·4 per cent. of alumina, phosphoric acid and oxide of iron. The remainder is carbonate of lime, 93·9 per cent.

The darker coloured nummulite rock contains a little more organic matter and oxide of iron.

10. Rock of hill south of Pyramid hill.

This is also a limestone containing 5·03 sulphate of lime, and 0·23 per cent. of common salt; also 2·58 carbonate of magnesia; 1·2 organic matter; 4·8 silica and clays; the remainder being carbonate of lime, with a little oxide of iron.

11. Rock near second Pyramid, in loose blocks near its foot, with special fossils.

This is also, like the others, a limestone, but contains no common salt—or only the most minute trace, and very little sulphate of lime (0·8 per cent.); silica and clay, 3·40; organic matter, 0·44; oxide of iron, phosphoric acid, and a little alumina dissolved from the clay, 4·4 per cent. The remainder is carbonate of lime, with a little carbonate of magnesia not estimated.

W. W.

PYRAMID MEASURES BY F. AYRTON, Esq.

Angles of inclination of corner lines of Great Pyramid, taken from the top with a theodolite—

North-East angle of Pyramid, 1st observation,	=	41°	19′	20″
,, ,, 2d ,,	=	41	34	40
,, ,, 3d ,,	=	41	11	0
North-West angle ,, ...	=	41	39	40
South-West angle ,, ...	=	41	41	0
South-East angle ,, ...	=	41	40	0
Mean of North-West, South-West, and South-East angles, ...	=	41°	40′	13″
Mean of the six observations, . . .	=	41°	30′	57″
Mean of second observation of North-East angle, and of North-West, South-West, and South-East angles, ...	=	41°	38′	50″

Note to the three observations of the North-east angle.—The disaccordance arises from the great irregularity of the angular projections of the stones at this corner. It is very difficult not only here, but at all the angles, to select those points down the angular line, which may best coincide with the intersections of the general planes of the adjacent sides—themselves hardly planes.

ANGLES OF FACES OF THE GREAT PYRAMID.

North face :	theodolite in the centre on top, .	=	52° 42′ 20″
,,	theodolite in another place on top,	=	51 51 40
,,	theodolite in a third place on top,	=	51 53 0
West face :	in centre of top, ...	=	54 44 20
South face :	,, ...	=	55 58 0
East face :	,, 1st observation,	=	52 38 40
,,	,, 2d ,,	=	54 44 40
,,	,, Mean, . . .	=	53 46 40
	Mean of all the facial observations,	=	53° 31′ 49″

(*F. Ayrton*, in October 1841.)—East face of Pyramid, probably the least worn, in its present state has angle of inclination = 53° 46′ 40″.

(*Howard Vyse*, in 1837.)—Casing-stone angle = 51° 50′ and 51° 52′.

Supposing altitude of Pyramid to have been 11-16ths of base; then angle of elevation at foot would be 53° 58′ 28″;

Or, supposing altitude of Pyramid 2-3ds of base, then angle of elevation at foot would be 53° 7′ 48″;

Or, supposing altitude of Pyramid 5-8ths of base, then angle of elevation of foot would be 51° 20′ 25″;

Or, supposing angle of elevation of foot of Pyramid to have been twice the angle of inclination of the entrance passage, and this to have been the angle given by the incline formed by two horizontal and one vertical, then such foot angle of Pyramid should be 53° 7′ 48″.

Inclination of entrance-passage by Howard Vyse,	=	26° 40′ 18″
Do. observed by F. Ayrton, with a theodolite at top of passage, and a lamp placed at bottom close to subterranean chamber,	=	26 41 0
Do. computed on supposition of being the incline formed by two horizontal and one vertical, ...	=	26 33 54

INCLINATION OF GRAND GALLERY (ASCENDING PASSAGE).

Measured by M. Jomard in 1800, . . .	=	25° 55′ 30″
,, Howard Vyse in 1837, . .	=	26 18 0
,, F. Ayrton in 1841—		
by measurement of a base and perpendicular, . . .	=	25 17 36
by measurement of a hypothenuse and perpendicular, . .	=	25 42 53

The combinations from linear proportions are very curious, particularly the result of double the angle of the sloping passage, derived from two horizontal to one perpendicular equalling the angle of inclination of the face of a Pyramid, whose height is 2-3ds of its base (length of side of base). I am persuaded that this view of the subject deserves consideration.[1] (Signed) F. AYRTON.

CAIRO, *4th January* 1865.

[1] The above is little more than a hastily written memorandum, or short extract, out of a lengthy paper on the subject commenced by its author many years ago, but apparently never completely finished. Yet in as far as it goes, that paper, of which I was kindly allowed a reading, shows so perfect a comprehension of all the methods and details of mathematical mensuration, and such unflinching honesty, that Pyramid literature has lost much from the memoir not having yet been published. Pyramid literature, however, I would suggest, rather than our knowledge of the ancient form of the Pyramid; for the subject having been pursued perhaps too exclusively as a problem of pure science, the author has been led into several errors of conclusion, by applying his measures to decayed and therefore altered parts of the surfaces. Hence his largely erroneous angle of the faces of the Pyramid as measured from the top; and they are self-proved to be erroneous as applied to the whole *face or side*, when the angle of such side is computed from the observed angles at the *corner-lines* of the Pyramid; where the measures, too, are more accordant with each other on account of the greater hardness of the stone there, and the less amount of degradation and disrepair.—C. P. S.

PYRAMID MEASURES BY MESSRS. AITON AND INGLIS.

THESE measures were taken by Mr. Inglis in April and May 1865, at the Great Pyramid, according to instructions from Mr. Aiton, his employer; and they were afterwards drawn out in Mr. Aiton's office in Glasgow, I believe by Mr. Inglis, in form of a series of plans and sections arranged on one long roll of tracing-cloth,—a copy of which was kindly given to me by Mr. Aiton in November of the same year. The measures taken, are mostly entered on the cloth against their respective subjects, and in feet and inches, which are here reduced to inches in the following extracts, from such numerical entries:—

Whole height of Pyramid = 5481 British inches above (as I, C. P. S., suspect) the floor of the north-eastern socket; whence, reduced to the Pyramid pavement, the quantity becomes 5475 British inches.

SPECIAL HYPSOMETRIC DATA.

Names of Subjects.	From level of general alluvial plane.	From Pyramid pavement, assumed.
	British inches.	
Floor of King's Chamber, ...	+ 3360	+ 1714
Floor of horizontal passage, ...	+ 2537	+ 891
Floor of Queen's Chamber, ...	+ 2504	+ 858
Junction of floors of entrance-passage, and of 1st ascending passage, produced, .	+ 1806	+ 160
Floor of North-East socket, ...	+ 1640	− 6
Floor of South-East socket, ...	+ 1627	− 19
Sand plain, variously, ...	+ 246	− 1400
Alluvial plain, ...	0	− 1646
Well-water in alluvial plain, ...	− 120	− 1766

THE FIRST FIFTY COURSES FROM BASE OF PYRAMID, THEIR HEIGHTS IN INCHES.

Number of course from base.	Height in inches at South-west angle of Pyramid.	Height in inches at North-east angle of Pyramid.	Number of course from base.	South-west.	North-east.
1	...	...	26	32	33
2	45	28	27	32	32
3	54	51	28	31	...
4	45	57	29	29	34
5	45	46	30	29	14
6	...	11(+32)?	31	28	58
7	76	33	32	28	29
8	46	40	33	28	...
9	34	39	34	27	57
10	40	41	35	26	28
11	31	34	36	27(+25)?	52
12	32	35	37	24(+26)?	28(+22)?
13	27	38	38	24(+25)?	49
14	32	35	39	41	43
15	30	27	40	25	38
16	28	...	41	...	36
17	29	57	42	49	34
18	28	27	43	46	...
19	31	31	44	32	64
20	39	53	45	31	29
21	...(+37)?	37	46	21	33
22	37	38	47	41	41
23	10	24	48	41	38
24	35	23	49	38	26
25	33	34	50	28	36
Corrected sums,	844	871	26 – 50	834	854
			1 – 50	1678	1725
Mean,	858			1702	

Some of the courses, in the drawing from which the above numbers are derived, are entered in pairs, as the 6th and 7th of the south-western angle, and the united height given at the 7th only. Others I fear are not entered quite correctly, for, on comparing them with my own measures, and with photographs,—it would appear that course 21 of the south-west angle is missed out ; course 6 of the north-east angle, is in large error ; while courses 36, 37, and 38 at the south-west angle, and course 37 at the north-east angle of the Pyramid, have altogether failed to notice (so far as these small figures are concerned, for the drawing itself seems more accurate) the very remarkable and sudden increase which in reality takes place there, in the thickness of the Pyramid courses. Wherefore, correcting for these several errors, as indicated, — we have the heights of the first twenty-five and first fifty courses of the Pyramid, at the south-west and north-east angles, as given at the foot of the columns above.

In the original drawing alluded to, the figures for the heights of all the rest of the courses up to the top of the Pyramid are given,—but as the anomalies seem to increase in ascending, I have not attempted to investigate them further.

KING'S CHAMBER.

The measures by Mr. Inglis of the sizes and numbers of the stones composing the walls and ceiling of this chamber, appear to have been his final and most complete work at the Great Pyramid ; and do him much credit, besides giving a completer account of them than has ever been published before. The following particulars are derived from the numbers entered by him on each stone, in his large and architectural drawing :—

NORTH WALL;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.		First course, or that next floor.	Second course.	Third course.	Fourth course.	Top course, or next ceiling.
		Inches.	Inches.	Inches.	Inches.	Inches.
East wall. .		0·0	0·0	0·0	0·0	0·0
First from East wall,		41·5	122·4*	122·4*	36·0	190·0
Second ,,		61·4	55·4	84·0	54·0	222·0
Third ,,		40·0	53·0	44·0	84·0	..
Fourth ,,		57·5	77·0	61·4	51·0	..
Fifth ,,		63·0	66·0	51·4†	79·0	...
Sixth ,,		49·9	37·9	48·5†	61·9	...
Seventh ,,		42·6	...	...	46·0	..
Eighth, or West side,		55·9	...	...	...	...
Sum, or length of room on North side,	=	411·8	411·7	411·7	411·9	412·0

SOUTH WALL;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.		First course, or that next floor.	Second course.	Third course.	Fourth course.	Top course, or next ceiling.
		Inches.	Inches.	Inches.	Inches.	Inches.
East wall. . .		0·0	0·0	0·0	0·0	0·0
First from East wall,		37·4	79·8	43·0	51·0	60·0
Second ,,		63·0	35·5	55·0	67·0	193·0
Third ,,		37·4	40·0	72·0	45·0	159·0
Fourth ,,		46·1	39·0	120·0	42·0	..
Fifth ,,		47·5	55·6	62·8	72·0	..
Sixth ,,		39·6	47·5	58·1	43·0	...
Seventh ,,		40·0	41·0	..	42·0	...
Eighth ,,		40·1	38·5	...	49·9	...
Ninth ,,		43·0	35·3	...	...	...
Tenth, or West wall,		18·0	...	...	...	..
Sum, or length of room on the South side, . . .	=	412·1	412·0	411·9	411·9	412·0

* The same block of stone here serves or fills up both these courses, making thereby a strong roof to entrance passage.

† These two blocks in my measures are 63·6 and 36·0 inches long.—(C. P. S.)

East Wall;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.	First course, or that next to floor.	Second course.	Third course.	Fourth course.	Top course, or next ceiling.
	Inches.	Inches.	Inches.	Inches.	Inches.
South wall, . .	0·0	0·0	0·0	0·0	0·0
First from South wall,	49·9	78·0	51·0	42·0	205·9
Second ,,	65·0	55·9	69·0*	35·0	...
Third ,,	44·0	72·0	33·0*	48·0	...
Fourth ,,	31·0	...	52·9	37·9	...
Fifth, or North wall,	16·0	...	...	43·0	...
Sum, or breadth of room at East end, =	205·9	205·9	205·9	205·9	205·9

West Wall;

Lengths of stones, from joint to joint, in the several courses.

Number of Joint.	First course, or that next floor.	Second course.	Third course.	Fourth course.	Fifth course.
	Inches.	Inches.	Inches.	Inches.	Inches.
North wall, . .	0·0	0·0	0·0	0·0	0·0
First from North wall,	34·1	49·9	31·9	58·8	205·9
Second ,,	31·9	69·0	58·1	41·0	...
Third ,,	42·0	35·0	67·9	41·0	...
Fourth ,,	61·9	37·0	48·0	65·0	...
Fifth, or South wall,	36·0	15·0	...	...	...
Sum, or breadth of room at West end, =	205·9	205·9	205·9	205·8	205·9

* These blocks appear in my measures as 58·2 and 44·8 inches respectively.—(C. P. S.)

Ceiling.

Formed of stone beams crossing from south to north wall in single lengths.

		Inches.
Breadth at West end, ...	=	205·9
And at East end, ...	=	205·9
Length of mean, ...	=	411·8

The length being thus made up of the breadths of the several beams,—

		Inches.
From West wall to first joint, ...	=	23·0
From first joint to second joint, ...	=	60·0
From second joint to third joint, ...	=	57·0
From third joint to fourth joint, ...	=	45·0
From fourth joint to fifth joint, ...	=	55·0
From fifth joint to sixth joint, ...	=	51·8
From sixth joint to seventh joint, ...	=	53·0
From seventh joint to eighth joint, ...	=	46·0
From eighth joint to ninth joint, ...	=	21·0
Sum, or length of ceiling, ...	=	411·8

Height of the Walls in the King's Chamber, and of the Courses composing them.

Courses.	East wall.		Courses.	West wall.	
	North side of.	South side of.		North side of.	South side of.
	Inches.	Inches.		Inches.	Inches.
First, or floor course,	41·6	41·6	First, or floor course,	40·9	40·9
Second course, .	48·0	48·0	Second course, .	46·1	46·1
Third course, .	46·0	46·8	Third course, .	45·6	45·6
Fourth course, .	48·0	47·2	Fourth course, .	48·0	48·0
Fifth, or top course,	47·0	47·0	Fifth, or top course,	48·0	48·0
Sum, or height of King's Chamber,	230·6	230·6	Sum, or height of King's Chamber,	228·6	228·6

Courses.	North wall.		Courses.	South wall.	
	West end of.	East end of.		West end of.	East end of.
	Inches.	Inches.		Inches.	Inches.
First, or floor course,	41·6	42·0	First, or floor course,	41·4	41·8
Second course, .	47·2	$\frac{94·2}{2}$	Second course, .	46·8	46·0
Third course, .	46·8	$\frac{94·2}{2}$	Third course, .	47·0	48·0
Fourth course, .	48·0	46·8	Fourth course, .	46·6	46·8
Fifth, or top course,	45·5	46·1	Fifth, or top course,	47·4	45·6
Sum, or height of King's Chamber,	229·1	229·1	Sum, or height of King's Chamber,	229·2	228·2

FRENCH MEASURE OF THE GREAT PYRAMID'S HEIGHT, IN 1800 A.D.

THE French *savants* of 1799 appear to have paid special attention to linear measures, particularly those of the Pyramid's height, both trigonometrically and by means of measuring each successive step, with a rectangular measuring-staff appropriately arranged. This latter mode of mensuration was performed firstly by MM. Jomard and Cecile before, and secondly by M. Le Père and Colonel Coutelle after, the discovery of the 'sockets;' hence the measures of the former are deficient at the starting-point, and I have replaced their imperfect idea of the two first courses at the ground in the following table by the same quantity derived from the second pair of observers. This pair seem to have begun their measures, not from the bed or floor of the socket, but from its inner edge, rather more than eight inches above the same, and therefore practically identical with the 'pavement' surface which I have assumed as the datum-plane of Great Pyramid hypsometry.

From the *pavement* then below, the French step-measures extend up to the topmost stones on the summit of the Pyramid; but as these topmost stones consist of two small fragments only of courses, one on the other,—I have thought that M. Nouet the astronomer had more reason in terminating his trigonometrical measures for height, at the 'platform' of the summit. Hence to make the points measured between, similar in all cases, I have cut off the two uppermost registered courses, which are the fragments before alluded to, from both the sets of step-measures,—which then terminate above, also with the *platform*.

This platform is easily recognisable as being about 400 inches long in the sides, and being the 202d course from the pavement upwards. The eminent French authorities indeed mark it the 201st; but then they make only one course of really the two lower ones, without apparently having good reason. They have, for instance, actually entered them in two several portions, as in the column of Le Père and Coutelle, but yet have summed them up together as a single course only,—*because* the upper one is part of the solid and standing rock of the hill, and they imagined that it indicated a high base to have originally extended all round the Pyramid. But Colonel Howard Vyse has since shown that no such high base ever existed; and my own photographs of the north-east corner of the Pyramid show a second higher ledge of the same standing rock further *inside* than the shelf above alluded to ; and in such a position of level with regard to the courses of masonry proper,—some of which are outside it,—as to show that it does not rule their number or heights. In addition to which, other photographs show, by the remains of coarse mortar outside the lower ledge of rock, that there were stones of Pyramid masonry courses outside that also, rendering its service in the structure solely to supply some of the *interior* bulk of building.

Hence there appears abundant reason, from the Pyramid itself, for giving force to the apparent separation which the French philosophers did see, in the whole height of their nominal lowest course ; and for calling it now with certainty, 'two.' Whence also, the height from the pavement below to the platform above,—which in their own immortal work appears as 201 courses,—is represented in the following English edition of the same as 202 courses : though with the same total height.

But while modern photographs lead me to make this correction on the work of those eminent *savants*, they have led me also to bear testimony to the remarkable accuracy of their measures of heights of the courses, for a great extent up the Pyramid's side; and it would be most satisfactory to their *excelsior* spirits, could they behold those apparent anomalies which they chronicled so faithfully at the 36th, 37th, and other courses, completely borne out in one of the recent Nature-painted views of the Pyramid. In fact, their measures of the courses of the Pyramid are extraordinarily good, and stand far before all others which have ever been made, either before or since, my own included : all honour to them therefore. And yet, for practical purposes, it is necessary also to mention that in the pages of their measures in *Antiquités Memoires*, vol. i., there are no less than four errors of a whole metre, or near it, each in Le Père and Coutelle's measures as given in metres ; errors, however, not of theirs in the measures, but of M. Jomard in reducing the old French feet and inches actually employed to metres ; or perhaps they are only printer's errors, except that two of them are repeated in the large engraved section of the Pyramid at Plate XIV. of their largest sized plates (vol. v.) ; and the only published Pyramid section I know of, which has attempted to give pictorially the true height of every course.

The errors alluded to are contained in pages 533 and 534 of *Antiquités Memoires*, vol. i. ; and the corrections required to the figures printed there, are—

Courses as now numbered from the pavement upwards.	
No. 37, . . .	+ 1·0 metres.
,, 101, . . .	− 1·0 ,,
,, 170, . . .	− 0·9 ,,
And 186 and 187 combined, .	+ 1·0 ,,

In my own reductions of Le Père and Coutelle's measures from metres to British inches, I have taken the liberty of dividing the several cases which he gives of only one measure for two small steps,—so that *every* step may be represented by figures; a proceeding which does not alter the whole height, while it makes errors of the above quoted nature easier to detect. At the same time, having only carried such reduction to the nearest inch, at every one of 202 steps, there arises a small difference between M. Jomard's and my summing up; and as he went to many more decimal places than I did, I prefer to take his final sums for the whole height; wherefore these are given at the end of the columns.

Touching the degree of trust to be placed on these measures, it will be interesting to all who respect the name of M. Fourier, to know, that he considered the mode employed,—that is, by the separate observations of 202 steps,—and gave it as his view of the probable error of the final result, as dependent on the error likely to be committed at each step,—that it would be bounded by *the known limit of error of one measure, multiplied by the square root* (*not the simple number*) *of the number of similar operations.*

Whence M. Jomard concludes the limits of error of his own observations dependent on having made each measure to a closeness of '6 lines' only, to be under 8 inches. But Le Père and Coutelle, he thinks, should have smaller limits of error, as they apparently measured to single lines.

If, however, in one place, from two step measures and one trigonometrical measure, the French *savant* thus gives the vertical height from pavement to platform at summit, or 202 courses of the Pyramid

= 5437 British inches,

we should caution our readers that he sometimes cuts off from this, the 72 inches of the first two courses from the ground; but on the erroneous theoretical idea we have already exposed, of the inclined surface of the ancient Pyramid having only begun at that upper level.

FRENCH MEASURES OF GREAT PYRAMID'S VERTICAL HEIGHT.

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.			Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.		Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.
1 }	72?			20			21	21			24		
2 }				52			22	24			24		
3	56			56			23	36			35		
4	43			53			24	32			33		
5	45			41			25	33	(146)	(859)	33	(149)	(877)
6	41			38			26	36			33		
7	39			39			27	24			30		
8	41			42			28	31			28		
9	39			36			29	30			29		
10	36	412	412	41	418	418	30	28	295	1008	29	298	1026
11	33			31			31	27			28		
12	31			35			32	27			31		
13	28			33			33	27			27		
14	29			26			34	24			26		
15	29			28			35	27			26		
16	29			31			36	49			50		
17	26			29			37	42			42		
18	27			28			38	37			37		
19	32			31			39	36			36		
20	37	301	713	38	310	728	40	33	329	1337	33	336	1362

French Measures of Great Pyramid's Vertical Height—*continued.*

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.			No. of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.		Br.in.	Br.in.	Br.in.	Br.in.	Br.in.	Br.in.
41	33			33			81	24			24		
42	30			31			82	24			23		
43	30			28			83	24			23		
44	33			34			84	23			25		
45	42			39			85	28			25		
46	39			38			86	21			22		
47	27			27			87	27			24		
48	35			34			88	22			24		
49	36			37			89	33			26		
50	33	338	1675	33	334	1696	90	22	248	2724	29	245	2746
51	29			27			91	35			29		
52	24			27			92	35			36		
53	26			25			93	33			33		
54	26			25			94	30			29		
55	23			26			95	27			25		
56	25			26			96	26			25		
57	24			25			97	24			24		
58	25			25			98	24			23		
59	27			27			99	41			41		
60	29	258	1933	29	262	1958	100	38	313	3037	39	304	3050
61	28			27			101	35			35		
62	27			27			102	33			34		
63	25			25			103	29			28		
64	26			26			104	29			28		
65	27			26			105	27			27		
66	26			26			106	27			26		
67	24			26			107	26			26		
68	33			33			108	25			27		
69	32			31			109	29			27		
70	30	278	2211	32	279	2237	110	27	287	3324	25	283	3333
71	28			29			111	24			25		
72	27			27			112	24			23		
73	27			27			113	24			23		
74	26			28			114	24			23		
75	31			28			115	23			23		
76	30			27			116	22			24		
77	24			27			117	26			24		
78	24			24			118	23			29		
79	24			23			119	35			29		
80	24	265	2476	24	264	2501	120	33	258	3582	32	255	3588

FRENCH MEASURES OF GREAT PYRAMID'S VERTICAL HEIGHT—*continued.*

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br. in.	Br. in.	Br. in.	Br. in.	Br. in.	Br. in.
121	30			30		
122	29			30		
123	27			26		
124	27			26		
125	24			26		
126	23			23		
127	24			23		
128	24			23		
129	23			23		
130	22	253	3835	24	254	3842
131	26			24		
132	25			24		
133	24			24		
134	22			22		
135	22			22		
136	21			22		
137	24			22		
138	22			22		
139	27			26		
140	26	239	4074	26	234	4076
141	22			22		
142	21			22		
143	22			22		
144	22			22		
145	30			30		
146	23			26		
147	24			23		
148	22			22		
149	21			22		
150	22	229	4303	22	233	4309
151	27			25		
152	25			25		
153	24			23		
154	22			23		
155	21			21		
156	22			21		
157	21			21		
158	21			21		
159	21			21		
160	21	225	4528	21	222	4531
161	21			21		
162	21			22		
163	24			22		
164	23			24		

Number of course from Pavement upwards.	As measured by MM. Jomard and Cecile.			As measured by M. Le Père and Colonel Coutelle.		
	Br. in.	Br. in.	Br. in.	Br. in.	Br. in	Br. in
165	25			24		
166	23			21		
167	21			21		
168	20			21		
169	20			19		
170	20	218	4746	19	214	4745
171	21			20		
172	20			20		
173	21			20		
174	20			20		
175	20			20		
176	21			20		
177	21			20		
178	20			20		
179	21			20		
180	21	206	4952	20	200	4945
181	26			26		
182	24			25		
183	24			24		
184	23			23		
185	22			22		
186	21			21		
187	21			21		
188	20			20		
189	21			20		
190	21	223	5175	20	222	5167
191	20			20		
192	20			20		
193	20			21		
194	21			20		
195	21			20		
196	21			22		
197	23			22		
198	24			23		
199	22			23		
200	22	214	5389	21	212	5379
201	23			23		
202	22	45		22	45	
			5434			5424
Fragmentary.						
203	21			22		
204	21	42		22	44	

Summed up in metres in the French work, and reduced to British inches here—

MM. Jomard and Cecile, .	=	138·30 metres.			
+ Neglected portion at bottom,	=	·77	,,		
– two top fragmentary courses,	=	1·08	,,		
		137·99	,,	=	5433 Br. in.

Le Père and Colonel Coutelle,	=	139·17 metres.			
– two fragments, . . .	=	1·13	,,		
		138·04	,,	=	5435 Br. in.

M. Nouet, astronomer, measures height of 'Platform' at top of Pyramid, and finds it from ground = 137·53 m. = 5415 in.; but his 'ground' is supposed to be 28 inches above the socket-edge or pavement *afterwards* discovered, therefore 5415 + 28 = 5443 British inches.

SOCKETS, DISCOVERY OF.

The discovery by the French *savants* of two, out of the four, corner sockets of the Great Pyramid, was so entirely original with them, and has proved of such infinite importance since in all studies of the Pyramid, either in theory or practice, that the two following extracts chronicling the circumstances may not be considered out of place:—

'In the month Pluviôse, year 9 (January 1801), 'MM. Le Père and Coutelle, in excavating at the 'foot of the Pyramid, towards the two angles of 'the northern side, found an esplanade which is 'the ancient "*sol*" or ground-plot of the monument; 'i.e., of the pedestal, "*socle*," on which it reposes. 'Upon this esplanade, and in front of the apparent 'extremities (of the building) they further dis-'covered two sockets, "*encastrements*," almost 'square, cut in the rock. They recognised that 'these sockets were well on a level, and their 'angles sharp, and perfectly rectangular. It was 'from one angle to the other, and on the outside, 'that they took the measure of the base, and on 'the line which joins them, with a minute atten-'tion, and most exact methods:—finding its length '716 feet 6 inches French, or 232·747 metres,' =9163·45 British inches.—M. JOMARD, *Antiquités Memoires*, p. 513, vol. i.

'While we were occupied with these operations, 'other workmen laboured at the north-east angle 'of this (the Great) Pyramid to discover its true 'base. At two metres and three-quarters, about, of 'distance from the nucleus or of the present base, 'we found the part of the rock in which the stone 'of the angle of the casing had been inlaid "*in-'crustée*." The rock is still perfectly flattened '"*dressé*" and cut out to the depth of 207 milli-'metres, over a space of 3·9 by 3·4 metres.'—M. COUTELLE, *Antiquités Memoires*, p. 46, vol. ii.

ENGRAVINGS.

The great French work on Egypt is very notable for the large number of engravings of atlas size which it contains, touching the Pyramids of Jeezeh, there called usually of Memphis. In execution, these engravings are magnificent, forming examples of the 'line manner,' or true work of the graver, such as the present generation seldom sees. Some faults have however crept in, as thus:—In Plate IX. vol. v. of *Antiquités Planches* of the smaller size of atlas, there is a grand view of the Great and second Pyramids from the north,—with a sun, just below the horizon, radiating from thence magnificently over all the sky,—but in an azimuth which is due *south*, or where the Egypt of our days most assuredly never sees the sun at so low an altitude.

