ASIATICK RESEARCHES:

OR,

TRANSACTIONS

OF THE

SOCIETY;

INSTITUTED IN BENGAL,

FOR ENQUIRING INTO THE

HISTORY AND ANTIQUITIES, THE ARTS, SCIENCES, AND LITERATURE,

OF

ASIA.

VOLUME THE TWELFTH

CALCUTTA:

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1816.

LETTER from the Right Honorable the Governor General to the President, transmitting the following communication.

Fort St. George, 3d January, 1810.

SIR,

I have the honour to transmit to you for the purpose of being laid before the Asiatic Society, a paper which I have received from Major William Lambton of H. M. 33d Regiment of Foot, entitled, "An account of the measurement of an Arc on the Meridian, comprehended between the latitudes "8° 9′ 38″.39 and 10° 59′ 48″.93 North, being a continuation of the grand Meridional Arc, commenced in 1804, *and extending to* 14° 6′ 19″ *North."*

I have great pleasure in being the channel of communicating to the learned Society a paper containing matter of such high importance to the interests of science, and furnishing so many new proofs of the eminent endowments and indefatigable exertions which have long distinguished the character and labours of its respectable and meritorious author.

I have the honour to be, Sir,

Your obedient humble servant.

MINTO.

Hon. H. T. Colebrooke, &c. &c. &c.

CONTENTS OF THE TWELFTH VOLUME.

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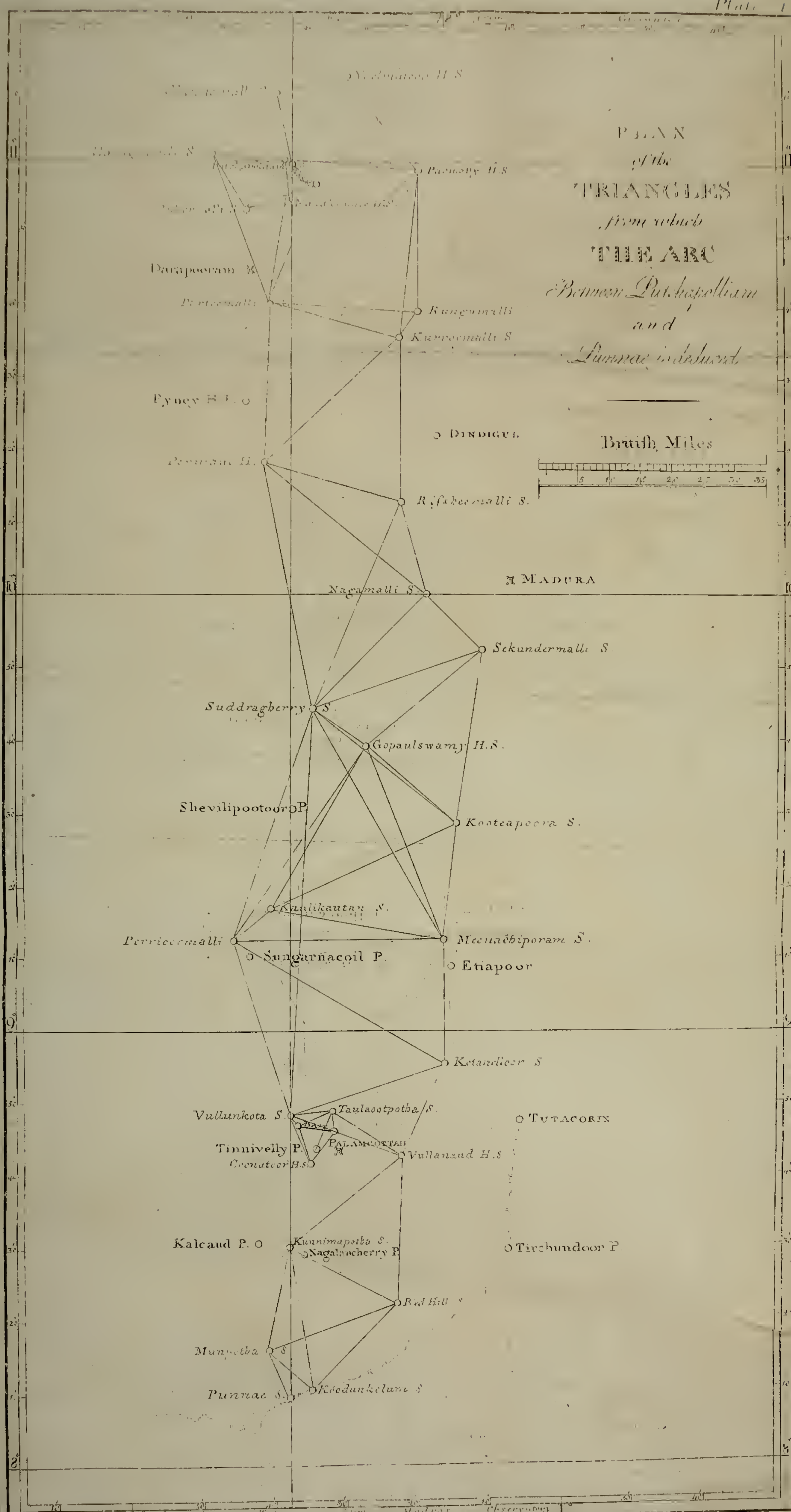
LIST OF PLATES.

☞ A plan of the Lake *Mánasaróvara*, and a drawing of the Camphor plant, will be given with the next volume.

☞ *For* "By the President," *read* "By H. T. COLEBROOKE, Esq."

Plate 1


PLAN
of the
TRIANGLES
from which
THE ARC
Between Putchapollium
and
Punnae is deduced
British Miles
Madura
Dindigul
Pulnsey H.S.
Rungumalli
Kurreemalli S.
Darapooram
Pyney H.L.
Rishbeemalli S.
Nagamalli S.
Sekundermalli S.
Suddragberry S.
Gopaulswamy H.S.
Shevilipootoor P.
Kooteapoora S.
Perricoomalli
Sungarnacoil P.
Meenachiporam S.
Etiapoor
Ketandioor S.
Vullunkota S.
Taulaootpotha S.
Tinnivelly P.
Palamcottah
Vullanaud H.S.
Tutacorin
Kalcaud P.
Kunnimapotha S.
Nagalancherry P.
Tirchundoor P.
Red Hill
Munpotha S.
Punnae S.
Koodunkelum S.

TRANSACTIONS