In Plate XIV. of vol. v. of the larger size of atlas, there is a section of the Great Pyramid, very recommendable as the only one known, at least by me, where every course of the masonry has been put in by measure; yet is the interior unfortunately faulty. Thus (1.) the entrance passage *terminates* below, at its junction with the first ascending passage.

(2.) The portcullis of the said first ascending passage has slipped down *into the entrance passage*, thereby blocking it up.

(3.) The well is far from true, being too straight and vertical in its entire; and its entrance hole from Grand Gallery is of a wrong shape; *i.e.*, square and door-like, whereas its top, is really inclined suitably with the ramp-lines, so that it would be concealed were the ramp completed, or the ancient stone, now broken out, put back into its place.

(4.) The floors of the Queen's chamber and horizontal passage are erroneously represented all on one level, *i.e.*, not showing the deep step towards the southern end.

(5.) The Grand Gallery roof is made with distinct inverted steps, but having only *thirty* of them, instead of thirty-six.

(6.) The *south-east* socket of the Pyramid is shown as well as the north-east; but the only other socket which the French *savants* discovered, besides the north-east one, was that at the north-west corner. Since then, viz., in 1865, Messrs. Aiton and Inglis found by excavating that a south-east socket really existed. But, that the French had not seen it, is pretty plain from their having drawn it of the *same* size as the north-east socket, while its meridian length is really only one-third of that.

In another Plate, the faults of not showing the granite leaf of the antechamber to be composed of two pieces, and one of them garnished with a certain projecting portion,—are to be noticed; also, and still more importantly, the total neglect of the *ledge* on the coffer in the King's chamber. But many other features are well given, and with splendid treatment as works of the draughtsman.

HYPSOMETRICAL REFERENCE OF THE GREAT PYRAMID, BY M. JOMARD, IN 'DÉSCRIPTION DE L'ÉGYPTE,' 'ANTIQUITÉS DÉSCRIPTIONS, VOL. II. p. 62.

'Les opérations du nivellement des deux mers, 'l'un des ouvrages les plus importans des ingénieurs 'de l'expédition Française, ont été rattachées, 'd'après une idée très-judicieuse de M. Le Père 'aîné, directeur de ce travail, au sol de la Grande 'Pyramide, qui servira ainsi de repère invariable à 'toutes les observations future sur le niveau des 'crues du Nil, sur l'exhaussement du lit du fleuve 'et celui de la vallée. Ce point de départ est le 'sol de l'encastrement du socle de la Pyramide, à 'l'angle nord-est : il est élevé de 42·88 mètres' (1688 British inches) 'au-dessus de la coudée supé-'rieure du meqyâs ou nilomètre de Roudah : de '42 mètres' (1654 British inches) 'au-dessus de la 'vallée et des hautes eaux moyennes (de 1798 à '1801) ; et de 49·97 mètres' (1967 British inches) 'au-dessus des basses eaux moyennes pour la même 'époque. Ces données précieuses ne doivent pas 'être perdues de vue.'

Compare vol. iii. p. 77 : adding to the numbers above given, six inches, to reduce them from the floor of the north-east socket, to the upper surface of the general pavement surrounding the Great Pyramid. See vol. ii. p. 137.

PYRAMID MEASURES BY COLONEL HOWARD VYSE AND MR. PERRING.

No series of authorities on Pyramid measurement would be complete, without the combined work of the two authors above mentioned. We have indeed been obliged to point out in more than one instance, such as that of the height of the present Pyramid, that their numbers are by no means always so correct as they might be; but we believe them to be perfectly honest, as published by Colonel Howard Vyse, either in his octavo volumes of *Operations carried on at the Pyramids of Jeezeh in* 1837, or his folio atlas of *The Pyramids of Jeezeh*, published soon after; and they furnish besides, the greatest body of measures of different portions of the Pyramid ever collected by any single party, and contain some items with regard to which there are no other authorities. The publication, too, since then, by Chevalier Bunsen, of some of these measures, as unfortunately altered by Mr. Perring to suit a theoretical view of his own, makes a republication of the original numbers important for the credit both of Mr. Perring and Colonel Howard

Vyse, as *measurers;* and their numbers of feet and inches being here reduced to inches only, renders their results more immediately comparable with our own.

WHOLE PYRAMID.

	British inches.
Ancient base-side, length of, ...	= 9168·
Present base-side, ,, ...	= 8952·
Ancient height, vertical, computed by angle 51° 50′, .	= 5769·
Present height, vertical, ...	= 5409·
Ancient height, inclined, ...	= 7332·
Present height, inclined, ...	= 6819·
Angle of casing-stones, between 51° 50′, and 51° 52′ + x seconds.	

ENTRANCE.

Vertical height from base to bottom of entrance, . .	= 588·
Distance of the centre of this entrance eastward from the centre of the Pyramid, ...	= 294·
Breadth of passage, ...	= 41·5
Height of passage, perpendicular to incline, . . .	= 47·0
Angle of this entrance passage, = 26° 41′.	

LENGTH OF ENTRANCE PASSAGE.

From present dilapidated beginning of roof to the junction with first ascending passage, ...	= 758·
Thence to the forced passage, ...	= 214·
Thence to the well, ...	= 2582·
Thence to the subterranean horizontal passage, . .	= 296·
Or, present length inclined, of whole entrance passage, .	= 3850·
But, ancient length must be increased for an extent of more than 276 inches broken away at the beginning with the exterior of the building, and is therefore more nearly, ...	= 4126·

SUBTERRANEAN HORIZONTAL PASSAGE.

Breadth, ...	= 33·
Height, ...	= 36·
Length, ...	= 324·

SUBTERRANEAN CHAMBER.

	British inches.
Cut out of rock of hill *in situ*.	
Length, East to West, ...	= 552·
Breadth, North to South, ...	= 325·
Ceiling flat, floor uneven from the excavation not having been completed: depth from ceiling to deepest part of floor, ...	= 138·
Northern side distant from the central vertical axis of the Pyramid, northwards, ...	= 96·
Eastern side is distant from the same axis eastwards, .	= 311·
Depth of ceiling below base of Pyramid, ...	= 1088·

SUBTERRANEAN PASSAGE TO THE SOUTHWARD.

Length, ...	= 633·
Breadth, ...	= 31·
Height, ...	= 29·

SUBTERRANEAN SHAFT OR HALF-WELL.

This was situated near the eastern end of this chamber, in the deepest part of the floor, so far as excavated; it was described as very rude, evidently unfinished, and about in depth, ...	= 150·

See further particulars of it at the end of the list.

FIRST ASCENDING PASSAGE.

Length, from lower end of granite portcullis blocks to the Grand Gallery, including the space of 177 inches at present occupied by said blocks, ...	= 1492·
Height, perpendicular to incline, ...	= 47·
Breadth, ...	= 41·5
Angle of inclination = 26° 18′.	

GRAND GALLERY, OR SECOND ASCENDING PASSAGE.

Height, vertical, ...	= 336·
Length from North end to step at South end, . . .	= 1810·
Further length from step to passage leading to King's chamber, ...	= 62·
Total length of Grand Gallery, ...	= 1872·
Breadth between ramps, ...	= 41·5

		British inches.
Breadth of each ramp, ...	=	20·5
Height (vertical) of ramp, ...	=	24·

ANTECHAMBER NEIGHBOURHOOD.

Length of passage, horizontal, leading through antechamber, from Grand Gallery into King's Chamber, .	=	265·
Height of said passage, ...	=	44·
Breadth of ditto, ...	=	41·5
Height of portcullis, ...	=	169·

KING'S CHAMBER.

Length from East to West, ...	=	411·
Breadth from North to South, ...	=	205·
Height, floor to ceiling, ...	=	229·
Height from base of Pyramid to floor of chamber, .	=	1665·
Northern side distant from centre of Pyramid to southward, ...	=	195·
Eastern side distant from same eastwards, . . .	=	315·

There is supposed to be a difference of a quarter of an inch in one of the sides of the chamber, which is probably an inflection in the stone.

NORTHERN AND SOUTHERN AIR-CHANNELS.

Inclined height of upper ends from base of Pyramid, .	=	3972·
Distance of lower ends from East side of King's Chamber, westwards, ...	=	97·
Height of same from floor of chamber, ...	=	36·
Dimensions of same, in height, ...	=	6·
,, breadth, ...	=	8·
Length of northern air-channel from King's Chamber to outward part of Pyramid, ...	=	2796·
Dimensions of average section, in height, ...	=	9·5
,, ,, breadth, ...	=	9·
Length of southern air-channel from King's Chamber to outward part of Pyramid, ...	=	2091·
Dimensions of average section, height, ...	=	9·1
,, ,, breadth, ...	=	8·9

The mouth of the southern air-channel has been forced and enlarged; but was probably originally of the same size as the other.

SARCOPHAGUS OR 'COFFER' IN THE KING'S CHAMBER.

		British inches.
Outside of coffer, length,	=	90·5
,, breadth,	=	39·
,, height,	=	41·
Inside of coffer, length,	=	78·
,, breadth,	=	26·5
,, depth,	=	34·5

CHAMBERS OF CONSTRUCTION.

Length of passage leading to Davison's Chamber out of south-east corner of top of Grand Gallery, . . . = 297·

DAVISON'S CHAMBER, DISCOVERED BY MR. DAVISON IN 1764.

Length, East to West,	=	460·
Breadth, North to South,	=	205·
Height, varies between	=	{ 30· 42·

WELLINGTON'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

Length, East to West,	=	462·
Breadth, North to South,	=	204·
Height, varies between	=	{ 26· 44·

NELSON'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

Length, East to West,	=	465·
Breadth, North to South,	=	200·
Height, varies between	=	{ 24· 58·

ARBUTHNOT'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

Length from East to West,	=	448·
Breadth from North to South,	=	196·
Height, varies between	=	{ 16· 53·

CAMPBELL'S CHAMBER, DISCOVERED BY COL. HOWARD VYSE IN 1837.

		British inches.
Length from East to West,	=	454·
Breadth from North to South,	=	246·
Height, in centre of angular roof, varies between	=	70· / 103·
Whole height from floor of King's Chamber to roof of Campbell's Chamber,	=	831·

PASSAGE LEADING TO QUEEN'S CHAMBER.

Length from North end of Grand Gallery to beginning of low passage,	=	199·
Length from the low passage to the step,	=	1104·
Length from step to Queen's Chamber,	=	215·
Total length of this passage from North wall of Grand Gallery,	=	1518·
Breadth of passage,	=	41·5
Height of passage, in 'low' part before the step,	=	46·
,, beyond the 'step,'	=	68·

QUEEN'S CHAMBER.

Length, East to West,	=	225·
Breadth, North to South,	=	204·
Height to commencement of roof,	=	177·
Extreme height to upper angle of roof,	=	243·
Recess in eastern side, width at bottom,	=	61·
,, whole height,	=	183·
,, depth to forced passage,	=	41·
,, width at top,	=	23·5 ?
,, distance of central vertical axis from same feature of East wall of room,	=	26·0 ?
Distance from western side of chamber to centre of Pyramid,	=	90·
Distance from southern side of chamber to centre of Pyramid,	=	34·
Whole height from base of Pyramid to floor of this chamber,	=	808·

WELL; i.e., Upper or Dry Well.

		British inches.
Depth of upper and vertical part of shaft,	=	313·
Thence to grotto,	=	389·
From grotto to bottom,	=	1596·
Total depth,	=	2298·
Square in section, with length of one side,	=	28·
Height of top of natural rock above base of Pyramid,	=	264·

Note.—As the mouth of the well has been forced through the masonry, Mr. Perring supposes it was not part of the original design; but, if the upper inclined passage was filled with solid masonry, it was the only way in which the workmen could go out after they had closed up the passage from the upper end of it.

The platform on the top of the Pyramid is about 396 inches square; above this are four or five stones belonging to the upper layers.

CONCLUDED AREA AND WEIGHT.

		Acres.	roods.	poles.
Former extent of base,	=	13	1	22
Present extent of base,	=	12	3	3

Supposing the natural rock to average 96 inches over the extent of base, and deducting the space occupied by chambers and passages, the original quantity of masonry would be, in cubic feet, = 89,028,000

Or in tons, ... = 6,848,000

And the present quantity, in cubic feet, . . = 82,111,000

And in tons, ... = 6,316,000

The space occupied by chambers and passages being only 56,000 cubic feet, or 1·1590th of the whole mass.

MISCELLANEOUS DETAILS.

		British inches.
Pavement at centre of North front, width,	=	402·
Thickness of its stones,	=	21·
Width of same pavement at excavations near middle of each half of North front,	=	from 132· to 144·
Horizontal distance of outer surface of bevelled casing-stones at foot of North front, from the rectangular masonry behind them,	=	about 108·

MR. PERRING'S ACCOUNT OF THE SHAFT SUNK IN THE SUBTERRANEOUS CHAMBER, DURING THE YEAR 1838.

Base of Great Pyramid above Nile in 1838 A.D.,	=	1647·
Rise of Nile bed in 4000 years, estimated	=	120·
Sum, or base above Nile in 2162 B.C.,	=	1767·

		British inches.
Base of Great Pyramid to ceiling of subterraneous chamber,	=	1088·
Height of said apartment, ...	=	138·
Probable height of any undiscovered chamber below, .	=	120·
		1346·
Balance to former sum, ...	=	421·
		1767·

Shaft in floor of subterraneous room was sunk from that depth, or 1226 inches below base, 432 inches further, or to 1658 inches below base, without meeting anything else than solid and dry rock.

(To have met with *wet* rock, this shaft ought to have been driven fully 120 inches further down, or to 1780 inches below the Pyramid pavement. See Hypsometric table in our vol. iii. p. 82.—C. P. S.)

PYRAMID MEASURES BY MR. E. W. LANE.

The unrivalled accuracy and loving conscientiousness with which the talented Mr. E. W. Lane described 'the Modern Egyptians,' leaves amongst further regrets for his too early death, that his researches among the monuments of ancient Egypt are fewer than they would otherwise probably have been. The only fragments of his labours in this direction, that I am acquainted with, are all of a high order, viz. :—

First, A large view of the Great Pyramid from its north-eastern corner, contained in Colonel Howard Vyse's atlas of the Jeezeh Pyramids.

Second, His arrangement of the ancient Egyptian dynasties and interpretation of the traditions of Osiris, contained in the article 'Egypt,' by his nephew, in the last edition of the *Encyclopædia Britannica*.

And, *third*, some measures of the Great Pyramid which appear in his sister, Mrs. Poole's, *Englishwoman in Egypt*, published between 1842-45.

These measures I have extracted as follows, thinking it only due to his excellence, skill, and general accuracy that he should appear among Great Pyramid authorities; though, had he lived longer, and published the measures himself, he might have revised some few of the numbers first.

GREAT PYRAMID GENERALLY.

	British inches.
Height of Pyramid base above plain, approximately, .	= 1800·
Present height of Pyramid from base to summit, . .	= 5472·
Number of courses of masonry, base to summit, = 203	
Length of side of platform at summit, ...	= 396·
(Do. in time of Pliny (70 A.D.), . . = 170 British inches.)	
(Do. in time of Diodorus Siculus (60 B.C.), = 108 ,,)	
Present length of every or any side of the base, . .	= 8796·

N.B.—A socket 144 inches square, alluded to as being 144 inches *outside* the parts above measured, and showing the ancient size of the Pyramid.

ENTRANCE PASSAGE.

'Over' the sixteenth course from bottom, or high, .	= 600·
Distant eastward of middle vertical plane of North side, more than, ...	= 240·
Angle of dip southward, = 26° 30′.	
Height of, at right angles to incline, ...	= 48·
Width, ...	= 42·
Granite portcullis block, distance of from beginning of roof of entrance passage, ...	= 840·
Almamoon's hole, distant from the same, ...	= 960·

N.B.—This passage, so far, well built, of good Mokattam stone, and with fine joints.

FIRST ASCENDING PASSAGE.

Length of, from South, or upper end of portcullis, .	= 1308·
Add projection of into floor of Grand Gallery, . .	= 18·
Total length from above, to above-mentioned points, .	= 1326·

N.B.—Sides and roofing very rough.

QUEEN'S CHAMBER.

	British inches.
Visible beginning of passage leading to, from projection of floor of first ascending passage, ...	= 183·
Length thence to deeper part, ...	= 1116·
Further length of that deeper part, ...	= 213·
Total length from North wall of Grand Gallery, . .	= 1530·
Height of deeper part, ...	= 67·
Width of same, ...	= 41·
Height of shallower part, ...	= 47·
Width of same, ...	= 41·
Queen's Chamber, length, ...	= 228·
,, breadth, ...	= 204·
,, height to commencement of roof, .	= 162·
,, height to point of roof, . . .	= 246·

GRAND GALLERY.

Height of grand step therein near North end, . .	= 87·
Same, including a small cut-off above, ...	= 95·
Angle of ascent, = 26° 30′.	
Ramps, square in section, length of one side, . .	= 20·5
Width of Grand Gallery above the ramps, . . .	= 82·
Whole length of Grand Gallery, ...	= 1896·
Upper and southern step, horizontal length, to be taken off above, ...	= 61·
,, its height, ...	= 35·

ANTECHAMBER AND PASSAGES.

Horizontal passage from Grand Gallery to antechamber—	
Length, ...	= 53·
Height, ...	= 43·5
Width, ...	= 41·5
Antechamber, length, ...	= 116·
,, breadth near top, nearly	= 83·
Granite leaf, in *two* pieces, each in thickness, . .	= 15·
Horizontal passage, antechamber to King's chamber—	
Length, ...	= 101·
Height, ...	= 43·5
Breadth, ...	= 41·5
Total length, Grand Gallery to King's Chamber, . .	= 270·

KING'S CHAMBER.

		British inches.
Length of, ...	=	412·5
Breadth of, ...	=	206·25
Height of, ...	=	230·25

Number of courses in walls of, = 6 (?)

WELL AND SUBTERRANEAN CHAMBER.

The lower parts of both the well and the entrance passage leading to the subterranean chamber, are characteristically described for their *irregularities.*

GREAVES' STANDARD OF MEASURE.

Professor Greaves of Oxford (A.D. 1638) was so eminently in advance of his age in metrological researches, that much interest has been expressed at various times, and for various purposes, to learn,—if it were possible,—the length of the measuring-rod which he used, in terms of a modern known standard. But the rod itself having been lost,—though the case which once held it, is said to be preserved still in Oxford,—the comparison has not been possible directly; indirectly, however, Greaves' intentional method by successive measures of stated parts of the Great Pyramid, can be brought into use through the agency of our own measures.

His principle he describes in vol. i. of his *Pyramidographia*, by Dr. Birch, page 126; and at page 346, towards the end of his Denarius dissertation, he supplies the following data for his own measures :—

(1.) 'The first and most easterly of the three 'great Pyramids of Egypt hath on the north side a 'square descent; when you are entered a little past 'the mouth of it, there is a joint or line, made by 'the meeting of two smooth and polished stones over 'your head, which are parallel to those under your 'feet; the breadth at that joint or line is 3·463 of 'the English feet;' or × 12 = 41·56 Greaves' inches.

(2.) 'Within the Pyramid, and about the midst 'of it, there is a fair room or chamber, the top of 'which is flat, and covered with nine massy stones; 'in it there stands a hollow tomb of one entire 'marble stone; the length of the south side of this 'room, at the joint or line where the first and 'second rows of stone meet, is 34·380 feet;' or × 12 = 412·56 Greaves' inches.

(3.) 'The breadth of west side of the same room, 'at the joint or line where the first and second row 'of stones meet, is 17·190 feet;' or × 12 = 206·28 Greaves' inches.

(4.) 'The hollow, or inner part of the marble 'tomb near the top, on the west side of it, is in 'length 6·488 feet;' or × 12 = 77·86 Greaves' inches.

(5.) 'The hollow or inner part of the marble 'tomb near the top of it, on the north side, is in 'breadth 2·218 feet;' or × 12 = 26·62 Greaves' inches.

Now the first of these specified places may be identified in our table of heights and breadths of entrance passage, page 36, = 41·50 inches.

The second, or length of the south side of the King's chamber, 42 inches above the floor, is from our measure on the floor of 412·60, reduced for the angular inclination of the walls + 412·56 inches.

The third, or west side of the room, similarly corrected, is 206·26 inches. (See p. 102.)

The fourth, or inside length of the coffer near the top on the west side, = 78·03 inches. (See p. 121.)

And the fifth, or inside breadth of the coffer near the top on the north side, = 26·68 inches.

Hence we have the following double series :—

	Greaves. Inches.		C. Piazzi Smyth. Inches.
(1.)	41·56	=	41·50
(2.)	412·56	=	412·56
(3.)	206·28	=	206·26
(4.)	77·86	=	78·03
(5.)	26·62	=	26·68
Sum, . .	764·88	=	765·03

One would think from the above numbers that four and five had been measured with a different rod from the others either by Professor Greaves or myself; but I am not aware of any error of the sort in my own observations; and the coffer, which they belong to, has always been a puzzling object to passing travellers. There seems, therefore, at present to be no opportunity of doing anything else than taking the sum of each series; and thereupon declaring, that 764·88 of Greaves' inches are equal to 765·03 of the present British imperial inches; or in fact that Greaves' measuring-rod was based on a standard foot much closer to the truth, than most persons have hitherto deemed possible or likely.

LENGTH OF THE CUBIT OF MEMPHIS.

From a comparison of Professor Greaves' measures of various parts of the Great Pyramid, Sir Isaac Newton deduced a value in British inches for the length of the cubit of the ancient city of Memphis, or of ancient Egypt generally; and arrived thereby at a quantity very fairly close to that which has been subsequently determined on perfectly different grounds by later investigators: few of whom, however, appear to expect a precision of more than two or three tenths of an inch.

The method on which Sir Isaac Newton proceeded was based on the assumption,—that if the Great Pyramid was built by Egyptian workmen, there was a probability that even numbers of whole lengths of their favourite linear standard—or the Memphian cubit,—would be employed by them, for practical convenience, in laying off the chief lengths, breadths, and heights throughout the structure.

This principle seems to contain *some* truth, but is not always to be implicitly depended on; for many circumstances connected with either use or art, may require fractional, and very intricate fractional, portions of a cubit to be introduced into some parts of a building, even *because* whole cubits are introduced into another. Further also, if the length of the part measured, be very great, and the difficulties of measurement notable,—as in the side of the base of the entire Pyramid,—the errors of observation may exceed the length of any possible fraction of the cubit; and some number of whole cubits can then be placed by the modern observer with perfect ease, but not propriety, within the limits of his several observations, and claimed as being the length originally intended.

To keep therefore on the safe side, I have confined myself, in a similar inquiry based on my own measures, to interior features of the Pyramid only; and to cases in which, both the whole lengths were small, as of 2, 4, or more cubits,—if cubits existed at all;—and the error of observation was probably under a tenth of an inch.

The final mean of the whole set of determinations obtained in this manner = 20·73 British inches, as the length of the cubit employed by the masons engaged in the Great Pyramid building, or, that of the ancient city of Memphis; and which cubit need not, and actually is not, by any means the same as the cubit typified in the more concealed and symbolized metrological system of the Great Pyramid.

The above length for the Memphis and Great Pyramid cubit comes very near the mean of Sir Isaac Newton's, Sir Gardner Wilkinson's, Mr. Perring's, and other determinations—hitherto considered, = 20·70 inches; but the nearness is accidental only, for our individual results are found anywhere between 20·10 and 21·35 British inches; and some of theirs are almost as wide. The best of them, indeed, are usually between 20·6 and 20·8 British inches; thus a preserved cubit recently found in pulling down a building at Thebes, supposed to date about 1000 B.C., is mentioned by Sir Gardner Wilkinson, as equal to two ordinary cubits, each of 20·65 inches long; and he makes the cubit-marks of the Elephantine Nilometer, dating from the Roman Emperors, = 20·63 inches, but mentions a French determination of the same = 20·73 inches; and likewise notices a stone with 10-14ths of a cubit built into the wall at Elephantine, and part apparently of an older Nilometer, where the cubit was = 21·0 British inches. The cubit of the Nilometer at Cairo is given by the same author at 21·4 English inches, but attributed to no earlier authority than an Arab Caliph about A.D. 860.

The differences amongst our own results are partly due to dilapidation effects, but are partly dependent also on variations introduced by the builders, or actual errors in their work: as when the breadth of the Grand Gallery varies in different parts of its length, irregularly, anywhere between 81·7 and 83·0 inches. Another source of error is more uncertain, as where two parts taken by Sir Isaac Newton and most other writers as certainly intended to be the same in measure, are found to be positively different. An example of this is presented in the breadth and height of the ramps, assumed by Sir Isaac to be equal, but found by my measures to be (on the mean of a number of places, but nowhere very uniformly), nearly an inch different, without a probable uncertainty of more than 1-10th of an inch. (See p. 83.)

All the results are given without exception in the table below; and may probably be held to indicate, that it was no principal object with the architect of the Great Pyramid, to memorialize the exact length of the cubit of Memphis in that manner: while they may further show, that the cubit of Memphis is an entirely different length from, and is never to be confounded with, the cubit of the symbolical Great Pyramid system, and the sacred cubit of the Israelites, which are both = 25·025 British inches nearly.

Parts of the Great Pyramid measured.	Measured length in British inches.	Assumed to contain of cubits of Memphis, the following numbers.	Consequent length of the ancient cubit of Memphis in British inches.
Breadth of entrance passage,	41·5	2	20·75
Breadth of North doorway in Grand Gallery,	42·2	2	21·10
Breadth of Grand Gallery,	81·7 83·0	4	20·43 20·75
Breadth between ramps,	40·8 42·7	2	20·40 21·35
Breadth of South doorway of Grand Gallery,	41·4	2	20·70
Mean breadth of East and West ramps,	20·1	1	20·10
Mean height at right angles to incline of do., do.,	21·0	1	21·00
King's Chamber, length,	412·6	20	20·63
,, breadth,	206·3	10	20·63
,, height,	230·1	11	20·91
Mean,	...	...	20·73

SIR ISAAC NEWTON'S DISSERTATION ON CUBITS.

'A DISSERTATION upon the *Sacred Cubit* of the 'Jews (Hebrews rather, or Israelites) and the '*Cubits* of the several Nations; in which, from 'the Dimensions of the greatest *Egyptian* Pyra-'mid, as taken by Mr. *John Greaves*, the antient 'Cubit of *Memphis* is determined.

'*Translated from the* Latin *of Sir* Isaac Newton, '*not yet published.*' And now extracted from 'MISCELLANEOUS WORKS of Mr. *John Greaves*, 'Professor of Astronomy in the University of '*Oxford*: many of which are now first published. 'Vol. II. Published by THOMAS BIRCH, M.A., 'F.R.S., and Member of the Society of Anti-'quaries, London.—1737.'

'To the description of the Temple belongs the 'knowledge of the *Sacred Cubit*; to the understand-'ing of which, the knowledge of the Cubits of the 'different nations will be conducive.

'The *Roman* and *Greek Cubits*[1] were a Foot and

[1] 'Vitruvius lib. 3. Hero in Isagoge. Hesychius. Suidas in voci-'bus πλέθρον & πους. Columella lib. 5, de Re Rusticâ, qui cubitum 'nominat *semipedem*, quasi *pedis* & *semis*. Vid. & Frontin. de Limit. 'Agrorum; & Isidor. Hispalensem, lib. 15, c. 15. Authors are agreed 'upon these Cubits, amongst whom *Agricola* and Mr. *Greaves* are espe-'cially to be consulted.'

'a half, and, like the *Sacred Cubit*, consisted of six '*Palms*, and twenty four *Digits*. For the *Roman* and '*Greek* Feet contain'd four *Palms*, and sixteen *Digits*. 'The *Roman* Foot was likewise divided into twelve '*Unciæ* or *Pollices*, and was equal to $\frac{967}{1000}$ of the '*English* Foot, as Mr. *Greaves*, who examined dili-'gently the antient monuments in *Italy*, and consi-'der'd the arguments of former writers, as *Philander*, '*Agricola*, *Pætus*, *Villalpandus*, *Snellius*, and others, 'has determined with the greatest accuracy of all 'other authors. The *Roman Cubit* is therefore '$1\frac{4505}{10000}$ of the *English Foot*.

'Of the *Greek Feet*, the *Attic* was most eminent. 'Modern writers represent it as equal to a *Roman* Foot 'and a *Semuncia* of that Foot; because the *Greek* '*Stadium* consisted of six hundred *Greek Feet*; 'and a *Roman Milliare*, or Mile, of a thousand of 'the greater *Roman Passus*, or five thousand Feet; 'and antiently eight *Greek Stadia* were equal to a '*Roman Milliare*. But it is probable, that the 'nearest round numbers were used here; and if we 'say, that the antients sometimes made the *Stadium* 'equal to an hundred and twenty-five *Passus*, that 'proportion might be deduced, not from a compari-'son of the Feet with one another, but from the fore-'going proportion of the *Stadium* to the *Milliare*, 'express'd very near the truth in round numbers. 'This conjecture is confirm'd by reflecting, that '*Polybius*, cited by *Strabo*, receded from this vulgar 'computation, and represented the *Milliare* as equal 'to 8 *Stadia*, and one-third part; by which means 'the *Attic* Foot will be equal to the *Roman*. The 'former computation is favour'd by the *Ptolemaic* 'Foot, which is equal to a *Roman* Foot and a '*Semuncia*, if the latter Foot was deriv'd from the '*Attic*. The latter computation is countenanc'd by 'the Porphyry pillar dug up at *Rome*, with this in-'scription, *ΠΟΔ*· *Θ*. that is, *nine Feet*; for the Foot 'of this pillar, as measured by *Philander*, exceeded 'the *Roman* foot only a ninth part of an *Uncia*. 'This difference shews the Foot not to be *Roman*, 'and the inscription proves it to be the *Greek* Foot. 'But whether it was the *Attic* Foot, let others de-'termine. Till something more certain shall appear, 'we shall assume nothing, but that the *Attic* Foot 'was neither less than the *Roman*, nor greater than 'the *Roman* above a *Semuncia*. This being granted, 'we shall have the magnitude of the *Attic* Cubit to 'pretty great exactness.

'The *Derah*, or *Arabian* Cubit[1] consisted in like 'manner of six *Palms*, and 24 digits; and, in my 'opinion, was very near equal to the *Roman* or *Attic* 'Cubit. For it was a fifth part of the Royal Cubit 'of *Ægypt*; that is, as will immediately be shewn, 'four simple Cubits of *Ægypt*, which are now equal 'to five *Roman* ones.

'Three *Arabian* Miles were likewise equal to the '*Persian Parasanga*, that is, to thirty *Attic Stadia*,

[1] '*Abulfedæ* Geograph. Arab. and *Muhammed Ibn Mesoud*, quoted 'by Mr. *Greaves*.'

'and consisted of 1000 *Orgyiæ*, or *Arabian* Paces, 'that is, 4000 Cubits; by which means the *Arabian* 'Cubit will be equal to the *Attic*. For the wander- 'ing *Arabians* at first serving in war under the '*Romans*, and afterwards founding an empire in '*Syria*, learned from the conquered people the 'money, weights, and measures of the *Romans* and '*Greeks*. We shall pass over this Cubit therefore, 'and proceed to those which are more antient.

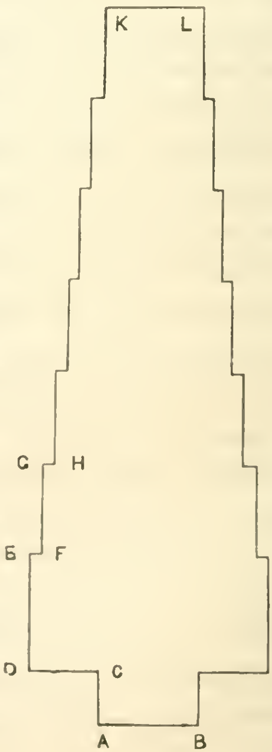
'From the Pyramids of *Ægypt* accurately mea- 'sured by Mr. *John Greaves*, I collect the length of 'the antient *Cubit* of *Memphis* in this manner. 'The side of the first Pyramid was 693 *English* feet. 'It is very probable, that at first the measure of it 'was determined by some round number of *Ægyp- 'tian* Cubits. *Ibn Abd Alhokm*, quoted by Mr. '*Greaves*, tells us, that the measure of each side was 'an 100 Royal Cubits of the antient times. But it 'is probable, that the *Ægyptians* learn'd, from the '*Orgyiæ* of the *Greeks*, their measure of four Cubits 'of *Memphis*, and gave it the name of the *Royal* '*Cubit*. Thus the side of the Pyramid will be 400 'simple Cubits, or four *Arouræ*; and the *Cubit* of '*Memphis* will be equal to $1\frac{732}{1000}$ of the *English* 'Foot.

'That the Pyramid was built by the Cubit of this 'magnitude, appears from several dimensions of it. 'The square passage leading into it of polished 'marble was in breadth and height $3\frac{463}{1000}$ of the '*English* Foot; that is, two of the above-mentioned

‘ *Cubits* of *Memphis.* And of the same breadth and
‘ height were the four other galleries. In the middle
‘ of the Pyramid was a chamber most exquisitely
‘ form'd of polished marble, containing the monu-
‘ ment of the king. The length of this chamber was
‘ $34\frac{38}{100}$ *English* Feet, and the breadth $17\frac{19}{100}$; that
‘ is, it was 20 Cubits long, and 10 Cubits broad, the
‘ Cubit being supposed to be $1\frac{719}{1000}$ of the *English*
‘ Foot. The difference between this measure and
‘ the former is $\frac{125}{10000}$, or one-thirtieth of a Foot,
‘ that is, about one-seventh of an Inch; an error of
‘ no importance, if we consider the much greater
‘ irregularities observ'd by Mr. *Greaves* in the best
‘ buildings of the *Romans.* The roof of this chamber
‘ consisted of nine oblong and parallel stones; the
‘ seven middle ones of which were of the same
‘ breadth, but the two outermost were less by half
‘ in breadth than the rest; and the breadth of them
‘ all together was equal to the length of the chamber,
‘ or to 20 Cubits; so that the length of the middle
‘ stones was two Cubits and an half. The marble
‘ gallery, which led into this chamber, was six feet
‘ and 87 of 100 parts of a foot; that is, 4 Cubits of
‘ the chamber, in breadth. In the middle of this
‘ gallery was a way of polished marble, $3\frac{433}{1000}$ feet;
‘ that is, 2 Cubits broad; and on both sides the
‘ way were two banks, like benches, of polish'd
‘ marble likewise, $1\frac{717}{1000}$ feet broad, and $1\frac{717}{1000}$ feet
‘ deep; that is, in breadth and depth one Cubit.
‘ Who will therefore imagine, that so many dimen-

'sions not at all depending upon each other, should 'correspond by mere chance with the length of the 'Cubit assigned by us?

'Besides, the division of this Cubit into 6 *Palms* 'is evident from the dimensions of the Pyramid. 'For the height of the gallery, according to Mr. '*Greaves*, was about 26 Feet, that is, 15 Cubits. 'Subtract the height of the benches, and the remain-'ing height will be 14 Cubits. This was divided 'into seven parts, according 'to the 7 ranges of the 'stones in the walls of the 'gallery; and every upper 'range projected over the 'lower about three inches, 'as is represented in the 'annexed figure; where *A B* 'expresses the breadth of 'the way, *A C D* the bank 'or bench, *D E* the height 'of the first range of stone, '*E F* the projection of the 'second range, and *F G* the 'height of it; *G H* the pro-'jection of the third range, 'and *H I* the height of it; 'and so on to the roof *K L*, 'which answers to the way '*A B*. The height therefore 'of every range of stone was two Cubits; and the



'6 projections *E F, G H*, &c., answering to one 'Cubit, were *Palmares.*

'There are likewise, in the king's monument 'above-mentioned, specimens of the division of the 'Cubit. For since the Cubit *D C* is $1\frac{717}{1000}$ of a 'Foot, and consequently the *Palm* $\frac{286}{1000}$ of a Foot, 'ten *Palms* will be $2\frac{86}{100}$ Feet; seven *Palms* and 'three Digits will be $2\frac{217}{1000}$ Feet; and twenty-five '*Palms* and two Digits will be $7\frac{293}{1000}$ Feet. Now 'Mr. *Greaves* found the measure of the height of 'the monument within to be $2\frac{860}{1000}$ Feet, the breadth 'within to be $2\frac{218}{1000}$ Feet, and the length of the 'exterior superficies to be 7 Feet, 3 Inches and an 'half; that is, $7\frac{292}{1000}$ Feet. The height of the 'monument within was therefore 10 *Palms*, the 'breadth within 7 *Palms* and 3 Digits, and the 'length of the exterior superficies 25 *Palms* and 2 'Digits, without any sensible error. The height and 'breadth of the exterior superficies was 3 Feet, 3 'Inches and 3 quarters; that is, 11 *Palms* and 2 'Digits and a quarter, if Mr. *Greaves* has been suf-'ficiently exact in setting down the dimensions 'of it.

'There are also other specimens of this Cubit; 'as particularly that the whole length of that gal-'lery, with the hypothenuse of a rectangular triangle, 'whose base was 15 Feet, and height about 5 or 6, 'or perhaps 7 Feet, being measured by a cord, was '154 Feet. Subtract the hypothenuse, and there 'will remain the length of the gallery, 138 Feet;

'that is, 20 times the breadth, or 20 *Royal Cubits.* 'Two other galleries were likewise measured, and 'found to be in length 110 Feet, that is, sixteen '*Royal Cubits;* and another Chamber was in 'breadth about 17 Feet, that is, 10 Cubits; and 'an *Anticameretta,* or *Anticloset,* was in length 7 'Feet, in breadth about 3½ Feet; that is, 4 Cubits 'long, and about 2 Cubits broad. And it is my 'opinion, that the Pyramid was built throughout 'after the measure of this Cubit.

'If any person shall hereafter exhibit in this 'manner the dimensions of the remains of the old 'buildings of the *Babylonians* and other nations, it 'will not be difficult to determine from thence the 'antient Cubits of those countries. In the mean 'time I shall produce one instance, which occurs, as 'a specimen of this calculation. Mr. *Purchas*[1] in-'forms us, that there is still extant between the 'antient *Babylon* and *Bagdad,* a vast rude struc-'ture of brick; the bricks of which his friend Mr. '*Allen* found to be one Foot long, eight Inches 'broad, and six Inches thick; he means Inches of 'the *English* Foot. These proportions shew, that 'the bricks were regularly formed, and consequently, 'that in the making of them regard was had to some 'particular measure used by the *Babylonians,* which 'was of great use, to enable the workmen from the 'number of bricks to determine immediately the 'dimensions of the walls with respect to the length,

[1] 'Pilgrimage, par. 1. lib. I. c. 11.'

'breadth, and thickness, and *vice versâ* to compute 'the number of the bricks necessary to the building 'of the wall agreed upon. As the *Babylonians* 'therefore measured their buildings by Cubits, it 'follows, that the bricks according to their length, 'breadth, and thickness conjunctly must compose 'the measure of the Cubit. Now two bricks according to their length, three according to their breadth, 'and four according to their thickness, form the 'same measure; and consequently the measure is 'that of a Cubit. A *Babylonian* Cubit is therefore 'equal to two *English* Feet; and the component 'parts intimate the division of this Cubit into six '*Palms*, so that the dimensions of the bricks may be 'express'd in round numbers of *Palms;* the length 'by 3 *Palms*, the breadth by 2, and the thickness by '1½. This Cubit may perhaps be determined hereafter with more exactness by a greater variety of 'observations.

'The magnitude of the *Persian Cubit*, I think, 'may be determin'd from their *Parasanga*. For 'it is to be considered, that the greater measures, 'which exceeded the human members, us'd to be 'deduced from the lesser by multiplication, in which 'multiplication the *denary* and sometimes the '*binary* numbers were employ'd. Thus the *Roman*[1] '*Calamus* or *Pertica* consisted of ten Feet; the '*Scrupulum* of ten Feet in length, and ten in

[1] 'Vide Hygin. de Limitib. constituend. & Siculum Flaccum de 'Condit. Agrorum.'

'breadth; the *Versus* of an hundred Feet in length, 'and an hundred in breadth; the *Clima* (a measure 'deriv'd from the *Greeks*, as the name shews) of 'ten *Orgyiæ* in length, and ten in breadth; the '*Actus* of two *Climata* in length, and two in 'breadth; the *Jugerum* of two square *Actus* in 'length; the *Decumanus* of ten *Actus* in length, 'and ten in breadth; the *Centuria* of ten *Decumani* 'in length, and ten in breadth, within *Italy*; but 'without, of twice that number; the *Saltus* of an 'hundred *Decumani* in length, and an hundred in 'breadth; the *Milliare*, or Mile, of a thousand '*Passus* in length; and the *Iter Diei*, or *Day's* '*Journey*, of twice ten *Milliaria*. The *Greek* Reed, 'called *Ἄκαινα*, consisted of ten Feet; the *Clima* 'of ten Feet in length, and ten in breadth; the '*Plethrum* of an hundred Feet in length and breadth; 'the *Stadium* of an hundred *Orgyiæ* in length; and 'the *Iter Diei*, according to *Herodotus*, of two hun-'dred *Stadia*. And in the province of *Cyrene*, in 'the lands which *Ptolemy* a *Greek* king of *Ægypt* 'left to the *Roman* people, the[1] *Plinthides* consisted 'of fifty *Limites* in length, and fifty in breadth; 'and each side of those square *Limites* were ten '*Stadia*.

'It appears also from several instances, that as 'the western nations proceeded from the Foot mul-'tiplied by ten, so the eastern did from the Cubit multiplied in the same manner. Thus among the

[1] 'Hygin. de Limit. constit.'

'*Jews*, a nation us'd to the feeding of cattle, the '*Kibrath Terræ* or pasture-land, sufficient, I think, 'for a flock under one shepherd, was determined by 'the space of a thousand Cubits, and a Sabbath-day's 'Journey by that of two thousand Cubits. And 'thus among the *Ægyptians*, the *Aroura* consisted 'of an hundred Cubits in length, and an hundred in 'breadth. And because the *Ægyptians* every year 'after the inundation of the *Nile* divided their lands 'into *Arouræ*, the Reed ought, for the greater expe- 'dition in measuring, to consist of ten Cubits, that 'by the repetition of ten they might make an '*Aroura*. And for the like reason the greater 'measures, into which those lands were divided, 'ought to consist of tens and hundreds of *Arouræ*.

'The greater measures therefore of the antient 'nations consisted of the round numbers of those 'lesser measures from which they were derived ; and 'consequently the *Schœni* of the *Ægyptians* and 'other eastern nations, and the *Parasangæ* of the '*Persians*, consisted of round numbers of Cubits. 'Now the least *Schœnus* of the *Ægyptians*, by the 'testimony of *Artemidorus* and *Strabo*, was equal 'to thirty *Greek Stadia* ; and the *Parasanga*, by 'the testimony of *Herodotus*, *Xenophon*, *Hesychius*, '*Suidas*, *Agathias*, and others cited by *Strabo*, was 'likewise equal to thirty *Stadia* ; and the round 'number of Cubits, to which so many *Stadia* were 'equal, are ten thousand. That *Schœnus* therefore 'consisted of 10,000 *Cubits* of *Memphis*, and the

'*Parasanga* of as many *Persian* Cubits; and 10,000 'of the Cubits of both kinds were equal to 30 '*Stadia*.

'The calculation of the *Ægyptian* Cubit is con-'firmed by the present Cubit of the *Ægyptians* used 'in the city of *Grand Cairo*, which Mr. *Greaves* 'found to be $1\frac{824}{1000}$ of the *English* Foot. This 'Cubit approaches nearer to the antient Cubit of '*Memphis*, than to the lesser Cubits of the *Greeks*, '*Romans*, and *Arabians* who reigned in *Ægypt*; 'and therefore it seems to be derived from that of '*Memphis*. But it is greater than that. And what 'wonder is it, that a measure should be somewhat 'increased in the space of above 3000 years? The 'measures of Feet and Cubits now far exceed the 'proportion of human members; and yet Mr. '*Greaves* shews from the *Ægyptian* monuments, 'that the human stature was the same above 3000 'years ago, as it is now. The measures therefore 'are increased, the reasons of which may be assigned. 'The instruments, which use to be preserved as 'standards of measures, by contracting rust are in-'creased. Iron beaten by the hammer may insen-'sibly relax in a long space of time. Artificers 'likewise, in making instruments, choose to err in 'the excess of the materials; and when by filing 'they attain any measure, which they think suffi-'cient, they stop, knowing that they can soon cor-'rect that little excess by filing, if their master 'should complain of it; but that they cannot 'remedy a defect. Let us suppose therefore, that 'all measures have increased by degrees, especially 'in the first ages, when less care was taken of 'them; and the Cubit of *Memphis*, about the time 'of the *Roman* Empire, will be a mean between 'the antient and the modern Cubit, but will ap-'proach nearer to the modern. The antient Cubit 'was $1\frac{719}{1000}$ of the *English* Foot, and the modern 'is $1\frac{824}{1000}$ of the *English* Foot. The mean there-'fore between them will be about $1\frac{78}{100}$, or $1\frac{79}{100}$ 'of a Foot. Now 10000 of such mean or middle 'Cubits make, as they ought, about 30 *Attic* '*Stadia*.

'The former calculation of the *Persian* Cubit is 'confirmed by the *Arish*, or modern *Persian* Cubit, 'which (being doubled, as I suppose) Mr. *Greaves* 'found by measuring to be $3\frac{197}{1000}$ of the *English* 'foot. If half of this was the simple Cubit, and it 'increased from the time of the *Greek* and *Roman* 'Empire after the manner of the Cubit of *Memphis*, 'it must antiently have been about $1\frac{57}{100}$ of the *Eng-*'*lish* Foot. *Herodotus* stiles this Cubit, compared 'with the Cubits of the *Greeks* and neighbouring 'nations, the *middling Cubit;* and tells us, that the 'royal *Persian* Cubit was larger than it by 3 Digits. 'If we understand by them, Digits of the middling 'Cubit, which was more known to the *Greeks*, the 'royal Cubit will be to the middling Cubit, as 27 to '24; and since the middling Cubit is $1\frac{57}{100}$ of the '*English* Foot, the royal Cubit will be about $1\frac{676}{1000}\frac{1}{4}$.

'Now 10000 of such Cubits make, as they ought, 'about 30 *Attic Stadia*.

'The preceding computations are likewise con-'firm'd by a certain general reason, by comparing 'the Feet and Cubits used at first in every nation 'according to the proportion of the members of a 'man, from which they were taken. For the Foot 'of a man is to the *Cubit* or lower part of the Arm 'of the same man as about 5 to 9, as I my self have 'measur'd, and any person may easily find by his 'own body. And the oldest Feet, of which any ac-'count has been transmitted to us, are the *Roman*, 'the *Ptolemaic*, and the *Drusian* Foot at *Tongeren* 'in *Germany*, the last of which is equal to $13\frac{1}{2}$ '*Unciæ* of the *Roman* Foot. And to these three 'Feet, according to the proportion of 5 to 9, answer 'the three Cubits, $1\frac{7406}{10000}$, of the *English* Foot, '$1\frac{8056}{10000}$, of the *English* Foot, and $1\frac{9582}{10000}$, of the '*English* Foot; and of about these magnitudes are 'the antient Cubits determined by us above, viz., 'those of *Memphis*, *Babylon*, and *Persia*; to which 'add that of *Samos*, which *Herodotus* represents as 'equal to the Cubit of *Memphis*. The *Greek* and '*Roman* Cubits, which were secondary measures, 'adapted to the measures of the Feet before received, 'ought not to come under consideration here.

'The Cubits of the Eastern Nations, with which 'the *Jews* were surrounded, being determined in 'this manner, we may from hence form a conjecture 'concerning the magnitude of the *Jewish* Cubit.

'The vulgar *Jewish* Cubit ought not to be greater 'than them all, nor the sacred Cubit less than them 'all. The opinion of *Villalpandus* and others there- 'fore is to be rejected, who represent the vulgar 'Cubit as equal to two *Roman* Feet and an half; 'and I think them likewise mistaken, who make the 'sacred Cubit and *Attic* Cubit equal. That the 'sacred Cubit was very large, appears from the '*Jewish Calamus* or Reed, which contained but six 'of these Cubits; and from the antiquity of this 'Cubit, since *Noah* measured the Ark with it. How- 'ever, it is not to be magnified in such a manner, 'that the vulgar Cubit (which in the time of *Moses* 'was called the *Cubit of a man, Deut.* iii. 11.) should 'much exceed the Cubit of a tall man. But we shall 'circumscribe these Cubits in narrower limits in the 'following manner.

'We learn from the *Talmudists* and *Josephus*, 'that the *Jews* used the measure of four sacred *Palms* 'instead of the *Greek* Cubit. The *Greek* Cubit there- 'fore approached nearer to 4 *Jewish Palms* than to '5 or 3; that is, it was less than 4½ *Palms*, and 'greater than 3½. Hence it follows, that the sacred 'Cubit of 6 Palms was less than 2$\frac{4}{7}$ *Attic* Feet, and 'greater than 2 *Attic* Feet.

'The stature of the human body, according to the '*Talmudists*,[1] contains about 3 Cubits from the feet 'to the head; and if the feet be raised, and the arms

[1] 'This proportion is expressly set down in *Mishnaioth*, Tract. de '*Ghaburim*, cap. 4. ה in Comment.'

‘ be lifted up, it will add one Cubit more, and con-
‘ tain 4 Cubits. Now the ordinary stature of men,
‘ when they are bare-foot, is greater than 5 *Roman*
‘ Feet, and less than 6 *Roman* Feet, and may be
‘ best fix'd at 5 Feet and an half. Take the third part
‘ of this, and the vulgar Cubit will be more than 20
‘ *Unciæ*, and less than 24 *Unciæ* of the *Roman* Foot;
‘ and consequently the sacred Cubit will be more than
‘ 24 *Unciæ*, and less than $28\frac{4}{5}$ *Unciæ* of the same Foot.

‘ *Josephus* writes, that the Pillars of the great
‘ court were as large as could be embraced by three
‘ men with their arms join'd. The *Orgyia* or Fathom
‘ of a man is commonly supposed equal to the stature
‘ of the same man, but in reality exceeds it about
‘ one Palm of the *Roman* Foot. The common
‘ people use the nearest round numbers; in this
‘ case the true numbers are to be employed; add
‘ therefore a Palm to the measures of the stature of
‘ a man above express'd, and the sum being tripled,
‘ $15\frac{3}{4}$ *Roman* Feet will be greater, and $18\frac{3}{4}$ less than
‘ the circumference of the pillar.

‘ Now that circumference, according to the *Tal-*
‘ *mudists* and *Josephus*, was, as above, 8 Cubits, at
‘ least in the inner court. Taking therefore about an
‘ eighth part of the preceding numbers, the sacred
‘ Cubit will be greater than two *Roman* Feet, and
‘ less than two and a third. We have taken here
‘ the pillars of both courts, that is, in thickness, tho'
‘ not in height. It is certain, that the pillars of the
‘ inner court were not thicker than those of the outer

'court; and therefore the latter computation must 'necessarily be admitted.

'A Sabbath-day's journey, by the unanimous 'consent of the *Talmudists* and all the *Jews*, was 'two thousand Cubits. Hence the *Chaldee* inter-'preter upon *Ruth* i. 6. says, "We are commanded '"to observe the Sabbath and good days, so as not '"to go above two thousand Cubits." The *Jews* 'describing this journey, instead of Cubits, some-'times substitute Paces. *Erasmus*, in his notes 'upon *Acts* i. 12. writes thus concerning the Sab-'bath-day's Journey: *The Evangelist means the 'space of two thousand Paces. It was not lawful 'for the Jews to travel farther on the Sabbath-day. 'This is asserted by St.* Jerome, *writing to* Algasia, '*in his tenth question,* viz. *that the* Jews *religiously 'observed not to walk on the Sabbath-day above 'two thousand Paces, agreeably to the appointment 'of* Akiba, Simeon [*the Just*] *and* Hillel, *Rabbins, 'whom they use to call our masters.* Thus writes '*Erasmus*, who reads *passus* in St. *Jerome*, and not '*pedes*, as it is corruptly in the printed editions of 'that father. And hence in *Numb.* xxxv. 4. instead 'of *a thousand Cubits*, the *Latin* interpreter substi-'tutes *a thousand Paces.* But we must take care 'not to understand by them the *Roman* or *Greek* 'Paces; for in *Sebbolch Lecheth, Tract.* 22. *cap. de 'Sabbat.* those Paces are thus described: Samuel '*travell'd thro' the valley, and knew not the limit 'of the Sabbath. A Sabbath-day's journey is two* '*thousand middling Paces.* As if he had said, a 'Sabbath-day's journey is a journey of two thou-'sand paces of a man travelling upon a sabbath, 'not with speed, as in the *Roman* Paces, not too 'slowly, but moderately, in the manner of those 'who travel on the sabbath-day. Now men of a 'middling stature, in walking in this manner, go 'every step more than two *Roman* Feet, and less 'than two and a third. And within these limits 'was the sacred Cubit circumscribed.

'The *Talmudists* write, that the height of the 'steps, by which they ascended to the inner 'court, was half a Cubit, and their retractions half 'a Cubit. They mean the sacred Cubit; and we 'see that *Josephus's* computation, with regard to 'the height of these steps, corresponds with them. 'Now *Vitruvius* determines, that the height of 'steps ought not to be more than 10 *Roman Unciæ,* 'and the retractions not less than 18 *Unciæ;* whence, 'since the *Jews* make the height equal to the retrac-'tions, we must suppose that they took a middle pro-'portion, and that the height, as well as the retrac-'tions, made about 12, or at most 13 *Roman Unciæ.* 'The middle proportion between 10 and 18 is about '$13\frac{5}{12}$. And I should be inclined to maintain, that 'this height was not at all exceeded, lest it might 'have been difficult to ascend the steps. The sacred 'Cubit therefore was less than 27 *Roman Unciæ,* but 'not less than 24 *Unciæ,* in order that the retrac-'tions of the steps might not be too much lessen'd.

'The Cubit being thus circumscribed within certain limits, and the erroneous opinions of other 'writers being thus refuted, we may now assign the 'more exact measure of it with greater assurance; 'and this we shall do by the following argument.

'It is agreeable to reason to suppose, that the '*Jews*, when they passed out of *Chaldea*, carried 'with them into *Syria* the Cubit which they had 'received from their ancestors. This is confirmed 'both by the dimensions of *Noah's* ark preserv'd by 'tradition in this Cubit, and by the agreement of 'this Cubit with the two Cubits, which the *Talmudists* say were engrav'd on the sides of the city '*Susan* during the empire of the *Persians*, and that 'one of them exceeded the sacred Cubit half a Digit, 'the other a whole Digit. *Susan* was a city of '*Babylon*, and consequently these Cubits were *Chaldaic*. We may conceive one of them to be the 'Cubit of the royal city *Susan*, the other that of 'the city of *Babylon*. The sacred Cubit therefore 'agreed with the Cubits of divers provinces of '*Babylon* as far as they agreed with each other; 'and the difference was so small, that all of them 'might be derived in different countries from the 'same primitive Cubit, the *Jewish* Cubit being less 'enlarged after sacred things began to be determined by it. This therefore was the proper and 'principal Cubit of the *Jews*. But that people 'afterwards going down into *Ægypt*, and living for 'above two hundred years under the dominion of 'the *Ægyptians*, and endurging an hard service 'under them, especially in building, where the 'measures came daily under consideration; they 'must necessarily learn the *Ægyptian* Cubit. 'Hence came the double Cubit of the *Jews*, viz. 'that of their own country, and the adventitious 'one, which, from its being used upon ordinary occa-'sions only, was esteemed vulgar and profane. This 'hypothesis is confirmed by the proportion of the 'Cubits to each other. For the *Babylonian* Cubit 'of two *English* Feet is to the Cubit of *Memphis* 'of $1\frac{719}{1000}$ of the *English* Foot, as 6 to $5\frac{157}{1000}$, that 'is, as the sacred Cubit to the vulgar Cubit very 'near. The small fraction of $\frac{157}{1000}$ might arise 'from either the difference of the *Babylonian* 'Cubits, or the greater antiquity of the *Babylonian* 'building, than of the pyramid, or the dimension 'of the brick, expressed not in the exact, but the 'nearest round numbers.

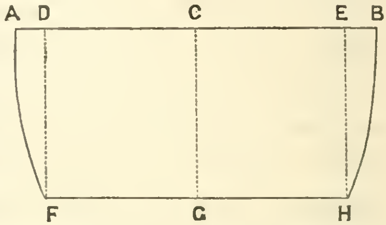
'Suppose the thickness of the brick to be $6\frac{3}{16}$ '*English* inches, the breadth $8\frac{1}{4}$ inches, and the 'length $12\frac{3}{5}$ inches; and a Cubit double that 'length will be to the Cubit of *Memphis* as 6 to 5. 'I am inclined therefore to think, that the Cubit of '*Memphis*, at the time when the *Jews* went down 'into *Ægypt*, was equal to 5 *Palms* of the *Chaldæo*-'*Hebraic* Cubit; and that the *Jews* thus determin-'ing the magnitude of that Cubit by five *Palms* of 'the proper Cubit, the *Palms* of *Memphis* became 'at last neglected, and the double Cubit, with only 'a simple *Palm*, remained among the *Jews*. Besides, 'as it is reasonable to suppose, that the profane and 'adventitious Cubit agreed with the Cubits of the 'nations round about, viz. those of *Memphis*, *Samos*, 'and *Persia;* so it appears from the following argu-'ment, that this Cubit was the same with that of '*Memphis*. The different measures of the Cubit of '*Memphis*, taken from different parts of the Pyra-'mid, were $1\frac{717}{1000}$, $1\frac{719}{1000}$, and $1\frac{732}{1000}$ of the *English* 'Foot. To these measures in the proportion of the 'sacred Cubit to the vulgar *Jewish* Cubit are the 'measures $2\frac{604}{10000}$, $2\frac{628}{10000}$, and $2\frac{784}{10000}$ of the *Eng-'lish* Foot, which in *Unciæ* of the *Roman* Foot are '$25\frac{57}{100}$, $25\frac{60}{100}$, and $25\frac{79}{100}$, and consequently 'fall in the middle of those limits, with which we 'have before circumscribed the sacred Cubit, and 'which were 24 and 27 *Unciæ* of the *Roman* Foot. 'Thus therefore, by means of these limits, those 'measures agree with the sacred Cubit, and conse-'quently the measures of the Cubit of *Memphis* 'agree with the vulgar Cubit. Supposing therefore 'that the *Jews* learned the Cubit of *Memphis* in '*Ægypt*, and that it was their vulgar Cubit, and 'consequently that in the time of *Moses*, and soon 'after, when, as Mr. *Greaves* contends, the Pyramids 'were built, the vulgar Cubit was of the same mag-'nitude with that of *Memphis;* the sacred Cubit in 'those times was not less than $25\frac{57}{100}$, nor greater 'than $25\frac{79}{100}$ *Unciæ* of the *Roman* Foot. Those, 'who shall hereafter examine the Pyramid, by mea-

'suring and comparing together with great accuracy 'more dimensions of the stones in it, will be able to 'determine with greater exactness the true measure 'of the Cubit of *Memphis*, and from thence like-'wise of the sacred Cubit. In the mean time for 'the precise determination of the Cubit of *Memphis*, 'I should choose to pitch upon the length of the 'chamber in the middle of the Pyramid, where the 'king's monument stood, being very large, and built 'with admirable skill; which length was the twen-'tieth part of the length of the whole Pyramid, and 'contained 20 Cubits, and which was very carefully 'measured by Mr. *Greaves*, as he informs us him-'self. And from hence I would infer, that the 'sacred Cubit of *Moses* was equal to 25 *Unciæ* of 'the *Roman* Foot, and $\frac{6}{10}$ of an *Uncia*; or, what is 'equivalent, that it had the same proportion to two '*Roman* Feet as 16 to 15.

'*Mersennus* in his treatise *de Mensuris, Prop.* 1. '*Cor.* 4. writes thus: *I find that the Cubit, (upon 'which a learned* Jewish *writer, which I received 'by the favour of the illustrious* Hugenius, *Knight 'of the order of St. Michael, supposes the dimen-'sions of the temple were formed,) answers to* $23\frac{1}{4}$ '*of our inches, so that it wants* $\frac{3}{4}$ *of an inch of two 'of our Feet, and contains two* Roman *Feet, and 'two Digits and a Grain, which is* $\frac{1}{4}$ *of a Digit.* 'The *Paris* Foot, with which *Mersennus* compared 'this Cubit, is equal to $1\frac{68}{1000}$ of the *English* Foot, 'according to Mr. *Greaves;* and consequently is to 'the *Roman* Foot as 1068 to 967. In the same 'proportion reciprocally are $23\frac{1}{4}$ and $25\frac{68}{100}$. That 'Cubit therefore is equal to $25\frac{68}{100}$ *Unciæ* of the '*Roman* Foot, and consequently falls within the 'middle of the limits $25\frac{57}{100}$ and $25\frac{79}{100}$, with which 'we have just circumscribed the sacred Cubit; so 'that I suspect this Cubit was taken from some 'authentic model preserved in a secret manner from 'the knowledge of the Christians. Lest any person 'should be surprised, that the Cubit, which we have 'concluded to have been in the time of *Moses* '$25\frac{60}{100}$ inches, should not have increased more in 'three thousand years; he may observe, that the '*Palms* used in building at *Rome*, which was 'antiently 9 *Unciæ* of the *Roman* Foot, is now 'equal to $\frac{732}{1000}$ parts of the *English* Foot, that is, '$9\frac{1}{12}$ *Unciæ*, and consequently that in fifteen hun-'dred years it has increased but $\frac{1}{12}$ of an *Uncia*, 'though it was not preserved in a religious manner.

'Some compute the Cubit from *Solomon's* brazen 'sea. Lest any objection should be raised from 'thence, I shall briefly remark, that the bottom of 'that sea ought not to be represented spherical, as 'it generally is, but flat, in such a manner that all 'the water might run out for the use of the priests, 'and the vessel might stand commodiously upon 'the backs of the oxen, and the oxen not hinder 'the priests from coming to the cocks. However I 'would not represent it under a cylindrical figure. 'The following one will be more beautiful. Let

‘ the line *A B*, of ten Cubits, be bisected in *C;* and ‘ taking upon it *A D*, *E B*, of a Cubit each, erect ‘ the perpendiculars ‘ *D F*, *C G*, *E H*, ‘ each of them of ‘ five Cubits, and ‘ with the semiaxes ‘ *A D*, *D F*, and *B E*, ‘ *E H*, describe the quadrants of the ellipses *A F*, ‘ *B H*, and drawing the right line *F H*, the figure ‘ *A F G H B* convolved round the axis *C G*, will ‘ describe the external superficies of the vessel, ‘ whose cavity, if it be an hand-breadth thick, will ‘ contain about (?) thousand baths, supposing that a ‘ bath was equal to twelve *Roman Congii* (as *Agri-* ‘ *cola* and others maintain) and that seven *Congii* ‘ and an half will fill a Cubic *Roman* Foot, as Mr. ‘ *Greaves* found by the *Farnesian Congius.* It is ‘ said likewise, that this sea contained three thou- ‘ sand baths ; whence some affirm, that there were ‘ two kinds of baths. Others understand a dry mea- ‘ sure, whose *Cumulus* equalled half the contents ; ‘ others suspect a various reading ; others imagine, ‘ that the sea contained two thousand baths for daily ‘ use, but, when full, could receive three thousand ‘ baths. I shall not attempt to determine the dispute.



‘ This is what I thought proper to lay down at ‘ present with regard to the magnitude of this Cubit. ‘ Hereafter perhaps those, who shall view the sacred ‘ mount, and the monuments of the *Chaldeans*, by 'taking accurately the various dimensions of the 'stones, bricks, foundations, and walls, and comparing them together, will discover something more 'certain and exact.

'The *Roman* Cubit therefore consists of 18 *Unciæ*, 'and the sacred Cubit of 25$\frac{3}{5}$ *Unciæ* of the *Roman* 'Foot; and consequently those Cubits are to each 'other in round numbers as 2 to 3 very near. And 'this proportion is used by *Josephus*, out of regard 'to the greater expedition in computing the bulk of 'the buildings. For writing to the *Romans*,[1] he 'everywhere puts three *Roman* Cubits for about 'two sacred Cubits, except in some of the most 'eminent dimensions of the temple, properly so 'called, and set down in scripture, in which case he 'thought proper to retain the sacred Cubit. This 'will appear by comparing the Cubits of *Josephus* 'with the sacred Cubits of the *Talmudists*, in the 'following table :—

	Josephus's Cubits.	Sacred Cubit.	*Talmud* Cubits.	*Vulgar* Cubits.
'The height of the wall *Chajil* without,	40	26$\frac{2}{3}$	...	...
'The height of the wall *Chajil* within,	25	16$\frac{2}{3}$	...	...
'Difference answering to the 19 steps,	15	10	...	...
'Height of those 19 steps,	15	10	9$\frac{1}{2}$	...
'Height of the *Septum cancellatum*,	3	2	...	2
'Height of the gates,	30	20	20	...
'Breadth of the gates,	15	10	10	...
'Height of the altar,	15	10	10	...
'Breadth of the altar,	50	33$\frac{1}{2}$	32	...
'Height of the temple within,	60	40	40	...
'Circumference of the pillars,	12	8	8	...

[1] 'Josephus in Prologo Belli Judaici.'

'Thus likewise, where *Josephus* in a round num-
'ber makes the *Exhedras* thirty Cubits, we must
'write twenty sacred Cubits, or more exactly twenty-
'two; and the like reduction is necessary in all the
'other numbers of *Josephus*.'

LETTERS OF THE FREEMASONS.

I.

(1866.)

'Sir,—I have been reading your work on the 'Pyramid,[1] and have been very much amused. 'Had you been a Freemason, or studied the rites 'and ceremonies of the ancient mysteries, you 'would have had no difficulty in understanding 'what the Pyramids were built for. They were 'simply places for initiating the neophytes in—and 'as the mysteries in every country were *funereal*, 'the use of the sarcophagus is easily explained. 'Should you care to investigate this hypothesis—if 'what is certain can be called a hypothesis—you 'may read to advantage the Rev. Dr. Collier's '*History of Initiation*, and Faber's *Mysteries of* '*the Cabiri*, and *Pagan Idolatry*.

'Freemasonry was the original of the "Mysteries." 'A pure society was in existence on the plains of 'Shinar (before the dispersion) in which Divine 'truths were taught by means of symbols. After 'the dispersion the same symbols were used all 'over the world, but the true *interpretation* of 'them was gradually lost; except amongst the

[1] *Our Inheritance in the Great Pyramid.*

'*Essenes.* If you read Josephus's account of that 'sect, you will be greatly entertained, and you will 'find evidence of the fact that they were Free- 'masons. The initiated *easily* understand his 'allusions: the "profane" do not.—I am, yours 'truly,' (Signed) 'OXONIENSIS.'

'*P.S.*—Extract from Greaves (*Pyram.* vol. ii. 'p. 34):—

'"The places of initiation were indifferently a '"*pyramid*, a pagoda, or a labyrinth, furnished '"with vaulted rooms, etc."'

'"Pits or wells were occasionally used in the '"the mysteries."—Faber's *Pagan Idolatry*, vol. iii. 'p. 187, etc. etc.

'The Pyramids, Cave of Elephanta, etc., the 'Round Towers of Ireland (built by pupils of Zoro- 'aster) were all places of initiation.'

II.

'HALIFAX, *Nov.* 21*st*, 1866.

'MY DEAR SIR,—Do you remember my borrow- 'ing a Manual of Freemasonry from you, and being 'greatly surprised at finding certain symbols that 'had attracted my attention previously, and my 'predicting to you that the day would come when 'my studies would throw a new light on the history 'of the Pyramids? I told you when the prediction 'was fulfilled I would remind you of it.

'I forget the correct date, but it was soon after 'you and I left Poplar Grove. Important dis-'coveries have recently been made in Egypt, which 'render our conversation at that time of interest. '—I am, yours truly,

(Signed) 'R. G. HALIBURTON.

'Please write on the other leaf and return this 'with your reply—as I wish to use them both.

'JOHN M'GREGOR, Esq., Halifax.'

(Mr. *Haliburton* is *not* a Freemason.)

III.

'HALIFAX, *Nov.* 21*st*, 1866.

'DEAR SIR,—I have a very distinct recollection 'of my lending you a Manual of Freemasonry, and 'of the conversation to which you refer, which took 'place in 1853.

'My Manual was burned with your library 'January 1st, 1856.

'I am glad to find that your expectations have 'been realized in so singular a manner.—I am, 'yours faithfully,

(Signed) 'JOHN M'GREGOR.

'To R. G. HALIBURTON, Esq.,
'Barrister, Halifax.'

EXTRACTS FROM ETHOLOGICAL RESEARCHES BEARING ON THE YEAR OF THE PLEIADES.

By R. G. Haliburton, F.S.A., F.R.S.N.A., Barrister, of Halifax, Nova Scotia. 1863.

On returning from Egypt in 1865, I (C. P. S.) had much besought Mr. Haliburton to prepare a condensed account of his researches regarding the Pleiades year, for publication in this country: and, as he kindly informed me by letters from time to time,—he both began such a paper, or book, and had nearly completed it, when recent political troubles and commercial excitements interrupted the course of his work. The interruption, we may well hope, is temporary only; but meanwhile he seems to be losing a fitting opportunity for establishing his claims to priority in a very unusual line of research, and one which has been found to have much connexion with the Great Pyramid.

Hence at the last moment for closing this volume, and when I have had to give up all expectation of receiving Mr. Haliburton's new, and special paper in time, I have thought the next best thing to be done, alike for the public, the cause, and himself, would be to publish a considerable section of his privately printed work of 1863, in the following pages.

Such a course will neither represent the whole of his discoveries, nor will it give the full amount of priority of date, to which he may justly lay claim ; for the letters on pp. 368 and 369, will be found to refer to years much earlier than 1863. Nor again will such a course perform the more delicate operation of separating some few of his earlier and cruder notions, which neither himself, nor others might care to uphold now ; but until he himself comes out with something later and fuller,—these extracts may assist in attaching his name to the subject,—and will at least show how much I have been indebted to him, for some of the original ideas, which have been lately recognised to exist in the Pyramid.

Without further apology, therefore, I beg to submit the following portions of what he had written, long before I went to Egypt.

'THE FESTIVAL OF THE DEAD.

' BY R. G. HALIBURTON, F.S.A.

' In European Calendars, the last day of October, ' and the first and second days of November, are ' designated as the festivals of All Halloween, All ' Saints, and All Souls.

' Though they have hitherto never attracted any 'special attention, and have not been supposed to 'have been connected with each other, they originally constituted but one commemoration of three 'days' duration, known among almost all nations 'as "the Festival of the Dead," or the "Feast of '"Ancestors."

'It is now, or was formerly, observed at or near 'the beginning of November by the Peruvians, the 'Hindoos, the Pacific Islanders, the people of the 'Tonga Islands, the Australians, the ancient Persians, the ancient Egyptians, and the northern 'nations of Europe, and continued for three days 'among the Japanese, the Hindoos, the Australians, 'the ancient Romans, and the ancient Egyptians.

'Halloween is known among the Highlanders by 'a name meaning the consolation of the spirits of 'the dead, and is with them, as with the Cinghalese, 'the Pacific Islanders, and almost every race among 'whom the festival is observed, connected with a 'harvest home, or, south of the equator, with a first 'fruits celebration. An old writer asks why do we 'suppose that the spirits of the dead are more abroad 'on Halloween than at any other time of the year? 'and so convinced are the Irish peasantry of the 'fact, that they discreetly prefer remaining at home 'on that ill-omened night. The Halloween torches 'of the Irish, the Halloween bonfires of the Scotch, 'the Coel Coeth fires of the Welsh, and the Tindle 'fires of Cornwall, lighted at Halloween, are clearly 'memorials of a custom found almost everywhere 'at the celebration of the festival of the dead. The 'origin of the lanthorn festival has never yet been 'conjectured. It will be found, I believe, to have 'originated in the wide-spread custom of lighting 'bonfires at this festival.

'The church of De Sens, in France, was endowed 'by its founder in the days of Charlemagne, for the 'purpose of having mass said for the dead, and the 'graveyard visited on All Halloween Wherever 'the Roman Catholic Church exists, solemn mass for '*all souls* is said on the second day of November; 'on that day the gay Parisians, exchanging the 'boulevard for the cemetery, lunch at the graves of 'their relatives, and hold unconsciously their "feast '"of ancestors," on the very same day that savages 'in far distant quarters of the globe observe in a 'similar manner their festival of the dead.

'Even the Church of England, which rejects *All* '*Souls,* as based on a belief in purgatory, and as being 'a creation of Popery, devoutly clings to All Saints, 'which is clearly a relic of primeval heathenism.

'On All Souls day, the English peasant goes '*a-souling*, begging for "a soul cake for all Christen '"souls." He has very little suspicion that he is 'preserving a heathen rite, the meaning of which is 'not to be found in the Book of Common Prayer, 'but (as I shall hereafter show) is to be discovered 'in the sacred books of India, in which country the 'consecrated cake is still offered, as it has been for 'thousands of years in the autumn, to the souls of 'deceased ancestors. But, though the festival of 'the dead is so generally observed in November, 'there are some exceptions. Thus it was observed 'in February by the Greeks, the Romans, the Per- 'sians, and the Algonquins of America, and in 'August by the Japanese and Chinese. The traces 'of its being observed in May are very few, and 'those of its being held at any other times of the 'year are of exceedingly rare occurrence. Before, 'therefore, I can attempt to treat of the festival of 'the dead, or refer to its origin and history, and the 'influence it has exerted on ancient mythology, it 'is necessary to confine this paper simply to ques- 'tions connected with the calendar, and the times 'when the festival is found to be observed. It is 'important to trace the ancient November festival 'to the primeval year, which must have fixed it in 'that month among races south, as well as north of 'the equator. This year, I believe I have succeeded 'in discovering; and, as it appears to have ori- 'ginated in, or at least only now exists in, the 'southern hemisphere, I have designated it as 'the Primitive Southern year. It is also necessary 'to show that the festival of the dead, occurring in 'February or August, indicates a change having 'taken place, and a more recent year, commencing 'in February, having been substituted. As we only 'find this year north of the equator (so far as I have 'been able to learn), I have designated it as the 'Primitive Northern year.

'Wherever the festival occurs in November, it is, 'or at least originally was, the new year's festival 'of the primitive southern year. Where it is held 'in February, it is, or once was, the commemoration of the commencement of the northern year.

'As the mode of investigation pursued on this 'point materially adds to the credibility of my con-'clusions, I may be pardoned for referring to it.

'The startling fact that "this feast was cele-'"brated among the ancient Peruvians at the same '"period, and on the same day that Christians '"solemnize the commemoration of the dead (2d '"November)," at once drew my attention to the 'question, *how was this uniformity in the time of 'observance preserved, not only in far distant 'quarters of the globe, but also through that vast 'lapse of time since the Peruvian, and the Indo-'European first inherited this primeval festival 'from a common source?*

'It was plain that this singular uniformity could 'never have been preserved by means of the defec-'tive solar year in vogue among ancient nations. 'How then could this result have been produced? 'It was apparent that the festival must have been 'regulated by some visible sign, or mark, that 'nature had supplied, such as the rising of some 'constellation.

'Remembering the ancient traditions as to the 'Pleiades, I naturally turned my attention to them. 'Professor How kindly offered to ascertain from an 'excellent astronomer whether the Pleiades could 'have ever risen in November in Asia or Europe. I 'was fortunately, however, able to save that gentle-'man the calculation. On turning to Bailly's *Astronomie Indienne,* I found him state that the most 'ancient year, as regulated by the calendar of the 'Brahmins of Tirvalore, began in November, and I 'was much gratified at finding that, in that calendar, 'the month of November is called Cartiguey, *i.e.*, 'the month of the Pleiades,—a circumstance which, 'M. Bailly says, would seem to indicate that that 'constellation by its rising or setting in that month, 'must have regulated the commencement of the 'ancient year in November.

'But here a fresh difficulty arose as respects the 'calendar. To suppose that the Pleiades rose in 'that month, and commenced the year in the autumn, 'was not only opposed to ancient traditions respect-'ing them, and to their name as the Stars of Spring '(*Vergiliæ*), but also to their actual movements, at 'the present day at least.

'We could not assume that great astronomical 'changes could ever have produced this result. How 'then could we account for the anomaly? I dis-'covered the clue in extending my researches to the 'southern hemisphere, where I found the festival 'of the dead to occur in November, and to be the 'vernal new year's festival of a year commencing 'in November, and regulated by the rising of the 'Pleiades *in the evening.*

'Before concluding this prefatory paper, it may 'be as well to state that the whole subject, both as 'regards the primitive new year festival of the 'dead and the primitive year, has altogether 'escaped the observation of the learned. De 'Rougemont, in his *Peuple Primitif*, published at 'Paris in 1856, has, out of three volumes, not de-'voted as many pages to "Les Fêtes des Morts," 'though they are unquestionably the most remark-'able memorials we possess of *Le peuple Primitif*. 'Festivals connected with the seasons, he says, can-'not now be investigated, from our ignorance of the 'primitive calendar; and he therefore only selects 'those that took place at the time of the vernal 'equinox and the summer solstice, *i.e.*, associated 'with a solar year, and hence of a comparatively 'recent date, and subsequent to those of the two 'primitive calendars to which I have referred.

'The primitive year of two seasons, commencing 'in November, and the connexion of the Pleiades 'with the primeval calendar, are not even referred 'to in the latest work on the astronomy of the 'ancients, published last year in Paris. Though 'very many remarkable facts in the history of the 'calendar and of our race, to which the study of the 'festival of the dead has afforded me a clue, are 'referred to by Greswell in his learned works on 'the Calendars of the Ancients, he has attempted to 'explain them by resorting to the miracles in the 'Bible—as to the sun having stood still or gone 'back on certain occasions—events which he con-'tends must not only have disturbed, but have even 'left their impress on the calendars of the ancients. 'But they are, I believe, capable of a more common-'place solution.

'THE FESTIVAL OF THE DEAD BROUGHT TO EUROPE 'AND ASIA BY A MIGRATION OF RACES FROM THE 'SOUTHERN HEMISPHERE.

' " Who can restrain the sweet influences of the ' " Pleiades ?" we are asked in the book of Job, the 'most ancient production of sacred or profane 'literature. " The lights in the firmaments of the ' " heavens," " for signs and for seasons, and for days, ' "and for years," are supposed to have reference to 'that constellation, as well as to the sun and moon, 'for in early ages neither the sun nor the moon 'could have indicated the length of the year, or its 'division into seasons. The extreme veneration of 'remote antiquity for the Pleiades, or *Ver*giliæ, for 'having marked the seasons, and the beginning of 'spring, are amongst the most venerable traditions 'of our race, and are now only realized among 'Australian savages, who still worship the Pleiades 'as announcing spring, " and as being very good to ' " the blacks ;" and at their culmination hold a 'great new year's corroboree in November, in 'honour of the *Mormodellick*, as they call that time-

'honoured constellation. The name given to these 'stars by the Romans, *Vergiliæ*, is plainly con-'nected with the strange tradition of Northern 'natives, of the Pleiades having marked the com-'mencement of spring. They are popularly known, 'from France to India, by the same name—a cir-'cumstance which proves, says M. Bailly, that our 'first knowledge of these stars was derived from 'the most ancient nations of Asia.

'The question naturally suggests itself, Whence 'arose this veneration for a constellation, that 'among us, at least, is no longer reverenced? 'When and where can they have marked the begin-'ning of spring, and what were those "sweet in-'"fluences," referred to in the book of Job, and still 'celebrated by Australian savages?

'So far from rising in Europe or Asia in the 'spring, they first appear in June, a summer month. 'How could the *Ver*giliæ, then, have acquired their 'name, as the stars of spring? It is plain that 'they could not have marked a vernal commence-'ment of the year, *as the most ancient year com-'menced in the autumn*, and among most ancient 'nations we find traces of a traditionary or civil 'year commencing in the autumn.

'We also find traces of a very singular year of 'six months, the very existence of which Sir Corne-'wall Lewis has somewhat hastily questioned. '"These abnormal years," he tells us, "are desig-'"nated by Censorinus as involved in the darkness '"of remote antiquity." Dupuis suggests that we 'must turn to the Pleiades, as well as to other con-'stellations, to account for these "abnormal years," 'as well as for the ancient year commencing in the 'autumn,—"pour expliquer les fictions relatives à '"ce commencement d'année, soit chez les Juifs, soit '"chez les autres peuples, qui ont eu le commence-'"ment d'année en automne. Tels étaient ceux qui '"avaient des années de six mois." In confirma-'tion of this conjecture, I have found that in the 'Arabian calendar of lunar mansions, which is made 'up of two divisions, one belonging to summer, and 'the other to winter,—one of the mansions is 'designated by the name of the Pleiades. Let us 'see if this suggestion will prove equally correct 'respecting the autumnal year; and let us endea-'vour to find in that constellation a clue to the re-'markable circumstance of the festival of the dead 'having been observed in Hindostan, Peru, Ceylon, 'Egypt, and Europe, in November.

'I may here state that the classical nations of 'antiquity, with whom the influence of the Pleiades 'was rather a matter of tradition than of practical 'use, when they spoke of the rising of the Pleiades, 'referred to the heliacal rising of the constellation 'in the morning, *i.e.*, the time, when at dawn, the 'stars were first visible—

"The grey dawn and the Pleiades
Shedding sweet influence."

'This took place in the middle of May, 2000 'years ago, and marked the beginning of summer 'in the south of Europe and Asia. But we must 'conclude either that the Pleiades must have once, 'in some other manner than by their heliacal 'rising, indicated the beginning of spring, or else 'that there must have been, by a long lapse of 'years, a change in their movements, that rendered 'their rising inconsistent with their very name as 'the stars of spring. It must, however, have been 'nearly 5000 years since the heliacal rising of the 'Pleiades occurred at the beginning of April, and 'even then it could not have indicated the com-'mencement of seed-time in the south of Asia and 'of Europe, or marked the beginning of spring. 'Their name, the *Hesperides*, too, would seem to 'connect them with the evening rather than the 'morning. But if, at such a remote era, the Plei-'ades regulated the seasons by their heliacal rising 'at that time of the year, they must have left their 'impress on primitive calendars, and traces of the 'connexion of the calendar with the heliacal rising 'of the Pleiades, would still be found among many 'races, either in their names for March or April, or 'at least in their traditions as to the time when 'their year once commenced. But this is not the 'case. There are no traces of a primitive year in 'general use in remote antiquity, commencing in 'March, April, or May; the only apparent exception 'being the solar year, regulated by the vernal equi-'nox, which was of comparatively recent invention.

'But on examining the calendars of ancient 'races, we find in Persia, India, Egypt, and Peru, 'that the month in which our first of November 'festival would fall, bears in its very name a singu- 'lar impress of its former connexion, either with 'the Pleiades or the festival of the dead.

'In the most ancient calendar in India, the year 'commenced in the month of November, which 'bears the name of Cartiguey, *i.e.*, the Pleiades; a 'constellation which, Bailly suggests, must by its 'rising or setting at that time, once have regulated 'the primitive year. We find also that, in the 'month of October the Hindoos, like ourselves, have 'three days which are connected with the festival 'of the dead.

'In the ancient Egyptian calendar the same re- 'semblance can be traced between the name of the 'Pleiades, which among the Hebrews and Chaldeans 'is Athor-aye, with that of the Egyptian month of 'November, which is Athor. The Arab name for 'the Pleiades, Atauria, also suggests a resemblance.

'In November took place the primeval festival of 'the dead, clad in a veil of Egyptian mythology. 'In the Isia, the solemn mourning for the god Osiris, '"the Lord of Tombs," lasted for *three* days, and 'began at sunset, like the Lemuria of the Romans, 'and the festival of the dead among the Persians 'and other nations.

'The singular custom of counting the day from 'the sunset of the preceding day, or the nocti-

'diurnal system, was so universal, that Greswell 'refers to it as a conclusive proof of the unity of 'origin of our race. The Bible tells us "the even- '"ing and the morning were the first day." Our 'words "fortnight" and "se'nnight," are traces of 'this primitive custom. But the first day of our 'festival of the dead, is a still stronger illustration, 'as it is called Hallow*eve*. The origin of this custom 'has not been explained by Greswell. Volmer 'connects it with the word *Athor*, which means '"the night;" and which he therefore supposes re-'presented the first evening of creation. But the 'most important night, not only in that month, but 'in the whole Egyptian year, was that of the 17th 'of Athyr, when the three days of mourning for 'Osiris (*i.e.*, the festival of the dead) began with an '*All Halloweve*. Hence the origin of this wide-'spread noctidiurnal system is to be found in what-'ever caused the festival of the dead to commence 'at sunset, or with a Hallow*een*.

'Let us turn to the primitive races of the south-'ern hemisphere to find a solution:—

'1*st*, For the festival of the dead being connected 'with an agricultural celebration. 2*d*, For its being 'held in November. 3*d*, For its commencing with 'a Halloweve. 4*th*, For the primitive year com-'mencing in November. 5*th*, For the Pleiades 'being connected with that month. 6*th*, For their 'being reverenced as the *Vergiliæ* and Hesperides, 'the stars of the spring and the evening. 7*th*, For

'the "abnormal year" of six months, found north
'of the equator.

'We find that, among these southern races, when
'the Pleiades are in the evening first visible at the
'horizon, which is at the beginning of November,
'they mark the beginning of the year, and the
'vernal new year's festival, a feast consecrated to
'first fruits, and to the dead. As long as at evening
'they continue visible, they mark a season called
'*the Pleiades above.* When they cease to be visible
'in the evening, the second season commences of
'*the Pleiades below:* these seasons nearly equally
'dividing the year. Hence we can understand
'why tradition has connected the Pleiades with
'November, as the first month of the year, has pre-
'served their name as the stars of the evening and
'of the spring, and has caused the festival of the
'dead to commence in the evening, or with a Hal-
'loween. We can also understand how the year of
'six months arose, that has so puzzled astronomers.

'In the voluminous report on the Aborigines, by
'a Committee of the Legislative Council of Victoria,
'Session 1858-9, we find W. Hull, Esquire, J.P.,
'a gentleman who has written a work on the Ab-
'origines, stating "their grand corroborees are held
'"only in the spring, when the Pleiades are gene-
'"rally most distinct; and their corroboree is a
'"worship of the Pleiades as a constellation, which
'"*announces spring.* Their monthly corroboree is
'"in honour of the moon" (p. 9).

'In another place Mr. Hull says, "Referring again ' "to their worship of the stars, I may mention that ' "one night I showed Robert Cunningham the ' "Pleiades, and he said 'they were the children of ' "'the moon, and very good to the black fellows,' ' "—a remark that recalls to our mind 'the sweet ' "'influences of the Pleiades.'"

'C. J. Tyers, Esq., Commissioner of Crown Lands, 'Alberton (p. 79), says in confirmation of the fore- 'going,—"Regarding their religious practices very ' "little is known, so little that Europeans generally ' "believe them to be devoid of any. Yet they do, ' "according to their manner, worship the hosts ' "of heaven, and believe particular constellations ' "rule natural causes. For such they have names; ' "and *sing and dance to gain the favour of the* ' "*Pleiades* (Mormodellick), the constellation wor- ' "shipped by one body as the giver of rain." Now 'the Pleiades are most distinct at the beginning of 'the spring month of November, when they appear 'at the horizon in the evening, and are visible all 'night. Hence their vernal festival of the Pleiades 'takes place in honour of the Vergiliæ, the stars of 'spring, at the beginning of November, the very 'month called in the calendar of the Brahmins of 'Tirvalore, the month of the Pleiades, and among 'the ancient Egyptians connected with the name of 'that constellation.

'But we are told by another gentleman examined 'by the committee, that all the corroborees of the 'natives are connected with a worship of the dead, 'and *last three days.* If this be the case, is it not 'somewhat startling to find that Australian savages, 'at or near the time of Halloween, All Saints, and 'All Souls, also consecrate three days to the 'memory of the dead, as a vernal new year's cele-'bration, regulated by the time-honoured Pleiades, '—and, like the northern festival of the dead, be-'ginning in the evening, or with a Halloween?

'In the Tonga Islands, which belong to the Fee-'jee group, the festival of Inachi, a vernal first 'fruits celebration, and also a commemoration of 'the dead, takes place towards the end of October, 'and commences at sunset.

'"The Society Islanders," Ellis tells us, "divided '"the year into two seasons of the Pleiades or '"Matarii. The first they called the *Matarii i nia,* '"or the *Pleiades above.* It commenced when, in '"the evening these stars appeared at or near the '"horizon" (*i.e.*, at or near the beginning of No-'vember), and the half-year during which, imme-'diately after sunset, they were seen above the 'horizon, was called *Matarii i nia.* The other 'seasons commenced when at sunset these stars are 'invisible, and continued until at that hour they 'appeared again above the horizon. This season 'was called *Matarii i raro, i.e.*, "*the Pleiades* '"*below.*" The Pleiades are visible at the horizon 'in the evenings at the beginning of November. 'They then culminate near midnight, and are 'visible till morning. Ellis says that this year 'began in May; but it is evident that what he calls 'the first season, "the Pleiades above," commenced 'at or near the beginning of November, and the 'second division must have begun towards the end 'of April, or early in May. If they appear at the 'horizon in the evening, on the 5th November, they 'continue visible at that time till the 24th April fol-'lowing. But, not only was the month of November 'connected with the rising of the Pleiades, but also 'with a festival of the dead, and a first fruits cele-'bration, as among the people of the Tonga Islands.

'"The most singular of their stated festivals was '"the ripening or completing of the year. Vast '"numbers of both sexes attended it; the women, '"however, were not allowed to enter the sacred '"enclosure. A sumptuous banquet was then held. '"The ceremony was viewed as a *national acknow-* '"*ledgment to the gods.* When the prayers were '"finished, and the banquet ended, a usage prevailed '"*resembling much the Popish custom of mass for* '"*souls in purgatory.* Each one returned to his '"home or family marae, there to offer special prayers '"for the spirits of departed relatives." Ellis does 'not tell us to what mode of dividing the year he 'refers (for they appear to have had three); but, as 'the feast of Alo Alo in the Tonga Islands, as well 'as the festival of the Pleiades in Australia, took 'place in November, we may assume that this was 'the new year's festival of the season of the Pleiades.

'Let us turn from the Islands of the Pacific to 'Peru, and there we find the primitive calendar 'of two seasons marked by a new year's festival of 'the dead, occurring in November, and celebrated 'at precisely the same time as in Europe and 'Polynesia.

'The month in which it occurs, says Rivero, "is '"called Aya-marca, from *Aya*, a corpse, and '"*marca*, carrying in arms, because they celebrated '"the solemn festival of the dead, with tears, lugu- '"brious songs, and plaintive music; and it was '"customary to visit the tombs of relations, and to '"leave in them food and drink. *It is worthy of* '"*remark that the feast was celebrated among the* '"*ancient Peruvians at the same period, and on* '"*the same day, that Christians solemnize the com-* '"*memoration of the dead* (2d November)."

'Finding the festival held at the beginning of 'November, I felt convinced that it never could 'have been fixed in that month by a solar year, 'such as was in use in Peru, but that it must have 'been originally the new year's festival of the year 'or seasons of the Pleiades, that must have once 'been in use in that country. Subsequent investi- 'gations bore out the conclusion.

'Rivero tells us that in November took place the 'termination of the year and of seed-time. Garci- 'lasso bears distinct testimony to the existence of a 'traditionary year of seasons.

'"Yet, for all this sottish stupidity, the Incas '"had observed that the sun accomplished its '"course in the space of a year, which they called '"*huata;* though the commonalty *divided it only* '"*by its seasons,* reckoning their year to end or be '"finished with their harvest" (*i.e.,* in May).

'Here we have the year ending with the months 'of November and May, a plain proof that the 'Southern year of the Pleiades ending in November 'and May, must have existed there before the Incas 'invented or introduced the solar year, and must 'have been the seasons referred to by Garcilasso. 'As the festival of the dead is, however, the new 'year's festival of the year of the Pleiades, we may 'assume that it must have, in Peru, originally 'marked the commencement of the year at the 'beginning of November. Wherever the festival of 'the dead occurs in November, even among nations 'now far north of the equator, the same inference 'may, I believe, be adduced. The race by whom it 'is preserved must have once regulated that festival 'in November, by the rising of the Pleiades, like 'the Australians.

'In Persia, we find a singular light thrown on the 'calendar by the festival of agriculture and of death 'celebrated south of the equator. In the ancient 'calendar, November was consecrated to the angel 'who presided over agriculture and death. We have 'seen that the month in which this festival occurred 'in Peru, was called "the month of carrying corpses." 'The month of November was formerly called in

'Persia Mordad, the month of the angel of death. 'In spite of the calendar having been changed, the 'festival of the dead took place at the same time as 'in Peru, as a new year's festival (although the year 'no longer commenced then). It is called by some 'writers the *Nouruz of the Magi*, because the Magi 'still adhered to the primitive new year's festival. 'It commenced in the evening with a Halloween, 'which was regarded as peculiarly sacred. Unde 'hujus diei *Vespera* quibusdam Persarum, peculiari 'nomine signatur Phristâph. Bonfires are lighted 'at this festival as they are in Britain, and in most 'portions of the globe, at this season of the year.

'In Ceylon, Sir Emerson Tennent says, a festival 'is held that is a species of a harvest home and a 'commemoration of the dead. It must, however, be 'rather a first fruits celebration, like that of nations 'south of the equator, as the harvest is over in May 'or June. This festival of agriculture and of death 'takes place at the beginning of November.

'We now turn to Mexico, and there we find that 'the great festival of the Mexican cycle was held on 'the 17th of November, and was regulated by the 'Pleiades. It began at sunset; and *at midnight* as 'that constellation approached the *zenith*, a human 'victim, Prescott says, was offered up to avert the 'dread calamity which they believed impended over 'the human race. This belief was so remarkable 'that I cannot omit a reference to it here. They 'had a tradition that at that time the world had 'been previously destroyed; and they dreaded lest 'a similar catastrophe would, at the end of a cycle, 'annihilate the human race.

'Now it is most remarkable to find that the Egyp-'tians, with their Isia, or new year's festival of agri-'culture, and of the dead, that took place on the '17th day of November, associated traditions as to 'the deluge, and it is still more surprising to find 'that the 17th day of November is the very day on 'which, the Bible tells us, the deluge took place.[1]

'Greswell has devoted several chapters, and much 'learning, to the 17th day of November (Athor), to 'show how remarkable a landmark it has always 'been, through a long lapse of centuries, for the cor-'rections of the Egyptian calendar, and he derives 'from it some curious arguments in support of his 'views. De Rougemont and other writers have

[1] 'While the above was going through the press, as I was convinced 'that the memory of the deluge had been thus preserved among the 'Hebrews, Egyptians, Greeks, and Mexicans, in the traditions con-'nected with the new year's festival, and that the date of the com-'mencement of the deluge, the 17th day of the first month, of the 'primitive year, was not of an historical but of an astronomical 'character, I most closely examined the Mosaical account of the 'deluge, and found my conjecture singularly verified. The deluge 'commenced on the 17th of the second month of the Jewish year (*i.e.*, 'November); the ark rested on Mount Ararat on the 17th day of the '7th month; and the dove returned with the olive branch on the 17th 'day of the 11th month. Though the connexion of this with the 'traditions and calendars of heathen races is somewhat startling, I am 'convinced that should the study of *Ethology* afford a clue to the 'primeval origin of pagan idolatry, it will at the same time conclu-'sively prove how entirely different and distinct must have been the 'source from which the Hebrews derived the great truths and princi-'ples of our religion.'

'referred to this day, but have thrown no light upon 'it. They seem, however, not to have observed that 'even among the Persians the same day was pecu-'liarly venerated. Hyde says that in the ancient 'Persian calendar the 17th day of November was 'held so sacred, that all favours asked of rulers were 'granted on that day; but why it was so venerated 'he does not attempt to conjecture. Even tradition 'has been unable to preserve the history of this day; 'that must be sought for in the very earliest ages 'of the world, or among the rudest existing types of 'man. In the mysteries of Isis, the goddess of 'agriculture and of death, the funereal part of the 'ceremonies, the lamentations and search for Osiris 'commenced on the 17th and ended on the 19th. 'There was also a Julian year of the Egyptians, 'which commenced, Greswell says, on the 18th of 'November.

'Herodotus tells us, that Isis is the same as the 'Greek goddess Ceres, who, with her daughter Pro-'serpine, presided over agriculture and the dead.

'Among the Greeks, besides existing in other 'ceremonies, the primeval festival of the dead 'appears under a veil of mythology in all the 'ancient mysteries, but above all in the greatest of 'them, the Eleusinian. The Attic Anthesteria and 'the Roman Feralia were funereal celebrations, and 'held on the 17th, 18th, and 19th of February. 'We may therefore assume, that as the lesser Eleu-'sinian mysteries, which were sacred to Proserpine 'alone, were celebrated in that month, they were 'held on these ill-omened days.

'The Macedonians retained the primitive year 'beginning in November. It is peculiarly interest- 'ing to note that with the festival of the dead, the 'tradition as to the deluge was also transferred by 'the Athenians to the 17th day of February. Even 'in some other months, the 17th seems to have been 'a conspicuous day in the Greek calendar. In Per- 'sia, in every month, there were three days of fast- 'ing and sadness; but as the 17th and 18th days 'were *dies nefasti*, on which no work was done, we 'may assume that the 19th was the *ultima dies* '*placandis manibus*, and that the 17th, 18th, and '19th were the days of mourning. In Europe, 'Asia, and Africa, we find days in every month 'consecrated to the memory of the dead.

'Let us now look south of the equator for an ex- 'planation: 1*st*, Why the 17th, 18th, and 19th of 'the month were so funereal. 2*d*, Why the primi- 'tive year of the Egyptians and of other races, and 'their funereal mysteries, once began on the 17th 'day of the month. 3*d*, Why, not only at every 'new year's festival, but even monthly, the dead 'were commemorated.

'Almost all savage races, like all nations of re- 'mote antiquity, regulate their months by the new 'or the full moon, and hold festivals of a funereal 'character at the time of the new moon, or when 'the nights are darkest.

'The Australians not only hold an annual corro-'boree of the Pleiades, but also a monthly corro-'boree of the moon, apparently connected with a 'dread of ghosts, or a worship of the dead. They 'regulate their months by the full moon. The 'Hindoos offer in every lunar month, on Mahacala, 'the day of the conjunction, and defined as "the '"day of the nearest approach to the sun," "obse-'"quies to the manes of the *pitris*, or certain pro-'"genitors of the human race, to whom the *darker* '"fortnight is *peculiarly sacred*." Sir William 'Jones also says, referring to a Hindoo work, "Many '"subtle points are discussed by my author con-'"cerning *the junction of two*, or even *three lunar* '"*days in forming one fast* or *festival*."

'The Chinese, the Africans, the Caribs, and other 'races of America, the Greeks, the Romans, and 'almost all ancient nations, kept a commemoration 'of the dead in the dark nights of the moon.

'Here we have an explanation for a monthly 'commemoration of the dead, but why were the '17th, 18th, and 19th days of each month, among 'some races, especially of a funereal character? 'Ellis tells us that the Society Islanders regard the '17th, 18th, and 19th nights of the moon, as sea-'sons "when spirits wander more than at any other '"time," a plain proof that even among the Pacific 'Islanders, three days, in every month, must have 'been consecrated to the dead, as to this day, it 'is still believed in Britain, that on Halloween, 'when the festival of the dead once commenced, '"the spirits of the dead wander more than at any '"other time of the year." "This is a night when '"devils, witches, and other mischief-making be- '"ings, are all abroad on their baleful midnight '"errands."

'But the question arises, How came the beginning 'of the year to be, among some nations, on the 17th 'day of the month? The explanation, I think, is 'plain. The Chinese, the Hebrews, and other races, 'regulated the beginning of the year at the time of 'the new moon, *i.e.*, at the time of the festival held 'in the dark nights of the moon. With many 'races, the 17th, 18th, and 19th days after the full 'or the new moon, were evidently regarded as pecu- 'liarly sacred to the dead, and were the monthly 'days of rest or the monthly *sabbath* of heathen 'races.

'Our own mode of regulating Easter, will serve 'to explain the commencement of the ancient year. 'The Common Prayer-book says: "Easter-day is '"always the first Sunday after the full moon which '"happens upon or next after the 21st day of '"March." But the Hebrews probably substituted 'four sabbaths in place of one monthly time of rest, 'and used the vernal equinox, instead of the rising 'of the Pleiades, to regulate their Passover. Let 'us substitute the monthly festival of the dead for 'the word Sabbath, and the rising of the Pleiades 'for March 21, and we read, "New Year's day is

' "always the monthly sabbath, which happens upon ' "or next after the culmination of the Pleiades at ' "midnight." But as this would occur near the ' month of November, we can understand that when ' the months ceased to be lunar, and their festivals ' "moveable," the new year's festival would, for some ' time at least, continue to be held on the 17th day ' of the first month, and that the 17th, 18th, and ' 19th days of every month would still appear in ' ancient calendars as funereal days. We can also ' understand that a traditionary veneration for the ' 17th day of the month, especially of November, ' would long continue, like some old sea-margin, to ' show the changes which time had effected; and ' that the new year's festival of the dead, preserved ' in the mysteries of Isis, would long be held on the ' 17th, 18th, and 19th nights of the first month of ' the primitive year, though no longer those dark ' nights of the moon, in which the spirits of the ' dead are wont to wander forth from their Maraes ' and their temples to receive the offerings of their ' trembling worshippers.

' Among the Romans we find a trace of a partial ' observance of the festival of the dead in November. ' They seem however to have borrowed their Feralia ' or festival of the dead, from the Athenian Anthe-' steria, as they were both held on the 17th, 18th, ' and 19th of February. The more ancient institu-' tion was the Lemuria, or festival of the ghosts, ' celebrated in May—a month, therefore, so unlucky 'that no marriage took place in it. Ovid and Gres-'well both agree as to the antiquity of the Lemuria. 'It is evident that this festival, transferred from 'November to May, was originally regulated by the 'heliacal rising of the Pleiades in the morning. 'Yet the offering to the spirits took place at mid-'night, a time when that constellation was invi-'sible. What can have made that hour so peculiarly 'marked?

"Non hæc Pleiades faciunt, nec aquosus Orion."[1]

'Greswell connects this circumstance with the 'November festival of the Aztecs, which *com-'menced in the evening*, and in which *midnight* 'was the hour of sacrifice. From this he infers 'that the calamity commemorated was the event of 'the sun going back ten degrees in the days of 'Hezekiah. His remarks as to the Aztec festival 'supply a clue to the fact that the Lemuria must 'have been moved from November to May, from 'the month when the Pleiades rose in the evening 'and culminated at midnight, to May, when they 'were invisible till early dawn.

'Before concluding this necessarily superficial 'sketch of this primeval new year's festival, a 'subject respecting which scores of volumes might 'be written, I must turn to Britain to see if we have 'among us any traces of this primitive year, or 'seasons of the Pleiades. That it did exist among

[1] 'Propertius II. 16. 51.'

'the Celtic race, has long been known to those who 'have studied its history and customs. Wylde says, '"the first great division of the year was into '"summer and winter, Samradh and Geimradh, '"the former beginning in May or Bealtine, and the '"latter in November, the Samhfhuim, summer end. '"On the first of May took place the great Druid '"festival of Beal or Bel, and at the beginning of '"November, All Halloweven;" and it is strange 'that both the eve of May day, and Halloween, are 'ill-omened nights, on which prudent persons in 'Ireland, from fear of encountering fairies and 'ghosts, avoid being out after dark.

'Classical writers of antiquity tell us that in 'Britain, Ceres and Proserpine were worshipped in 'the same manner as in the mysteries of the Cabiri. 'Now we have seen that Proserpine and her mother 'Ceres, are really the same deities, both being con-'nected with agriculture and the dead. In Sicily, 'Ceres was worshipped in May, and Proserpine in 'the autumn.[1] The latter was called Core, or the 'damsel. Are there any traces of her still in 'Britain? It is manifest that the May queen, and

[1] 'The marriage of Proserpine, who was "in autumn wed," must 'have been almost simultaneously celebrated with that of the Core of 'the South. But the myth of the appearance and disappearance of 'Proserpine merely typified the appearance and disappearance of the 'Pleiades. For three days at the Thesmophoria Ceres mourns for her 'daughter, who for six months is visible on earth, and for the rest of 'the year is compelled to reign with Pluto in hell. Dupuis shows 'clearly that the story had some reference to Taurus. But as Ceres

'the Kernbaby of the harvest home, are either relics 'of this deity, or the origin of the myth. But we 'have evidence that they are as old, if not older, 'than Proserpine herself. In the Tonga Islands, at 'a first fruits celebration, a child presides as a sort 'of Southern queen of the spring, a November 'queen, if I may give her a new title.

'The Tow Tow, a species of first fruits celebration, 'takes place "at the time when the yams are ap-'"proaching maturity, *in the early part of Novem-*'"*ber*," when prayers are offered up to A'lo A'lo, 'the god of weather. Mariner, in describing it, 'says, "A deputation of nine or ten men from the '"priests of A'lo A'lo, all dressed in mats, with green '"leaves round their necks, arrives with a female '"child, to represent *the wife of A'lo A'lo*." They 'offer up a prayer for a fruitful season to the god, 'and then divide the provisions collected for the 'occasion. One pile being assigned to A'lo A'lo, 'and to other gods. Mariner tells us that "she is '"selected from the chiefs of the higher ranks, and '"*is about eight or ten years old*; during the eighty '"days of this ceremony, she resides at the conse-'"crated house of A'lo Al'o, where, a day before the

'was comforted by *Hesperus*, and by *certain stars* seen by her *in the* '*evening*, the appearance of Proserpine must originally have meant the 'beginning of "the Pleiades above," which commenced when those 'stars were first visible at the horizon in the evening. In Novem-'ber the great festival of the Pleiades is still celebrated by the Aus-'tralians. The fact that there was a temple in Sicily in which Ceres, 'Proserpine, and the Pleiades were jointly worshipped, confirms my 'view of this strange myth.'

' " ceremony, a cava party is held, at which she ' " presides, as well as at a feast which follows. She ' " has nothing to do on the actual days of the cere- ' " mony, except to come with the deputation and ' " to sit with them." Here, then, we have, south of ' the equator, a " queen of the May," or a *Kernbaby*, ' whichever we may call her. But in China, Core, ' or the damsel, assumes more distinctly the funereal ' character of Proserpine. At the festival of the ' dead, a child presides, who receives the offerings ' made to deceased ancestors. In the South, she is ' the wife of A'lo, the god of weather, but in Grecian ' mythology, she is "in autumn wed" to Pluto, the god ' of the dead ; and in Egyptian fables, she is doomed, ' at the November festival of the new year, to mourn ' Osiris, the God of Agriculture and "the Lord of ' Tombs." It would be strange, if, in the half-naked ' little Feejee savage, the wife of A'lo, we should find ' a clue to her, who was " the ancient goddess" in ' the days of the Patriarchs, and whose statues bore ' the inscription, " I am all that has been, that shall ' " be ; and none among mortals has hitherto taken ' " off my veil."

' Such then, north of the equator, are the scat- ' tered fragments of, what we can only regard as the ' wreck of the primitive Southern year, and of its ' new year's festival of first fruits, and the dead. ' I have endeavoured to collect together these *disjecta* ' *membra*, diffused and hitherto lost in vague myths, 'confused calendars, uncertain traditions, and ob-'solete customs. Yet, in the New, as well as in the 'Old World, civilized and savage races gaze with 'equal wonder on the memorials, that everywhere 'exist, of the observance of this festival by primeval 'man. In the large deposits of ashes, and of the 'remains of food, found in vast burial tumuli in 'Australia, America, and Asia, the graves of races 'long extinct, we have significant evidence of this 'new year's commemoration dating back to the most 'remote ages; while even at the burial cave at 'Aurignac, to which an antiquity of not less than '8000 (?) years is assigned by some authorities, we 'have the same memorials of the feasts and fires of 'this ancient festival. Its memory has long been 'forgotten. Preserved only in the rites of heathen 'races, or merely lingering, among civilized nations, 'in the customs and superstitions of the peasantry, 'this festival has never been considered worthy of 'the attention of the historian or of the ethnologist; 'and this paper is the first attempt that has been 'made to throw any light on its history or its 'origin.

'I have restricted my remarks to such points as 'connect it with a year commencing in November, 'a branch in itself far too extensive for the space at 'my disposal. My next paper will show the light 'which this festival, occurring in February, throws 'on the primitive northern year; and my third will 'be devoted to a far more interesting and easier 'branch of inquiry, as to the prime origin of this 'festival of the dead, and the influence it has ex-'erted on the idolatry, the mythology, and the 'religious rites of all ancient nations,—an influence 'even still discernible in the customs and modes of 'thought of civilized nations.

'That, from Australia to Britain, we have all in-'herited this primitive year and its new year's 'festival, from a common source, is plainly manifest. 'Was it carried south by northern nations; or, has 'there been a migration of southern races to northern 'latitudes?

'That the "Feast of Ancestors," which still lingers 'in our All Halloween, All Saints, and All Souls, is 'the same as the *Inachi* of the south, and was 'originally the new year's festival of a primitive 'year commencing in November, is a matter, which 'can, I believe, be established beyond any question; 'but in what part of the world it first originated, is 'necessarily, with me, a matter of vague conjecture 'only, especially with the limited materials I possess 'respecting the festivals of southern races. The 'fact, that the year of the Pleiades, as well as the 'ancient reverence for that constellation, only now 'exists south of the equator, is, however in itself 'very significant.'

Mr. Haliburton is at some pains in pages which follow, to show that the Pleiades year, and probably the human race too, originated in the isles of the Southern ocean, and came thence by ship to the Northern hemisphere of the world. And he considers this less extravagant as a scientific theory, than for another author to recur to a *miracle* affecting the seasons by six months,—in order to explain why, when we know that the Pleiades culminate at midnight in November, or the autumn of the Northern hemisphere,—they should yet have names and traditions connecting them with spring. But there is an easier method still of explaining the anomaly.

For, *first*, the Latin name of the Pleiades, or 'Vergiliæ,'—though by the classics connected with *Ver*, spring, is shown by the author of *Mazzaroth, or the Constellations*, on going to the roots of the words in languages earlier than the classics, to have nothing to do with 'spring,'—but with 'a turning round a centre.'

And *second*, many of the accompaniments of spring in high latitudes are found to affect the autumn in low latitudes, though keeping in the Northern hemisphere all the time. Thus, in the latter parallels, especially in very dry situations,—it is only when the sun goes low down to the south, and rains commence in autumn,—that the grass begins to grow, sheep to get fat, and small farmers venture to kill an ox, and feed on beef. Nay, even with some of the trees of these countries, the droughts of spring and summer are their period of almost deadly rest; and the winter their time of vigorous growth: so that, while the Usbekeeah square in Cairo was in magnificent vegetation when we were there in December 1864,—its numerous Locust acacia trees were nearly denuded of leaves, and were waving little more than 'iron boughs,' in the hot sand-winds, when we returned there in the beginning of May 1865.

This one difficulty, too, of *some* Northern *May*, or spring, accompaniments being compatible with the month of *November* in Egypt, Arabia, Shinar, and India, having been got rid of,—all the other traditionary notices and nominal distinctions of the Pleiades year are eminently suitable to its occurrence, for men of the Northern hemisphere, in the autumn, as regards all the circumstances of the *Sun*. For, as Mr. Haliburton well shows, while the primitive day began with sunset, and 'the evening and the morning,' not 'the morning 'and evening,' were 'the first day,'—so did the year begin with the autumnal decadence, or annual-evening declension of the sun; and the autumn night of the Pleiades culminating at midnight, in November,—or, for 4000 years ago say rather in September,—became 'the 'mother night of the year.'

There are, moreover, besides the above, some very simple facts connected with a certain *relative* alteration of sidereal chronology by the amount of six months, which seem fully able to explain the origin of many of the strange traditions from very early times, as to an actual alteration of the seasons having once taken place rather suddenly. But that subject will be treated of again in chapter viii. and Division III. of volume iii.

ADDENDUM I.

'The necessity of compressing the subject into 'such narrow limits, has rendered the following 'additional remarks unavoidable, in justice to a 'branch of inquiry, of which I feel I have given a 'most imperfect outline.

'Since the publication of the foregoing paper on 'the Festival of the Dead, Mr. William Gossip, the 'Secretary of the Nova Scotian Institute, has drawn 'my attention to the Rev. William Chalmers' re-'marks as to the existence of the year of the 'Pleiades among the Dayaks of Borneo. The facts 'mentioned by him, in addition to others which I 'have recently discovered respecting the Fiji and 'the Sandwich Islands, almost settle the point, that 'the identity in the November festival of the south 'with that of northern nations, cannot possibly be 'accidental; and confirm my conjecture as to the 'probability of the year of the Pleiades, and the 'new year's festival of first fruits and of the dead, 'being found to exist throughout the islands of the 'Pacific, and of the Indian Archipelago.

'We have seen that, north of the equator, in 'Hindostan, Persia, and Egypt, November was con-'nected by its very name, either with the Pleiades, 'or with the festival of first fruits and of the dead. 'The Bœotians designated it the month of Ceres. 'Even many of the northern nations of Europe, 'though they appear to have, thousands of years 'ago, transferred "the mother night," and the beginning of the year, from Halloween to Yule, retained 'traces of the ancient year, not only in the festivals 'of All Halloween, All Saints, and All Souls, but 'also in the very name of November, which was 'called among the Anglo-Saxons, the Dutch, the 'Danes, and the Swedes, the *month of blood* or of '*sacrifice.*

'South of the equator we have seen that the 'month of November is also connected either with 'the Pleiades or with the new year's festival of agri'culture and of the dead. In Peru it was called '"the month of carrying corpses." In Australia, in 'November takes place the festival of the Pleiades: 'at which time is held, in the Tonga or Friendly 'Islands, the feast of Alo Alo, the God of Agricul'ture, who is wedded to the little damsel, the 'November Queen of the Spring.

'The Fiji Islands, though peopled by a Melane'sian race, almost form part of the Friendly Islands, 'and the manners and customs of the inhabitants 'of the two groups are strikingly similar, and in 'many respects resemble those of the natives of 'Australia, from which those islands are not far 'distant.

'Among the Fijians, the Australians, and the 'Friendly Islanders, we find, connected with No'vember, the rude outlines and elements of almost 'all the myths and traditions associated by northern 'nations with that month, most of which have 'hitherto never been satisfactorily explained.

'No solution has yet been found for that strange 'myth of the Egyptians, almost the basis of their 'religion, viz., that in November Osiris, the God 'of Agriculture and "the Lord of Tombs" comes 'from the world of spirits, and is restored to his 'sorrowing spouse. Nor has any explanation been 'given for the Autumn festival among the Greeks, 'in which the rape of Proserpine, or the marriage 'of that Goddess "in autumn wed" to the God of 'Hell, was celebrated at the time of the acronycal 'rising of the Pleiades. No clue has been supplied 'to the belief of the ancient Persians, that winter 'comes up from hell at the beginning of Novem-'ber, "the month of Death" (Morâd), which is also 'known among the Arabs as Rajeb ("the Month of 'Fear").

'The festival of Kali the goddess of death, and 'the spouse of Siva, "the destroyer," takes place in 'Hindostan in November (the month of the Plei-'ades). Both of them, like Osiris, "the Lord of '"Tombs," are honoured as "delighters in ceme-'"teries," the goddess, like the wife of Alo Alo, 'being represented by a little girl. The explana-'tion of these myths will be found in the new year's 'festival of first fruits and of the dead, among the 'races of the far South.

'The Fijians, like the ancient Greeks and the 'Egyptians, believe that *in November a god comes*

'*up from the infernal regions.* He is named Ra-
'tumaimbulu, and is, like Osiris, Kali, and Proser-
'pine, a deity presiding over agriculture—and "a
'"god of great importance in Fiji, as he causes the
'"fruit trees to blossom, and on him depends the
'"fruitfulness, or otherwise, of the seasons. There
'"is a month in the year, about November, called
'"Vula i Ratumaimbulu (the month of Ratumaim-
'"bulu). *In this month the god comes from Bulu,*
'"*the world of spirits,* to make the bread-fruit and
'"other fruit-trees blossom and yield fruit. He
'"seems to be a god of peace, and cannot endure
'"any noise or disturbance, and his feelings in this
'"respect are most scrupulously regarded by the
'"natives. They, therefore, live very quietly dur-
'"ing this month, it *being tapu to go to war or to*
'"*sail about, or plant, or build houses, or do most*
'"*kinds of work,* lest Ratumaimbulu should be
'"offended, and depart again to Bulu, leaving his
'"important work unfinished."

'As the Fiji Islands are adjacent to the Friendly
'or Tonga Islands, and the natives of both groups
'strongly resemble each other in their customs and
'observances, there can be but little doubt that Alo
'Alo, the God of Agriculture of the Friendly Islands,
'whose festival takes place in November, is the same
'as the Fiji god, and like him is assumed to come
'in that month from the world of spirits, which is
'called by the Fijians *Bulu,* and in the Friendly
'Islands *Bulotu.* For the same reasons we may

'assume that a vernal queen, like the little damsel 'who presides at the festival of Alo Alo, also wel-'comes the Fiji god, on his arriving in that month 'from the land of spirits—as Isis welcomed Osiris, 'and Proserpine wedded Pluto in November.'

ADDENDUM II.

'Such, then, are some of the conclusions to which 'the study of *Ethology* has led me.

'There, are, however, further proofs, deducible 'from chronology and astronomy, which, though 'less interesting to the general reader, are most im-'portant in confirming the inferences to which this 'inquiry tends. Though they were the last to 'suggest themselves to me, they will not be, I 'believe, the least conclusive in the hands of 'others more competent to deal with them than 'myself.

'If the foregoing paper is imperfect, this is almost 'unavoidably the case. The field is almost entirely 'new; and many points were incidentally sug-'gested, while I was preparing the paper; for 'though collecting materials for a comparison of 'the customs and festivals of nations required 'several years of drudgery, many identities in the 'mode of observing the Festival of the Dead only 'became apparent to me when I had carefully col-

'lated and compared the different references to it, 'which I had noted in the course of my reading 'during the past eight or ten years. Of course the 'difficulty of procuring, in a colony, any works 'bearing on the subject, not a little contributed to 'my labours.

'Before going into what may be regarded as, in 'some respects, a distinct branch of the subject, it 'would be as well to recall the steps which have led 'me so far in this inquiry.

'Accident drew my attention to the *antiquity* of 'certain popular customs; and further inquiry re-'specting them revealed to me some new facts as to 'their *universality*.

'The simultaneous observance of the festival All 'Halloween, All Saints and all Souls, in the old and 'in the new worlds, led me to infer that it must 'have been regulated by some visible mark or sign 'that nature had supplied; and on discovering that 'the midnight culmination of the Pleiades affords a 'clue to the almost simultaneous observance of this 'festival in America, Polynesia, Asia, and Europe, I 'at the same time found that the festival of the 'dead was a *new year's festival*, and that it, conse-'quently, was in Europe, Asia, and America a ves-'tige of a sidereal (or astral) year, actually in use in 'the southern hemisphere, but obsolete and for-'gotten in the north, though forming apparently 'the substratum of all ancient calendars. My next 'and last inquiry was, therefore, into the calendars 'of ancient nations, to see if astronomers have 'noticed any traces of a primitive system of regu-'lating the year having been once in vogue in 'different parts of the globe.

'Greswell, who has not suspected the existence of 'the year or seasons of the Pleiades among ancient 'nations, states that there is conclusive evidence of 'all calendars having been derived from a primitive 'calendar. He also states that they were not regu-'lated by or adapted to the tropical year, and that 'their mutual connexion consists in their relation 'to the 17th day of the Egyptian month of Athyr. 'This, though probably the primitive new year's 'day of the Egyptians, became in time the 17th day 'of the third month, still regulating the year, how-'ever; still the *point d'appui* of all calendars; still 'the basis of all cycles and of all corrections as far 'back as the year B.C. 1355. The earliest reliable 'astronomical data which we possess as to the cal-'endar of the Egyptians extend back to that 'date; and in Hindostan, B.C. 1306 is the limit 'to which we can safely carry back our calcu-'lations.

'Greswell shows us that the Egyptian and Hindoo 'calendars agreed at that remote era; that the fes-'tivals of the Egyptian Isis and of the Hindoo 'Durga were then new year's commemorations; and 'he even supposes them to have been first instituted, 'and the worship of these deities to have been in-'vented or introduced, near that time. As, how-

'ever, we find the rude elements of all the rites and 'attributes of those deities, among the gods, and 'ceremonies of savages of the Southern Ocean, we 'may question the correctness of his inference on 'this point.

'This coincidence in the observance of these fes-'tivals at that date has naturally appeared so 'remarkable, that he can only explain it by 'assuming that they must have had a common 'origin; and this he finds in the astronomical 'science of the Egyptians. Although Greswell 'acknowledges that the existence of a primitive 'universal calendar is evident throughout the 'world, he assumes that the Egyptian calendar was 'the source from which all nations derived their 'knowledge of the primitive year.

'This is plainly most incredible. We must en-'deavour to find in nature some more simple clue 'to these remarkable coincidences.

'Let us see whether this primitive year, the 'traces of which have been discerned in almost all 'countries, was not the year of the Pleiades, or 'rather the two seasons of "the Pleiades above," 'and "the Pleiades below."

'A careful perusal of his elaborate works will 'lead to the conclusion, that the four following 'days stand out with singular prominence as land-'marks of this primitive calendar, viz.,—Athyr '17th (November), February 17th, April 20th, and 'August 28th.

'Greswell appears to regard them all as different 'types of (what is unquestionably the most remark- 'able of them all) Athyr, 17th, as it appeared at 'different times in a moveable year. But he is evi- 'dently mistaken, as I shall hereafter show. All of 'these days were most conspicuous in the Roman, 'as well as in some other ancient calendars, and 'were connected with the primeval festival of the 'dead, or with the superstitions peculiar to it; 'while in more modern times we find the new year's 'festival of the Mexicans, and of the Dayaks of 'Borneo, fell respectively on November 17th and 'February 17th, each regulated by the Pleiades; 'and that on the 19th of February and the 28th 'of August, among the Chinese and Japanese, the 'annual commemoration of the dead, or a festival 'in honour of the new year takes place.

'It is however manifest, that each of these four 'days must have marked a division of the primitive 'year. But if this was the case, they must have 'had reference to some natural phenomena or signs; 'and could not have been merely conventional divi- 'sions of the year, as their unequal duration clearly 'proves; nor could they have been regulated by 'the seasons, because they are found in different 'latitudes.

'Thus a division commencing on Nov. 17th 'would contain 92 days; that on Feb. 17th, 62 'days; that on April 20th, 130 days, while that on 'August 28th would not extend over 81 days. Or, 'supposing that the year was divided into two seasons, the first, if commencing, like the primitive 'Southern year, on the 17th November, would last 'only 154 days, while the second season, commencing April 20th, would continue for 211 days. If, 'however, it was a year commencing, like the primitive Northern year, on February 17th, the first 'season must have consisted of 192, and the second 'season of 173, days.

'Such a system is so entirely unsuited to the 'seasons, and to the natural divisions of the tropical 'year, that we cannot assume that accident or 'caprice can have suggested it, much less have preserved such an uniformity, in the observance of 'such a singular and irregular mode of dividing the 'year, among nations inhabiting different quarters 'of the globe.

'The solution for all these difficulties will be 'found, I believe, in the primitive Southern 'and the primitive Northern years, each of which 'was sidereal or astral, and regulated by the 'Pleiades.

'I give below a statement of the times of the year, 'in various portions of the globe, when the Pleiades 'appear and when they disappear in the evening, 'also when they culminate at midnight, sunset, or 'at sunrise.[1]

[1] 'The following table, kindly prepared for me by Professor Everett, 'will afford sufficient data to guide the reader as to the variations in 'the times when the Pleiades appear, disappear, and culminate at the 'equator, and in northern and southern latitudes. Of course the

'The midnight culmination of the Pleiades occurs 'all over the world on the 17th of November (or 'Athyr, as it was called in the Egyptian calendar). 'Hence if the primitive year was regulated by the 'midnight culmination of the Pleiades, we may ex-'pect to find all affinities in calendars connected 'with that particular day. This is exactly what 'Greswell has discovered. He cannot explain why, 'out of the 365 days of the year, the 17th day of 'November should be such a *point d'appui* of all 'calendars. Yet he considers it derived from some 'primitive unknown calendar, in which it consti-'tuted the beginning of the year, and that in all 'modes of dividing the year, in every portion of 'the globe, a connexion with the 17th of Athyr is 'to be traced.'

ADDENDUM III.

'A study of the stars that are visible in the 'middle of November will, I believe, throw a new

'farther we go from the equator, the greater the variations will be-'come:—

	Appearance in evening.	Disappearance in evening.	Culmination at midnight.	Culmination at sunset.	Culmination at sunrise.
'Tongatabu, Friendly 'Islands. Lat. 21° 'S.,	Nov. 1.	April 22.	Nov. 17.	Feb. 2.	Aug. 7.
'Equator,	Oct. 31.	April 28.	Nov. 17.	Feb. 9.	Aug. 14.
'Heliopolis, Egypt, 'Lat. 30° N.,	Oct. 19.	April 30.	Nov. 17.	Feb. 17.	Aug. 21.

'light on the strange tradition referred to by Virgil, 'and which has excited so much speculation—

> "Candidus auratis aperit cum cornibus annum
> Taurus."

'This has, by all writers, been supposed to refer to 'a very remote period, when the sun was in the 'sign of Taurus, at the time of the vernal equinox. 'It has been assumed that the primitive year began 'at the time of the vernal equinox, and was a solar 'year.

'I think it is very apparent, from the facts re-'ferred to in the foregoing paper, that the most 'ancient year began in the autumn, and that there 'is not the slightest trace of any ancient year in 'general use beginning in May. How, then, can 'we connect this tradition with the evidence of 'ancient calendars, pointing to November, not to 'May, as the month in which the primitive year 'began?

'It is manifest that this universal tradition, that 'is so discernible to this day in the religious symbols 'and rites of Asiatic nations, and which was so 'conspicuous in the mythology of the Egyptians, 'had reference not to a solar, but to a sidereal year; 'not to the sun being in the *sign* of Taurus, but to 'the stars in Taurus, the Pleiades, which by their 'rising in the evening, culminating at midnight, 'and setting in the morning, marked the beginning 'of the primitive year in November. The reader 'has only to consult the various writers who have 'touched on this point, and he will find that there 'can be but little question as to the correctness of 'this view of the tradition. I have already con-'nected Io with the year of the Pleiades, accom-'panied as she was by those stars in her wandering 'over the globe. But I omitted to note a feature in 'the story of Io, which confirms this conjecture. 'Why was she represented as having been changed 'into a *Cow*, and as having in that form arrived in 'Egypt, where she was worshipped as Isis, to whom 'the bull Apis was sacred, as well as to Osiris?

'Io or Isis was called Athyr, which was the name 'of the month, on the 17th of which her great 'festival, the mysteries of Isis, took place. Gres-'well, who does not seem to have noticed the con-'nexion of the constellation of Taurus with the 'month of November, says, "according to some the '"Bull in the heavens is the same as *Io.*" "The '"Arabic name of the sign, or one of the Arabic '"names, is *Ataur* or *Ator*, which is evidently the '"same with the Egyptian *Athyr*—Ator or Venus; '"and she was only another conception of the '"Egyptian Isis." But the connexion of Taurus '(Ataur) with the festivals of *first fruits* and of *the* '*dead*, everywhere, even in the Pacific Islands, 'associated together, is clearly discernible. Sir 'Gardner Wilkinson says that at harvest time the 'Egyptians throughout the country "*offered the* '"*first fruits* of the earth, and *with doleful lamen-* '"*tations* presented them at her altar." He traces 'the connexion between two of her festivals in the 'fact that two of her votaries "*presented their* '"*offerings in the guise of mourners.*" As to the 'Egyptian fable of the cow of Mycerinus, Sir Gard- 'ner Wilkinson says, "if Herodotus was correct in '"stating that it was a heifer (not an ox), it may '"have been the emblem of *Athor* in the capacity '"which she held *in the regions of the dead.*" "The '"introduction of *Athor* with the mysterious rites '"of Osiris, may be explained by her frequently '"assuming the character of Isis."

'But the connexion of Taurus (Ataur) with a 'funereal commemoration which took place on the '17th of Athyr, is indirectly attested to by Plutarch, 'who says, "the priests therefore practise *certain* '"*doleful rites,* one of which is to expose to public '"view, as a proper representation of the grief of '"the goddess (Isis) *an ox* covered with a pall of '"the finest linen, that animal being considered the '"image of Osiris. The ceremony is performed for '"four days successively, beginning on the 17th '"day of the above month (Athyr)." "Thus they '"commemorate what they call '*the loss of Osiris,*' '"and on the 19th of the month another festival '"represents '*the finding of Osiris.*'" The autho- 'rities I have already cited seem to show that this 'refers to the 19th of *Athyr* (not of *Pachons,* as Sir 'Gardner Wilkinson suggests). Plutarch supposes 'this funereal celebration to represent the death of 'the year, and the beginning of winter. De Rouge-

'mont makes the same conjecture as to the festival
'of the German goddess of death; but I have
'already shown that these theories are incorrect;
'because in the Southern hemisphere, the *vernal*
'month of *November* is sacred to the god of the
'dead. But Plutarch supplies, unconsciously, the
'clue to the enigma, when he states that these
'funereal celebrations "take place *in the month when*
'*the Pleiades are most distinct, i.e.*, in Athyr.
'These *lamentations, followed by rejoicings*, were
'plainly connected with the disappearance and re-
'appearance of the Pleiades, and were in no way
'descriptive of the seasons. The Abipones of South
'America call that constellation their "*Grand-*
'"*father.*" When it disappears from the sky at
'certain seasons, "they suppose their grandfather is
'"sick, and are under a yearly apprehension that
'"he is going to die;" when these stars again ap-
'pear they rejoice, and hold festivals in honour of
'his recovery. In Borneo, *Se kera*, the God of
'Agriculture, resides in the Pleiades. Hence we
find the Pleiades, like Osiris and Proserpine, were
'regarded as the god of the dead and of agriculture,
'and thus the festival of the Pleiades was a feast of
'ancestors, and a first fruits celebration.

'In Australia, on or about the 17th November
'the savages celebrate their great corroboree in
'honour of the stars of Taurus (see p. 384), which,
'as I have shown, is of a funereal character. It
'is therefore evident that, as the Hindoo name

'for November is Cartiguey (the Pleiades), the 'Egyptian name for it, Athyr, is connected with 'Ataur (Taurus), and the seven stars the Pleiades. 'Hence we learn from the fable of Io, that the cow 'or bull, accompanied by the Pleiades, was wor-'shipped at the Isia on the 17th of Athyr, *i.e.*, when 'these stars in the constellation of Taurus are most 'distinctly visible; and thus as the primitive year 'began at that time, the constellation of Taurus 'may be said to have opened the primitive year.— 'See Landseer's *Sabæan Researches*, p. 75 to 85, '861. See Greswell's *Fasti Cath.* II. 88, n. II. 112; 'iii. 255, 257, 370; Introd. 241; iv. 280.

'A plate, in Hyde's learned work on the Religion 'of the Ancient Persians, taken from an antique 'gem, which was supposed to represent Mithra, or 'the sun in the sign of Taurus, evidently refers to 'the stars in the constellation of Taurus, and to 'Orion and Scorpio, which are at the same time 'visible in November, when the primitive year 'began.

'Hyde says that the representations of Mithra 'were intended by Zoroaster to be of an astronomi-'cal, not of a religious or mythical character.

'We have represented in this gem a man holding 'a sword and accompanied by two dogs (the form 'under which Orion was represented), near him a 'scorpion, and above him the seven stars, the sun 'and the moon. The tradition as to the scorpion, 'I have already shown, was connected with Novem-

'ber and with Orion by the ancient Romans, and to 'this day is associated by the Arabs with November. But the Persians themselves, when they 'changed their year from November to February, '*i.e.*, from the time of the midnight culmination of 'the Pleiades to that of their culmination at sunset, 'must have transferred the tradition as to the death 'of Orion by the bite of a scorpion to February, as 'they still celebrate a festival in February, in which 'charms are used to drive away scorpions. Hyde 'says this festival once took place in November. I 'can find no trace in the customs of any race in 'which any superstitions respecting Taurus, Orion, 'and Scorpio are connected with May.—Hyde '*de Rel. Vet. Pers.*, 113. Bailly's *Astr. Indienne*, 'xxx. cliv., 4, 18, 78. See also *ante*, p. 381.

'That the reverence of Asiatic nations, as well 'as of the nations of antiquity, for sacred bulls, 'arose from the seven stars in the constellation of 'Taurus marking the beginning of the year in 'November, is probable from the following facts 'connected with the traditions as to the deluge.

'We have seen that the memory of that event 'was preserved in the great religious festival of 'ancient nations, the new year's commemoration of 'the dead. But as this was regulated by the 'Pleiades, which are in Taurus, let us see whether 'the Bull and the Seven Stars are not mixed up 'with the traditions of the deluge.

'Bryant shows us that the Pleiades were con-

'nected with that event in Grecian mythology, 'though he gives no satisfactory explanation for the 'fact. We have already seen that, beyond any 'question, the Mexicans associated the memory of 'the deluge, and a dread of its recurrence, with the 'midnight culmination of the Pleiades.

'No solution has been supplied for the remark-'able circumstance that the Zendavesta, and even 'the prayers of the Parsees, mix up the bull with 'the memory of the deluge; nor has any clue been 'found to the meaning of the traditions of the 'Chinese, the ancient Britons, Greeks, Persians, 'Hindoos, and Egyptians, as to "the seven celestial '"beings" preserved from the waters of the Flood. 'They all plainly point, for their origin, to the con-'nexion of the memory of the deluge with the new 'year's commemoration. This festival, as we have 'seen, was regulated by the stars in the constellation 'of Taurus. Hence the belief of the Mexicans that 'the deluge commenced at the moment when the 'Pleiades, culminating at midnight, marked the 'beginning of the year, has been shared in by other 'races. We can therefore understand why the bull 'and the seven stars are connected with that event, 'not only in ancient mythology, but also in the 'traditions, and even in the prayers of Asiatic 'nations.

'The belief of many writers that the ancient 'British fables as to King *Arthur* are derived from 'some astronomical myth, will receive some con-

'firmation from the facts contained in this paper, 'and from the references which I give on this point. 'We find the Arkite God Hu (the bull), *Uthyr* or '*Arthur* (Athyr?) connected with the deluge, from 'which Arthur and his *seven* friends escaped. The 'lamentations for the death of *Hu* are traceable to 'the connexion of Taurus with the new year's feast 'of ancestors, which grew in time into a commemora-'tion of the *death of a divinity*, or into a festival of 'the *god of the dead.* Hence the death of Hu '(Taurus) is the same mythical event as the death 'of Osiris, with whom the bull *Apis* and *Athor* '(Taurus) were connected. The lamentations for 'Adonis, Thammuz, Proserpine, and other deities, 'are derived from the same myth. Dupuis says, '"Dans leur mystères on rappelait la chute, et la '"régénération des âmes, par le taureau mis à mort '"et ressuscité."

'The astronomical ideas of the ancient Britons 'confirm this view. We have the testimony of 'Plutarch that in an island to the west of Britain, 'a festival at the end of every thirty years was held, 'which was connected with, and probably, like the 'Mexican cycle, was regulated by the constellation of 'Taurus. "It is mentioned by Plutarch," says Gres-'well, "that the principal object of adoration among '"the Cimbri, in the time of Marius, was a *brazen* '"*bull;* by which they are accustomed to swear on '"occasions of greater solemnity than usual. If '"this bull was not borrowed by the Egyptians, and

' " was not merely their Apis or their Mnevis, we can ' " have but little reason to doubt but it must have ' " been intended as a type or symbol of the bull in ' " the heavens; and we consider this supposition ' " much the more probable of the two. This fact, ' " however, would do much to connect the origin ' " of time and the beginning of things, in the ' " opinion of these nations, with the sign of the ' " bull. The Hindoos, both of ancient and modern ' " times, and the Persians also, have always as- ' " sociated the sign of the bull with the origin ' " of time; and there is no reason why the nations ' " of the North might not have done the same, and ' " for the same reasons in general too, viz., be- ' " cause *primitive tradition and belief among* ' " *them also actually connected the beginning of* ' " *things with this sign, or the constellation in par-* ' " *ticular.*"

'But we need not go to remote antiquity or to ' distant nations for traces of this connexion of the ' stars of Taurus with the beginning of the year, ' which they regulated by their rising in the even- ' ing. To this day the Highlanders believe that ' *in the twilight* on *new year's eve* the figure of a ' gigantic bull is to be seen crossing the heavens. ' They even imagine that the course which it takes ' is ominous of good or ill for the coming year. ' Stewart says that as new year's eve is called ' Candlemas " from some old religious observances ' " performed at that time by candle-light," this 'mythical animal is popularly known among the 'Highlanders as "the Candlemas Bull."'[1]

'PROOFS FROM ASTRONOMY AND CHRONOLOGY, 'THAT IN RELATION TO THE PLEIADES OUR CALENDAR 'NOW EXACTLY CORRESPONDS WITH THE PRIMITIVE 'YEAR.

'Πληιαδων φαινουσαν Αθυρ τεκμαιρεται ωρην.

'ASSUMING all these inferences to be correct, a 'difficulty will suggest itself to the reader, which 'may naturally seem fatal to the conclusions at 'which I have arrived. It may be said, "It is true '"that these festivals falling among so many races '"at the present day, as well as among so many '"ancient nations, on the 17th November, in the '"middle of February, or at the end of August, '"appear to have been regulated by the culmination '"of the Pleiades at midnight, sunset, or sunrise, '"yet it is only a singular coincidence, that is, the '"result of accident. If those festivals now agree '"with the culminations of the Pleiades at the times '"named, yet they did not do so two thousand '"years ago. The Pleiades gain twenty-eight days '"on the tropical year in every two thousand years; '"hence the Pleiades that now culminate at mid-

[1] See Stewart's *Superstitions of the Highlanders*, 246.

'"night on the 17th November, did so in October '"two thousand years ago. Hence you must prove '"that the months have moved onward with the '"Pleiades, or all your assumptions fall to the '"ground." This difficulty, however, when inquired 'into, not only strengthens my conclusions, but also 'opens up a new question regarding calendars and 'chronology, that is in itself most important, as 'well as most interesting. It is evident that if the 'primitive year was regulated by the Pleiades, the 'months must have been gradually affected by the 'beginning of the year commencing one day later 'in every seventy-one years, and hence the first 'month, whether November, February, or August, 'if connected with a sidereal or astral year, must 'have moved onward in an equal ratio with the 'movements of these stars, and of course all the 'other months in the calendar must have shared 'equally in this progressive tendency.

'No one hitherto has suspected that the primi- 'tive calendars of ancient nations were based on a 'sidereal year. Let us, however, see whether astro- 'nomers have not supplied us with facts that 'necessarily lead to this conclusion.

'I may assume that if a sidereal year was the 'primitive basis of all calendars, astronomers must 'have been surprised to find *simultaneous and pro- 'gressive changes* in calendars, which must have 'appeared to have been the result of *artificial '"corrections."* If the primitive year was regulated 'by the culmination of the Pleiades at midnight, all 'derivative calendars would be found gradually to 'change, and yet to preserve a relation towards 'each other, and this connexion would be traceable 'to the *point d'appui* of these calendars, the day 'when the Pleiades culminate at midnight, sunset, 'or sunrise, by whichever the year was regulated. 'Let us see, then, what Greswell says on this 'point:—

'"The *natural* measures of time have had only '"one *primum mobile*, one point of departure or '"epoch; which never has been, nor could be, nor '"is even at present, anything different from what '"it was at first. The civil calendar also might '"have had only one epoch and point of departure '"at first, though that is a matter of fact which we '"would not be justified in assuming without suffi- '"cient proof of its truth; but whatsoever it might '"have been at first, it would still be notorious and '"incontrovertible that, since the beginning of '"human society, it has had an almost infinite '"number of epochs, and points of departure; *a* '"*different one almost in every age, and in every* '"*country, and among every nation on the face of* '"*the earth.*"

'To analyse, compare, and to trace back to a 'primitive basis, calendars of apparently so variable 'a nature, at first may appear a task too difficult to 'be surmounted. This arises "from not merely the '"possibility, but the fact of the substitution of new

' " types of the standard of nature, instead of the ' " first and original one ; from the various relations ' " of these new ones compared with those of the ' " old ; and from the necessity of finding out and ' " fixing the historical epoch of the substitution in ' " each of these instances, and of tracing and follow- ' " ing the subsequent history of such variations ; of ' " investigating in short, and ascertaining the whole ' " cycle of the changes, transitions, and modifica- ' " tions in passing from one state to another suc- ' " cessively, through which the original type of ' " nature itself may have had to run."

' " It follows that, when bringing down the ' " primitive and universal type of the reckoning of ' " annual civil time according to its natural law ; ' " we are bringing down at the same time in their ' " elementary and primordial state, in their seminal ' " principles, in their archetypal form, if not in their ' " actual conditions and constitutions from the first, ' " the civil calendars of all ages, and all countries, ' " and all nations. Nor is it more unquestionable, ' " in point of fact, that all existing distinctions of ' " men (even those which are most widely discri- ' " minated in other respects) were originally sum- ' " med up and comprehended in the loins of one ' " man, and afterwards of three men, than that *the* ' " *civil calendars of all such national divisions of* ' " *mankind have been comprehended and embodied* ' " *in this one type of all*, the civil calendar first of ' " Adam, and next of three sons of Noah ; and

' "through them the common birthright and com-
' "mon inheritance of their posterity everywhere."

' I have already shown that the system of count- ' ing the day from sunset, which Greswell says is so ' universal as to prove the unity of origin of our ' race, and which he believes to have belonged to ' the primitive calendar, is still in existence in the ' southern hemisphere, and connected with the Hal- ' loween of the year of the Pleiades. Let us see ' whether there are not some other land-marks of ' the primitive calendar that are relics of this ' system of regulating the year of the Pleiades. As ' the Egyptian and Hindoo calendars are the most ' important, let us see how far they exhibit traces of ' the progressive year of the Pleiades.

' I have shown that the *Isia* were originally the ' new year's festival of the dead, and were connected ' always with the 17th of Athyr, and with the mid- ' night culmination of the Pleiades. We find that ' the Egyptians had several modes of reckoning the ' year; two of them were perhaps in reality the ' same. The year commencing at the end of August ' was probably precisely the same as the primitive ' year commencing on the 17th day of Athyr or ' November. They would be both sidereal and ' subject to the same changes; but in the former the ' 17th day of Athyr (or November) is the 17th day ' of the third month. This therefore must be borne ' in mind, in reading the following remarks of Gres- ' well respecting that day, which at least will prove 'that it was the *point d'appui* of all calendars, 'though the reason for this has, if I am correct, 'escaped the observation of Greswell, Bunsen, and 'other writers who refer to this subject :—

'"It has been already seen that the Isia, among '"the Egyptians, were attached from the first to '"one particular month of their calendar, and to '"one particular day of that month; and that this '"particular month was the third, and this particu-'"lar day was the 17th of the third month. And '"the calendar of the Egyptians, both at this time '"and long after it, being altogether the same with '"the primitive, the 17th of the third month in the '"civil calendar of the Egyptians, and the 17th of '"the third in the civil calendar common to all '"mankind, both at this time and long after it, were '"absolutely one and the same. It follows that '"the stated date of the Egyptian Isia, once fixed '"to the 17th of the third month in their proper '"calendar, was thereby fixed to the 17th of the '"third month too in the common calendar of all '"mankind; and as long as the proper Egyptian '"calendar and this common primitive calendar '"continued to be the same, and to preserve the '"same relation to each other, the 17th of the third '"month in either was the 17th of the third month '"in the other; and *vice versa*."

'"This being the case, nothing being supposed '"to be known as yet respecting the Isia of the '"Egyptians, except these two facts, that they were '"fixed to one month, the third in their proper '"calendar, and to one day, the 17th of that month; '"the attention of the reader is next to be directed '"to a very remarkable phenomenon, which the '"history of the primitive calendar, after a certain '"time, but not before, brings to light; viz., a suc- '"cession of modifications, corrections, and changes '"of the primitive calendar itself on the cyclico- '"Julian principle, which we are able to trace in '"the retrograde order (that is, in the order of the '"recession of the equable in the Julian or natural '"year), all round the Julian or natural year, from '"the point at which it began, almost to the same '"point again: corrections or modifications of the '"primitive calendar, on this common principle, '"agreeing with each other not only in that respect, '"but in a still more remarkable and characteristic '"circumstance, that of being all attached to the '"same month of the primitive calendar, the third, '"and to the same day of this month, the 17th.

'"The fact, which we have just pointed out, in '"the majority of these instances (and even in all, '"as we ourselves have seen reason to conclude) is '"confirmed by proofs that place it out of question; '"and the fact being admitted, it must be allowed '"to be something curious and remarkable in the '"highest degree; something which could not be '"resolved into an accidental occurrence of circum- '"stances, in so many instances, in such different '"quarters of the world, and at such great distances

' " of time asunder ; and if it could not be explained ' " on that principle, something which must have ' " been the effect of design. Nothing but design, ' " or reasons of a common kind, motives and causes ' " which must have everywhere alike influenced ' " such corrections, and alike determined the process ' " of such corrections, could account for a coinci- ' " dence like this, extending over a period of 1136 ' " years, exemplified in fifteen different cases of the ' " kind at least, yet all in the same way, and sub- ' " stantially to the same effect; beginning in India, ' " the most remote quarter of the world of which ' " anything was known to the ancients, and ending ' " in Sweden or Norway, of which, until a very ' " late point of time, they knew absolutely nothing.

' " What, we may ask, must have been thought of ' " this fact, had nothing been known concerning it ' " except the fact itself? How difficult must it ' " have appeared to account for it, on any principle ' " which should exclude the idea of chance !"

' Greswell tries to account for these extraordinary ' coincidences by pointing to Egyptian science as ' the common fountain of all the analogies of the ' calendars and of the myths connected with the ' year ; but the assumption is plainly untenable. ' The Egyptians certainly never taught the Fijians ' to celebrate the festival of the God of the Dead in ' November, nor could they have led the Australians, ' the Dayaks of Borneo, and the Mexicans, to regu- ' late their year by the stars in Taurus. If, as he 'assumes, analogies in the calendars of nations are 'relics of a primitive year, we must look for it 'among the most primitive races, and among those 'who have been least affected by civilisation and 'change.

'If this primitive calendar was inherited from 'primeval antiquity, we may expect to find even 'among the rudest races some trace at least of their 'common heritage from the common parent of our 'race. What do we actually find? In the southern 'hemisphere, at the equator, and in Mexico, unmis-'takable proofs of the existence of a primitive 'sidereal or astral year, regulated by the Pleiades. 'Among civilized races we find all traditions and 'myths pointing to a primitive year regulated by 'Taurus. In Hindostan, November, we have seen, 'is called the month of the Pleiades, and in the 'Egyptian calendar was connected with Taurus. 'In the middle of November and of February, we 'have found among ancient nations, and even 'among existing races, either the commencement of 'a year, or the vestige of an ancient new year's day, 'still lingering in a festival of the dead; and we 'have seen that the Pleiades culminate at midnight 'or sunset at those times which I have mentioned 'as being so conspicuous in the calendars of nations. 'The inference from these facts would naturally be 'that, if any primitive calendar ever existed, we 'have in the year or seasons of the Pleiades the 'original type of the primeval calendar.

'And this we might infer, even if in the calendars 'of ancient civilized nations no trace of the primi-'tive type could be found. But I believe that 'there are some very significant facts, which have 'already attracted the attention of astronomers in 'connexion with the history of the calendar, and 'which can only be explained by assuming that all 'ancient calendars originally partook of the sidereal 'character of the primitive calendar, and that its 'progressive tendency is traceable in all ancient 'calendars.

'Though I cannot pretend to deal with these 'matters as an astronomer, and feel great hesitation 'in referring to this somewhat difficult subject, 'there are some simple but significant facts in con-'nexion with the history of the calendar, that can 'be perceived and understood by the most super-'ficial thinker.

'Before going into the question, it may be as 'well to recall the history of our present Gregorian 'calendar. The correction of Pope Gregory restored 'the calendar very nearly to what it was in the 'time of Julius Cæsar, as respects its relation to the 'tropical year. How then was the calendar affected 'by the Julian correction in this respect? In the 'time of Julius Cæsar the year had been so tampered 'with by the priests, that the months were supposed 'to have receded more than two months in relation 'to the seasons, and to the natural year; accordingly '67 days, exclusive of the intercalary month, were 'added for the purpose of advancing the months to 'their proper position. But the exact amount of 'error in the Roman calendar was probably a mere 'matter of conjecture, and cannot now be precisely 'ascertained. Clinton considers that it was much 'less than has been generally supposed. If so, then 'the months must have been advanced too far by 'the addition of 67 days. If this was the case, the 'effect is most important. For let us assume that 'the excess in the correction was 28 days, then, if 'the Pleiades culminated at midnight on the 17th 'of November in the Roman calendar prior to the 'Julian correction, their midnight culmination must 'have subsequently occurred in October ; and it 'would take 2000 years before they would again 'culminate at midnight, on the same day in No-'vember.

'Clinton censures Usher for venturing to make 'precise calculations as to the position of the months 'in the Roman calendar, prior to, and after the 'Julian correction ; and considers that he attempted '"a precision for which we have no authority."

'But we have some positive evidence as to the 'time when the Pleiades set cosmically in the 'Roman calendar in the second century B.C. I 'have already shown that in the time of Eudoxus 'the Pleiades set cosmically on the 14th of Novem-'ber ; and Greswell supposes November to have 'then coincided with Athyr. But the Pleiades 'must have then set about thirty days earlier than 'they now do; and consequently November, in relation to our present calendar and to the seasons, 'must have almost corresponded with our present 'October; if this was the case, the addition of 67 'days was probably nearly 28 days in excess, and 'November was advanced one month too far in 'relation to the seasons, and to the natural year.

'Let us turn to the Egyptian month of Athyr. 'It has been very fully demonstrated that the very 'name of this month, and the rites celebrated in it, 'show that when it first received its name (more 'than 3000 years ago), it must have been connected with the constellation of Taurus. That the 'connexion is not merely traditionary, is proved 'by the Greek epigram on that month, with which 'this division of my subject is headed, and which 'is referred to by Greswell. In it Athyr is distinguished as *the month in which the Pleiades are* '*most distinct.* Hesychius says that in the Egyptian '"Athyr meant both a *month* and a *bull*;" and 'Plutarch says that the Phœnicians called a bull '*Thor* (Taurus). Greswell explains the meaning 'of Athyr given by Hesychius, by referring to "*a* '"*stated connexion between the month Athyr and* '"*the Bull*," *i.e.*, Taurus. Athyr is supposed to 'have fallen three days before the Roman month of 'November; but this must have had reference to 'that month before the Julian correction, as November in the Julian calendar nearly coincided with 'our present month of that name in relation to the 'tropical year. Thus Greswell says, "the Roman '"Bruma, according to the calendar, bore date No- '"vember 24; the beginning of winter, properly '"so called, was dated *from the cosmical setting of* '"*the seven stars;* in the calendar of Cæsar, (?) '"November 11."

'It is therefore plain that the statements, that the 'Egyptian Athyr began three days earlier than the 'Roman month of November, must refer to the 'Roman calendar before the Julian correction. But 'Plutarch states that the Isia and other funereal 'celebrations of ancient nations were held "when '"*the Pleiades were most distinct.*" Hence the 'Isia and the 17th of Athyr must have corre- 'sponded with the midnight culmination of the 'Pleiades.

'It is unnecessary to go more fully into this point 'at present, as I have shown that the Pleiades cul- 'minated at midnight in the middle of the Egyptian 'Athyr, and of the Roman month of November, at 'or near the beginning of our era.

'As we have seen that the 17th day of Athyr is 'the *point d'appui* of all calendars, the great land- 'mark of the primitive year, and that the Isia, the 'most solemn festival of the Egyptians, were always 'connected with that day; and that, at the begin- 'ning of our era, the 17th of Athyr and the Isia fell 'when the Pleiades were most distinct, let us see 'what was the nature of the Egyptian calendar. 'Probably there are few questions more difficult of 'investigation. Everything connected with the 'year was veiled in the most profound secrecy; and 'simple truths were effectually concealed in the 'most trivial and childish myths. There were pro- 'bably several modes of regulating the year in use 'at the same time; there must have been at least a 'fixed year and a cyclical year; perhaps a sacred 'year known only to the priests. Hence the 17th 'of Athyr appears in different forms, as connected 'with a fixed or with a moveable year, and this 'gives rise to even more uncertainty. Were the 'Isia connected with a fixed year, or with the move- 'able year? If with a fixed year, what was it?

'Bunsen gives us no positive information on the 'subject. Greswell shows that the principle of the 'Julian year was always known in Egypt. Bunsen, 'referring to the probable existence of a civil and 'of a sacred or a sacerdotal year, says, "there can '"be little reason to doubt that the Egyptians had '"a means of marking the progress of the cyclical '"year." After showing the absence of any data 'for calculations on the subject, he says that "it is '"probable, *though there is no proof of it as yet*, '"that the details of these" (their sacred festivals) '"were reckoned by the primeval year, in which '"the 1st of Thoth commenced with the heliacal '"rising of Sirius. Biot even fancies he has disco- '"vered two proofs of it; but they will not satisfy '"anybody."

'"*The best evidence on this head would be ob-*

' "*tained, if we could get some more accurate know-*' "*ledge of the great festival of Isis.* It has been ' "already remarked that in the year 70 B.C. it took ' "place a month after the autumnal equinox."

' Speaking of the moveable festivals as affording ' data for calculations as to the nature of the year, ' he adds, "It was still easier to mark the com-' "mencement of the cyclical year, where, together ' "with these festivals, there were others connected ' "with immoveable points in the year, such as the ' "solstices and equinox." "It was easy to calcu-' "late these points after nature had ceased to indi-' "cate the beginning of the year."

' If my conjectures are correct, nature never ' ceased to afford a guide for the regulation of time ' to the Aztec or to the Egyptian. Let us take the ' Isia, as Bunsen suggests, as a test. The earliest ' date of their observance of which we have any ' record is B.C. 1350, when they were held on the ' 5th of October, and the latest is A.D. 355, when ' they took place about the 28th of October.

' Bunsen supplies us, as we have seen, with an ' approximation to the date of the Isia B.C. 70, by ' which it would appear that they must have been ' held then between the 21st and 24th of October. ' These dates extend over a period of 1705 years, ' and carry us back 3213 years from the present ' time. If the Isia, which were always attached to ' the 17th of Athyr, were held, as Plutarch says, ' "when the Pleiades are most distinct," and if

'Athyr was, as it has been designated, the month 'when these stars are most conspicuous, then these 'dates, though varying so much, should approximate 'to the time when the Pleiades culminated at mid-'night; and the assumption of many ancient and 'modern writers, that the Isia came, in the course 'of time, to be held at various seasons of the year, 'must be incorrect. It should be remembered that 'Eratosthenes only speaks from tradition when he 'says that the Isia were once held in spring; but 'both he and Geminus testify to the fact that, in 'their day, the Isia were celebrated *in the autumn*; 'and the same thing will be noticed as respects the 'alleged dates of the Isia given by other writers; 'they are generally connected with autumn.

'The Pleiades must have culminated 3213 years 'ago, forty-five days earlier than they now do. The 'Festival of Durga, 1306 B.C., fell on the 1st of 'October, and the Isia, 1350 B.C., on the 5th, and 'Greswell considers the coincidence as very remark-'able, and as proving that the Hindoos must have 'been guided by the Egyptians, who fifty years 'before had instituted the Isia, and invented all 'their myths relating to them. But 1350 B.C., the 'Australian savages must have held their Festival 'of the Pleiades about the 3d of October, and in 'that century the Mexicans must have regulated 'their cycle on the 3d of October, if the Aztec 'calendar was then in use. The same coincidence 'is found to exist between the other two dates and 'the midnight culmination of the Pleiades. In the 'first century B.C., the Isia, the Australian, the 'Mexican, and probably the Celtic festival of the 'year, or of the cycle of the Pleiades, must have 'been celebrated almost simultaneously on the 21st 'of October, and in the 4th century of our era, they 'must have been almost simultaneously celebrated 'on the 27th of October.

'Hence we have a very remarkable procession in 'the Isia, in those instances almost exactly coincid'ing with the year of the Pleiades.

'But it may be said that these are only coinci'dences. There are, however, some facts to show 'that they are not accidental. When the Isia were 'instituted at the beginning of October, the idea of 'seed-time became attached to them, and the Isia 'were described as occurring in seed-time in the 'calendar. But the Isia moved on in the course of 'time so palpably, that they were held after seed'time was nearly over. This has already attracted 'attention, as showing a change in the date of the 'Isia, as well as proving the time of their institu'tion. Couple with these facts what we have 'already seen, that Athyr and Taurus are synony'mous; that classical writers describe Athyr as '"the month *when the Pleiades are most distinct*," 'and I think it will be conceded that these are 'coincidences that at least deserve very careful 'inquiry.

'But the Celtic race appear to have had a cycle 'of thirty years, and the Mexicans one of fity-two 'years regulated by Taurus or the Pleiades. Is it 'not a little remarkable that the Apis and Mnevis 'cycles were cycles of the *Bull*, and that at the end 'the Apis cycle, the *Bull* Apis was drowned in the 'Nile? It may yet be found that the Mexicans 'and the Egyptians had precisely the same simple 'mode of regulating their eras, by the midnight cul-'mination of the stars in Taurus.

'I now turn from the calendar of the Egyptians 'to that of the Hindoos, in which we can find 'unmistakable traces of the past existence and 'influence of the primeval year of Taurus. The 'worship of Durga is supposed to have, about the 'year B.C. 1306, been borrowed from the Egyptians, 'and to have been introduced into India with the 'astronomical theories of Egyptian science.

'I give below two very remarkable passages from 'Greswell's works, which, in connexion with this 'subject, are well worthy of a perusal.[1] His assump-

[1] ' "The history of the calendar and of its various changes brings ' "many proofs of this influence to light; and these discoveries are ' "among the most important and the most interesting fruits of our ' "researches. Who would believe, *a priori*, that the fable of Osiris ' "and Isis should no sooner have been invented in Egypt, and asso-' "ciated with certain rites and observances there, than that the very ' "same fable, attended with similar observances signalized and per-' "petuated by similar changes and corrections of the calendar also, ' "critically accommodated to what had taken place in Egypt, in less ' "than fifty years afterwards should be found, merely in a different ' "dress and under a different name, in India, Phrygia, Cyprus, ' "Arabia, Greece, and elsewhere? in quarters of the world greatly ' "removed from Egypt, and between which and Egypt we should ' "not have supposed that, at this early period of the history of each,

'tions, however, are open to a good deal of doubt. 'The rites of Isis and Osiris, and of the Hindoo 'Durga, are the same as those of the German God-'dess of Death, of the Yucatan god *Mam* (the 'ancestor or grandfather), and of the Fiji god of 'Bulu, the world of spirits. All these deities, with 'Pluto, Ceres, and other funereal patrons of agricul-'ture, sprang from the primeval festival of first 'fruits and of the dead—a festival which was sub-'sequently converted into celebration in honour of 'a god, and yet still preserved through thousands 'of years its primitive and peculiar characteristics. 'Nor was the Hindoo calendar based on the astro-

' "there could have been any communication. The fact to which we ' "allude, however, is certain; being attested by the evidence of the ' "calendar itself.

' "At present, as our subject requires, we must confine ourselves to ' "the influence exercised by Egypt over its contemporaries in a much ' "less objectionable way; *i.e.*, as the centre of knowledge and science; ' "where all great and useful discoveries, all influential and perma-' "nent changes, in the principles or details of the reckoning of time, ' "first took their rise; and from whence they were extended to the ' "rest of the world."

' "It has been already explained that the earliest correction of the ' "primitive calendar among the Hindoos of antiquity was made ' "A.M. 2699, B.C. 1306, æra cyc. 2701: and that the first idea of this ' "correction must have been derived from the Egyptian (if correction ' "that could be called), which took place in Egypt B.C. 1350, æra cyc. ' "2657, along with the introduction of the worship of Osiris and ' "Isis; the proof of this connexion between the Egyptian correction ' "of earlier and the Hindoo one of later date being supplied by the ' "fact that the Hindoo correction was attached to the 17th of the ' "primitive Athyr, æra cyc. 2657; and that the Indian correction ' "was associated from that time forward with the worship of ' "Deunūs and Durga, as the Egyptian was with that of Osiris and ' "Isis; and that the Indian Deunūs and Durga were absolutely the ' "same kind of conceptions and impersonations in India as Osiris ' "and Isis in Egypt." '

'nomical science of the Egyptians; the arguments 'in favour of such a view would connect the calen-'dar of the Australians, the Pacific Islanders, the 'Mexicans, and the Celts with that of the Egyptians.

'This primeval calendar, with all its universal 'myths, was a heritage of all nations, and derived 'from the same common source to which the Egyp-'tians owed their knowledge of the primitive year.

'It appears that prior to B.C. 1306, the Hindoo 'festival of Durga, then attached as now to the 'autumnal equinox, and to the ninth day of the 'moon, had been regulated by some other system. 'From that time forth the new year's festival of 'Durga ceased to be regulated by the Pleiades, and 'became fixed by its relation to the tropical year.

'Let us suppose that the year having been sidereal, 'and therefore progressive, the new year's festival 'became fixed. It is manifest that unless the 'original system of the calendar were also changed, 'the months would still move onward as before, and 'the first month in 2000 years would become the 'second month, and the last month would become 'the first. This is exactly what we find to be the 'case. In B.C. 1306, the months first obtained their 'names, but these names the Hindoos state had re-'ference to contemporary astronomical phenomena. 'This Bentley assumes to have been the case. At 'that date, Cartica or Cartiguey, the month of the 'Pleiades, was the first month, and coincided then 'with our present October. Bailly, as we have seen, 'suggests that when that name was imposed, the 'year must have been in some way regulated by the 'rising or setting of the Pleiades in Cartica. I have 'already conjectured that Carticeya, the Hindoo god 'of war, was a mythical embodiment of the year of 'the Pleiades, and this I inferred solely from his 'name (which has apparently escaped observation 'hitherto) and from his emblems as they are given 'to us by Sir William Jones.

'But little question can exist that my conjecture 'is correct, as when it was made, the connexion of 'Carticeya with the beginning of the Hindoo year 'and with the month of Cartica was unknown to 'me. "Mr. Bentley has mentioned several facts '"connected with this month, and under this name, '"from which we may infer that it must have re-'"ceived its name at this time, or have been sup-'"posed to have done so. He tells us that to render '"this designation of Kartika, as the first month, '"the more remarkable, and the more effectually to '"perpetuate the memory of it, they fabled the birth '"of Kartikeya, the Hindoo Mars, or God of War, '"in this month, whom he considers nevertheless '"only a personification of the year, as beginning '"in this month."

'"We may perceive a reason for connecting the '"birth of their Mars with the autumnal equinox, '"because that was the beginning of the military '"season in India." On this point I trust a very 'different solution, suggested by me, will not be 'considered less satisfactory than that which I 'have quoted. At the festival of Kartikeya at 'beginning of October, "it was usual to represent '"him riding on a peacock; which Mr. Bentley ex- '"plains of his leading on the year, followed by the '"stars and planets in his train; and various '"epithets were familiarly applied to him, all '"founded on the same supposition of the relation of '"priority or precedence, in which he stood to the '"year, and to everything most closely connected '"with the year."

'Hence, we find that B.C. 1306, when the Pleiades 'culminated at midnight at the beginning of Octo- 'ber, the Hindoo year began with the month of the 'Pleiades; and that then, or soon after the festival 'of Carticeya, the god of the Pleiades was fixed at 'the beginning of Cartica, and was a new year's 'festival. Under these circumstances, after all that 'we have seen tending to this conclusion, it is 'difficult to avoid the inference, that as the Austra- 'lians must have celebrated their festival of the 'Pleiades B.C. 1306, at the time that the Hindoos 'held their festival of the God of the Pleiades, *they 'were each using a primitive calendar, which must 'have been inherited from a common source by the 'Egyptians, the Hindoos, the Aztecs, and the Aus- 'tralians.*

'But it is manifest that the Hindoo calendar still 'bears the evidence of its having been originally 'based on a sidereal and progressive year. In spite 'of the new year's festival becoming fixed to the 'autumnal equinox, the months have actually moved 'on in an equal ratio with the procession of the 'year of the Pleiades. Cartica, which began about 'the time of the culmination of the Pleiades at 'midnight, B.C. 1306, *i.e.* at the beginning of October, 'now begins in the middle of November in the 'Carnatic calendar, and in other instances near the 'time of the acronycal rising of the Pleiades, about 'the 19th of October. It has ceased to be the first, 'and has become the second month; and Aswina, 'the twelfth month of the year 3000 years ago, is 'now the first month.

'Nor was this progressive character of the 'calendar unknown to the Hindoos, who, however, 'like the Egyptians, and most nations of antiquity, 'for some strange reason, involved the subject in 'myths probably often unintelligible to the initiated 'themselves.

'Sir William Jones says, "Although M. de Gentil '"assures us that the modern Hindoos believe a '"complete revolution of the stars to be made in '"2400 years, or 44 seconds of a degree to be '"passed in one year, yet we have reason to think '"that the old Indian astronomers had made a more '"accurate calculation, *but concealed their know-* '"*ledge from the people under the veil of* 14 *Men-* '"*wantaras*, 71 *divine ages*, compound cycles and '"years of different sorts, from these of Brahma, to '"those of Patala or the infernal regions."

'Sir William Jones suggests that many Hindoo 'myths will be found to be astronomical truths, 'veiled under a garb of mystery, and he cites the 'following myth as probably referring to their 'calendar :—

'They believe that "in every 1000 divine ages, '"or in every day of Brama, 14 Menus are suc- '"cessively invested with the sovereignty of the '"earth; each Menu, they suppose, transmits his '"empire to his sons and grandsons, during a period '"of 71 divine ages; and such a period they call a '"Menwantara."

'Let us apply the primitive year of the Pleiades 'to this enigma, and the solution is perfectly clear. '*In every* 1000 *years* 14 *days are gained, and* 1 '*day is gained in every* 71 *years.*

'Hence it is plain that this must have referred to 'a sidereal year, which, it is equally evident, must 'have been the primitive year of the Pleiades.

'The same conclusions to which we have been 'led by an analysis of the dates of the festival that 'marked the season of "the Pleiades above," will 'follow also, I believe, from a careful examination of 'the times of observance of the second festival. As 'far as I have had data to guide me, I have found 'that in remote antiquity, in several instances, the 'latter was held more than a month earlier than the 'date assigned to it at the beginning of our era; 'and that hence it must have shared in the pro- 'gressive tendency of the primitive year.

'I believe it will be found that the evidence of 'the lunar and sidereal mansions of the ancients 'tends also in the same direction, as they seem to 'evince this progressive character in relation to the 'seasons, and to the natural year. For instance, 'Cartica (the Pleiades) which was once the first, is 'now the third Hindoo mansion. But this is a 'matter which I must leave to astronomers, or at 'least must reserve any further remarks for a future 'occasion.'

SIZE AND FIGURE OF THE EARTH; BY THE ORDNANCE SURVEY OFFICERS.

In the course of 1866 a noble volume was published by the Ordnance Survey Office at Southampton, under the direction of Colonel Sir Henry James, R.E., professing only to give 'comparisons 'of the standards of length of England, France, 'Belgium, Prussia, Russia, India, and Australia.'

This was indeed, in itself, a most important work for perfecting our knowledge of the size and shape of the earth; for the standards alluded to were the standard bars of reference employed by each of the above-named countries, in their measures of arcs of the meridian in their respective parts of the world; and they had never been thus directly and collectively compared before.

The comparisons appear to have been conducted with unrivalled skill by Captain A. R. Clarke, R.E.; and after he had brought his long labours therein to a successful conclusion, he appears, with all the zeal that might be expected from an accomplished mathematician, to have hastened to employ usefully these new and most exact data in correcting, where necessary, the results of all former arc-of-the-meridian measures; and thence deducing anew the chief elements for the size and figure of the earth.

Working as the learned Captain has done in this instance, with better and fuller materials than any of his predecessors, his results on this occasion must claim more confidence than any which have ever been put before the public; and they stand thus,—

ELEMENTS OF THE FIGURE OF THE EARTH.

		British inches.		French metres.
Polar semi-axis, ...	=	250,241,148·	=	6,356,068·
Equatorial semi-axis in longitude 15° 34′ East, ...	=	251,116,200·	=	6,378,294·
Equatorial semi-axis in longitude 105° 34′ East, ...	=	251,039,664·	=	6,376,350·

The Equatorial compression hence arising . . .	=	1 – 3270·
The greatest Polar compression being . . .	=	1 – 313·
The least " " . . .	=	1 – 286·
The mean " " . nearly	=	1 – 300·

Hence, too, it is computed, that the meridian quadrant passing through Paris, does not contain exactly 10,000,000 times the length of the standard French metre, but 10,001,472 times that quantity. And in fact there is another quadrant of the earth, very distant too from Paris, which may put in a claim for being more worthy than the meridian of Paris as a reference for the length of the French metre, viz., the quadrant in longitude 105° 34′ east; for that quadrant, Captain Clarke computes to be 10,000,024· metres long.

But this peculiar result depending on the last refinement in the theoretical treatment of earth measures, whereby the ellipticity of the equator has been, or is supposed to be, discovered,—and not being very overpoweringly attested to by all the numerical results, Captain Clarke computes these again on the older doctrine of a spheroid of revolution simply; and then finds, for

		British inches.		French metres.
The Polar semi-axis, . .	=	250,261,452·	=	6,356,584·
And the Equatorial semi-axis,	=	251,112,744·	=	6,378,206·

The Polar compression being nearly . . . . = 1 – 294·

and where *any* meridian quadrant will contain more than 1000 too many metres; or show the celebrated French standard of length to be most sensibly smaller than it is usually given out to be.

The above few numbers expressing the lengths of the several axes of the earth, contain the quintessence of all the best observations and measures which have been made towards that end by the whole human race, since the birth of modern science down to the present day. They are based therefore on such an enormous amount of work performed by the best men of all countries, and operating over a large part of the earth, that we may consider that no future more extended surveys are likely to alter the statements much. In fact, as a pure mathematician would like to have the earth described, he need go no further, or ask for no more, than the above numbers representing linear measures for showing size and shape.

But in the present day there are growing inquiries for something else of another kind; and therefore Sir Henry James has very properly added a notice on the *Specific Gravity of the Earth;* stating that Dr. Maskelyne in 1774, by observations on the attraction of the mountain Schehalien in Scotland, made that earth-quantity = 4·90 (times the weight of water); and that in 1855 a party of the Ordnance Surveyors under his, Sir Henry James's, direction, made similar observations on the hill of Arthur's Seat, near Edinburgh, and found the earth-quantity = 5·316.

Sir Henry James probably stopped at this point, because there were no other cases to mention of the earth's specific gravity being determined by Ordnance-Survey observations on British mountains. But he has thereby left us with a rather one-sided impression of what the real numerical value of that all-important physical feature is likely to be; for the Astronomer-Royal's experiment on the subject in the Harton Colliery pit,—in 1855 also,—gave 6·565; and the very extensive experiments of the late Francis Baily with the Cavendish apparatus, in 1842, gave 5·675; as described in the fourteenth volume of the Memoirs of the Royal Astronomical Society; and in the opinion of many persons, forming the closest approach to this truth as it is in nature, that has ever yet been attained by any one experimenter.

The quantities are evidently all rather rough, in spite of their being taken to three places of decimals, and it is to be hoped that posterity will obtain better and smoother results; but meanwhile we may assuredly expect that the true quantity in fact will be closer to a mean of the whole of the above statements, than to the mountain observations quoted, only. And if we assign half weight to the earliest observation on account of its rudeness,—the mean of the whole variety of results now brought together, comes to 5·7; which numbers we prefer therefore to adopt, as the best interim determination for the specific gravity, or 'mean density,' of the whole earth.

ON THE SACRED HEBREW STANDARDS OF WEIGHTS AND MEASURES.

THE SACRED CUBIT.

Some preliminary knowledge of this subject is necessary in following out any discussion of Great Pyramid metrology; and as the authorities are often not easy to refer to, very various in their conclusions, and rather imperfect in one or two points,—a condensed statement of how the question may now be considered to stand, will probably not be unacceptable to the general reader.

In each department of the old Hebrew metrology, the names and *relative* values of the measures, are comparatively easy and certain to arrive at; but the *absolute* values, extremely difficult. Thus in linear measure,—the chief standard of length, without doubt amongst all authors is by name the *cubit*; and as that word appears again and again in the Hebrew Scriptures, all readers of the Bible feel assured that it does express a sacred measure of length.

But the moment we apply to any of the same authors for the actual *length* of such cubit, in terms of some known modern measure, as British inches,—they, the authors, are found at variance with each other, and differing in their asserted values, anywhere between 42 and 12 inches. The reasons for these immense discrepancies are partly,—that there is, in the Bible, no simple mention upon which the absolute length of any cubit can be at once determined; and, partly,—that in the course of the long scriptural history there inscribed by a series of different hands, during a long succession of ages and continued reconstructions of the Hebrew nation on various models, and in many lands,—two and even three different cubits are alluded to. Hence arises a necessity for distinguishing the dates, or occasions when each separate cubit was employed; and from such investigation pursued by many explorers, has arisen a very extensive belief as to one particular length of cubit having been, more than any other, the cubit of the inspired founders and directors of the Israelite people.

What, then, was the length of *that* cubit, to be called, for distinction's sake, as well as of its own right, 'the sacred cubit?'

The venerable Bishop Cumberland, of Peterborough, in 1685,—whose idea of Scripture 'weights 'and measures,' is printed as an appendix to many of the Bibles published by authority in this country,—despairing of any more certain or direct process,—merely *imagined*, that the sacred cubit must have been the same as the old idolatrous Egyptian cubit;

and then adopted the only published length of *that* standard, which he could get,—unfortunately a very erroneous one, viz., 21·888 British inches,—for the length of the sacred cubit of the Bible.

The Rev. J. R. Beard, D.D., in Dr. Kitto's *Bible Cyclopædia*, 150 years after Bishop Cumberland, has found no better principle of research or method of discovery ; for he says, plainly and precisely,—
'As we have no unit of measure given us in the
'Scriptures, nor preserved to us in the remains
'of any Hebrew building, and as neither the Rab-
'bins nor Josephus afford the information we want,
'we have no resource but to apply for information
'to the measures of length used in other countries.
'We go to the Egyptians. The larger Egyptian
'cubit contained about 234·333 Parisian lines, the
'shorter about 204·8. According to this, the Hebrew
'measures of length were these—

'Sacred cubit, = 234·333 Parisian lines = 20·81 British inches.
'Common cubit, = 204·8 Parisian lines = 18·19 British inches.'

Again, the Rev. William Latham Bevan, M.A., in Dr. Smith's *Dictionary of the Bible*, goes over nearly the same ground, adding thereto the determinations of several modern German scholars,—very ingenious, though on equally irrelevant data to anything either contained in the Scriptures, or connected with the Hebrews ; and,—after hinting that the sacred cubit *may* be only 15, and *possibly* not more than 12 inches long,—concludes finally for a length equal to 19·0515 British inches.[1] He also declares that its origin must probably have been trivial and unimportant; being most likely derived from some parts of the human body, as with the measures of other then contemporary nations.

Now while these several authors themselves confess that their materials are insufficient for a safe conclusion, and do bring out such mutually conflicting, and generally uninteresting results,—it has been a matter of extreme surprise to us, that none of these eminent men have taken the smallest notice of the admirable *Dissertation* by Sir Isaac Newton *on Cubits*, reproduced in this volume, pp. 341-366; and alike noticeable for the author, the thoroughness of his treatment of the subject, and the grandeur of the result there brought out for the sacred Hebrew standard—*when still further examined by the light of modern science, as it has advanced since Sir Isaac's day.*

One of the proximate causes of Sir Isaac's remarkable success, in having apparently reached the true, and only, foundation on which subsequent investigators can build securely,—seems to have been,—his clear perception of the radical antithesis, in ideas,

[1] This is by no means a solitary instance amongst writers on Hebrew metrology,—immediately after declaring that they are uncertain to the amount of several units,—yet adopting and insisting on one particular length, exactly defined to the 1-10,000th part of one of the same units. But it is not an honest representation of the state of the subject to set before weaker brethren; who are led to believe that there can be but little more to discover, where the required length appears to be already known to the hundredth part of a hair's-breadth.

association, employment, and more particularly, in the essence of length,—though their names as *cubits* were the same, — between the 'sacred Hebrew 'cubit,' and the 'profane Egyptian cubit.'

The latter he proved to have been very nearly 20·7 inches in length: and our measures on p. 341, indicate that he was remarkably close to the truth.

But the former cubit he finds very different, and by his five successive methods of approach ascertains to be—

First, between	.	23·28	and	27·94	British inches.
Second, ,,	.	23·3	,,	27·9	,,
Third, ,,	.	24·80	,,	25·02	,,
Fourth, ,,	.	24·91	,,	25·68	,,

and Fifth, somewhere near 24·82.

The mean of all which numbers amounts to 25·07 British inches.

The sacred cubit, then, of the Hebrews, in the time of Moses—according to Sir Isaac Newton—was equal to 25·07 British inches, with a probable error of perhaps $\pm$·1. And what do we find within those limits, and therefore perfectly without the Egyptian cubit?

Why this really glorious consummation for the geodesical science of the present day to have brought to light (and first through the late John Taylor), viz., that a length of 25·025 British inches, or practically the sacred Hebrew cubit, is exactly one-ten-millionth of the earth's semi-axis of rotation; and that is the very best mode of reference to the earth-ball as a whole,—for a linear standard through all time,—that the highest science of the existing age of the world has yet struck out, or can imagine. In a word, the sacred cubit thus realized forms an instance of the most advanced and perfected human science, supporting the truest, purest, and most ancient religion ; while a linear standard, which the chosen people in the earlier ages of the world were merely *told* by maxim to look on as sacred, compared with other cubits of other lengths,—is proved by the progress of human learning, in the latter ages of time, to have had, and still to have, a philosophic merit about it, which no men or nations at the time it was first produced, or within several thousand years thereof, could have possibly thought of for themselves.

Hence we feel bound to give a fair hypothetic trial, connected with *all* Hebrew weights and measures, to Sir Isaac Newton's length of the sacred cubit,—say 25·025 British inches,—and to its being the necessary beginning, exponent, example, and inseparable accompaniment everywhere of the sacred system. If we are wrong in so doing ; *i.e.*, if the length given above is *not* the real length of the sacred cubit, nor anything at all near it,—we shall soon be convicted of our error, on attempting to deduce the sacred Hebrew measures of *weight* and *capacity* therefrom ; instead of from the 22·, or 19·, or 15·, inch cubits of other men. But if we are right, something else, also noble and pointedly convincing of a more than human origin, for those measures, *may* be expected to appear. Let us first however inquire what general investigation may have been doing in these further divisions of the subject.

SACRED HEBREW CAPACITY STANDARD.

John Taylor has shown very successfully[1] that the Hebrew weights were derived from their capacity measures, or from the contents of those vessels when filled with rain-water. And as the Bible informs us that the 'bath,' or capacity measure for liquids, was the same as the 'ephah,' or capacity measure for dry-goods,—our inquiry is narrowed down to ascertaining what the standard for Hebrew capacity was, in terms of modern British measure.

As with the cubit, we find here also that the names and *relative* values of the different ancient capacity measures, are easy to discover; especially when the Bible assists us with a remarkable part of the arrangement in decimals; or that

10 omers = 1 ephah;
and 100 omers = 10 ephahs = 1 homer or chomer.

To these, some smaller divisions have been supplemented from the accounts of the Rabbinists, as that

1 ephah = 3 seahs = 6 hins = 18 cabs = 72 logs;

while a more important step in the scale,—not only because it refers to a larger quantity, but because its proportions are stated in the Bible,—has been added by John Taylor, viz., the laver = 40 ephahs

[1] '*The Great Pyramid. Why was it built, and who built it?*' pp. 164-173.

or baths. Hence a complete table of the relative values of generally admitted Hebrew capacity measures, stands thus, beginning with the largest,—

Laver, . .	1							
Homer or chomer,	4	1						
Bath or ephah, .	40	10	1					
Seah, . . .	120	30	3	1				
Hin, . . .	240	60	6	2	1			
Gomer or omer, .	400	100	10	$3\frac{1}{3}$	$1\frac{2}{3}$	1		
Cab, . . .	720	180	18	6	3	$1\frac{4}{5}$	1	
Log, . . .	2880	720	72	24	12	$7\frac{1}{5}$	4	1

Many, nay most, of these subdivisions are Rabbinistical only, and not of any direct importance in the *sacred* system; wherefore the real problem before us now is, to determine the *absolute* value of any one in the series; and then to pick out the sacred *standard*.

Now here again, at this *absolute* point of these capacity measures, just as with the same feature of the cubit, comes the excess of our difficulty; for nothing yet recognised in the Bible has been held to throw any light on the matter.

In dearth, therefore of the proper information, some inquirers, as Bishop Cumberland in former, and M. Boeckh in latter, times, make everything depend on a statement of Josephus that an ephah was equal to an '*Attic Metretes;*' and while some contend with each other on what the value of that measure was, others aver that Josephus was not familiar with the Greek measures, and really meant a '*medimnus.*' Others still, prefer a statement of the Rabbinists,—that 1 log = 6 hen-eggs; and M. Thenius having ascertained their cubical contents by the quantity of water they displaced, and having also confirmed that observation by a reference to the stated weight of 1 log of water being equal to 61 barley-corns—announces that

	British cubic inches.
1 bath = 4·43 English gallons, ...	= 1239·

while M. Boeckh announces

1 bath = 8·67 English gallons, ...	= 2434·

and Bishop Cumberland announces

1 bath = 7 wine gallons 4 pints 15 cubic inches,	= 1748·

The mean of all these very different results, gives—

1 bath, ...	=	1,807 British cubic inches,
1 homer, ...	=	18,070 ,,
and 1 laver, ...	=	72,280 ,,

probably not very far from the truth.

Now John Taylor had his reasons for considering the laver = 71,329 British inches; and we are inclined to add, that if,—in terms of inches, each ·001 longer than a British inch, and of which longer inches the sacred cubit held 25,—the laver should be found to contain 71,250 cubic inches—or abundantly within the three measured determinations above given—it would be most remarkable as an expression for the *capacity and specific gravity* of the whole globe of the earth,—a problem of surpassing difficulty even to the most advanced science of the present day, yet precisely apposite to the purpose in hand, and ennobling to the soul of man to contemplate. (Vol. iii. p. 152.)

But such a result is not to be admitted, except on data much more precise than any of those above quoted; and we have not had as yet any Bible authority at all, for the absolute value; nor for the laver being considered, more than any other size of vessel, the *standard* of the system; from which standard, the other mentioned measures are derivations only for common purposes. Yet, such testimony exists, as we believe, in Sacred Scripture, and in rigorous connexion with the linear proportions of the sacred cubit, as already laid down; and thus,—

Of all the contents of the Tabernacle of the Congregation, prepared by Moses in the wilderness, none was so sacred as '*the Ark of the Covenant*.' It was kept in the Holiest of Holies; occupied its chief space; and was never to be looked on by any but the High Priest alone, even during a journey. Near it was placed an ephah measure; and outside its compartment, as Michaelis has shown, were various other standards of measure; but no metrological purpose, that we are aware of, has hitherto been assigned to the ark itself. As its original name, '*arca*' implies, it was a box or chest: and its first stated purpose as such, was,—to hold the Divine autograph of the law written on stone.

This box, made of shittim, or acacia wood, was lidless; though a crown of gold was afterwards added round about the rim, and a separate or loose lid was made for it of pure gold, called the mercy-seat. The actual seat, however—said to be occasionally occupied as a throne by an expression of the Divine presence—was not that lid; but was formed by the wings of two winged angels, constructed in gold at either end of the lid; which lid, at such time, together with the ark below, then *formed the footstool.*[1]

With the lower part only of this arrangement, or the ark, have we to do; and that was in itself (the loose, upper, lid of gold being removed), merely a lidless box, made of a hard and tough wood, derived from a tree common to the hills of Sinai.

Such a shape and material are not unusual for large vessels of capacity measure. But then, what was the size of this one? The Scriptures say, 2·5 cubits long, 1·5 cubit broad, and 1·5 high.

Was this outside measure, or inside measure? Outside without doubt; *first*, because, on the latter supposition, the vertical component of the proportions would inevitably have been spoken of as *depth*, and not *height;* and *second*, because the lid, or mercy-seat being made,—as duly stated in the same place, of only the *same length and breadth* as the open box of the Ark,—would infallibly have

[1] 'The lid or cover of the ark was of the same length and breadth, and made of the purest gold. Over it, at the two extremities, were 'two cherubim, with their faces turned towards each other, and in'clined a little towards the lid (otherwise called the mercy-seat). 'Their wings, which were spread out over the top of the ark, formed 'the throne of God, the King of Israel, while the ark itself was 'the footstool (Exodus xxv. 10-22; xxxvii. 1-9).'—Kitto's *Bible Cyclopædia*, p. 214.

tumbled down into it, if that length and breadth had applied to that box's inner, and not its outer dimensions.

Hence, with the length of the sacred cubit in our hands, we can immediately approach exceedingly near to the exact cubical contents of the ark. For, although the thickness of its sides is not mentioned in Scripture,—a knowledge of the size, shape, and material of the whole, being already given,—the limits within which such thickness must be found, are left very narrow indeed.

Let the thickness be assumed, for instance, 1·8 inches; and these inches similar to those, of which the sacred cubit contains 25, and the semi-axis of the earth's rotation 250 millions;—then the length, breadth, and depth, will be reduced from an *outside* of 62·5, 37·5, and 37·5 inches, to an *inside* of 58·9, 33·9, and 35·7: the continued multiplication of which three last quantities gives, 71,282 cubic inches for the capacity contents of the box.

Or, if we consider the sides and ends 1·75 inch thick, and the bottom 2 inches,—also very fair proportions in carpentry,—then the inside measures are 59·0, 34·0, and 35·5; which yield for their cubical contents, 71,213 inches. Mean = 71,248.

Thus in any mode, almost, of practically constructing the ark-box, on the data given in the Bible, taken in conjunction with Sir Isaac Newton's length of the *sacred* cubit,—as opposed to the profane cubits of Egypt, Phœnicia, Greece, and Rome, we come extraordinarily close upon that most important number of 71,250 cubic inches. And that is not only very near to the *mean* of all men's determinations of the contents of one Hebrew *laver*, or forty Hebrew *baths*; but is the very amount also of the coffer in the Great Pyramid,—which building, though in Egypt, will be shown in vol. iii. to have been composed for purposes much more anti- than pro-Egyptian; and without that nation's intelligent understanding, or concurrence. But here it is enough to remind, that the precise theoretical cubic-contents value already mentioned, is so remarkably expressive of the bulk and constitution of the earth as a whole,—that the stated use of the 'ark' under circumstances of Divine presence, *as a footstool*,—instantly brings to our minds the words of the Lord in Isaiah, and repeated in Acts, 'the 'earth is my footstool.'

When such remarkable earth-commensurabilities in size and internal physics, then, are assignable by modern science to the *ark* (of the Covenant), on the Scripture statement of its dimensions,—and when we add thereto the transcendently sacred character assigned by Moses to it, and the extraordinary means applied to its preservation,—we are *obliged* to consider it as the grand standard, and significant origin, of all the other Hebrew measures of capacity, which were allowed to be derived by various subdivisions from it.

The brazen lavers of Solomon, then, which were each of them of the same *relative*, or stated size as the ark,—*i.e.*, forty baths in contents,—may be considered merely copies of the more ancient ark, as to cubical bulk, for common metrological and other purposes; and may, in so far, remain at the head of our practical table, while their more precious original is only to be referred to on important occasions.

THE MOLTEN SEA.

If the above principles are correct,—they may throw some light on a very much larger measure of capacity still, once in use among the Hebrews for sacred purposes,—viz., the '*Molten Sea*:' that huge vessel cast in bronze by King Solomon,—and which has been restored, imaginatively, of almost every possible shape and size by various modern essayists, —but not connected by them with any very certain principles, or direct application of the sacred standard; while the notices of it in the Bible itself, are rather conflicting.

Thus, for the *relative* value of its contents,—they are stated in Kings to be 2000, and in Chronicles 3000, baths. But inasmuch as the account in Kings is much more full than that of Chronicles,— and in Kings alone is given at the *same time* the contents of the laver in baths also,—we shall secure ourselves from perhaps referring to a profane Egyptian or some other size of bath, if we conclude that the contents of the Molten Sea were 2000 of *those baths of which the laver held* 40 ; or that in fact the Molten Sea was equal, in cubic contents, to fifty times one Laver ; and one Laver was equal to the Ark of the Covenant ; whose cubic contents in inches we have shown to be as nearly as possible 71,250.

But then, how does the *absolute* size of the Molten Sea, as given by Bible-stated linear measure, accord with such a deduction ?

We read in 1 Kings vii. 23-26, 'And he made a 'molten sea, ten cubits from the one brim to the 'other : it was round all about, and his height was 'five cubits ; and a line of thirty cubits did com- 'pass it round about. . . . And it was an hand- 'breadth thick : . . . it contained two thousand baths.'

The first point to be ascertained, is the general figure ; and here, though some good men have imagined a cylindrical shape, and some a swelling caldron form,—we are inclined to agree with the greater number of all inquirers, who are for a *hemisphere*. For to such a figure the expression 'round 'all about,' conjoined with a diameter given 'from 'brim to brim,' and that diameter equal to twice the height,—seems best to apply ; besides such a figure being the most appropriate shape for a large vessel, as this was, of *cast brass*. Josephus, moreover, adds his testimony, whatever that may be worth, again and again, expressly stating that the 'Molten Sea' *was* of a hemispherical form.

There then remains only the one further difficulty, viz., that the circumference of the vessel is stated at thirty cubits; when, if the diameter of its brim had been really ten cubits, with a circular plan,—the circuit must necessarily have been 31·4159, etc., cubits.

It would seem to be probable, however, that the thirty cubits circumference applies to the *interior* measure; while the ten cubits breadth, coupled with the five cubits *height,* in place of *depth,* evidently allude to *exterior* measures, as explained in the similar case of the Ark. Such too, appeared in a manner of itself, on applying the thickness of 'a 'handbreadth' (deduced from a practical handling of a 25-inch cubit, and a liberal interpretation of the mere term, as meaning five inches or a little more); for, on decreasing the ten cubits diameter by that quantity on either side, the remainder was almost exactly the diameter of a circle, whose circumference measured the thirty cubits actually recorded.

Hence, then, we have to compute the cubical contents of a hemispherical hollow, whose diameter is, not ten sacred cubits or 250 inches, but 238·73 inches only; and such quantity, in the same inches cubic, amounts to 3,562,070; and divided by 50, gives 71,241.

That is, the Molten Sea contained (under the circumstances, within a microscopic quantity of difference), fifty times the contents either of the most sacred *Ark of the Covenant* standard of Hebrew capacity measure; or of the *Coffer* of the anti-Egyptian, and entirely un-idolatrous, Great Pyramid; *i.e.*, 71,250 cubic Pyramid inches.

So huge a vessel might perhaps be looked on by many persons as a mere solitary wonder, and no part of a regular system of capacity measures. But at the Great Pyramid, there is a space marked off to indicate a very large amount of cubical contents; utterly different in shape from King Solomon's brazen sea,—yet, when neatly and accurately measured, it is found to contain close on the same amount of cubical contents as that, or fifty times 71,250 cubic Pyramid inches. (More exactly, between 71,178 and 71,292; see vol. iii. p. 168.) At the Great Pyramid, too, the chamber space alluded to, fills so important a part, both in extending the practical application of the metrological system there embodied, and in pointing to its high origin and noble purposes,—entirely unknown to any Egyptians,—that we may safely thence infer, that 'the Molten Sea' of the Scriptures, is likewise no accidental or extraneous feature in the sacred Hebrew metrology; but will be found to fulfil purposes, and to have been framed with a wisdom,—as already shown in the case of both the sacred cubit and the Ark of the Covenant,—fully to justify the place which it occupies in Holy Writ.

END OF VOL. II.

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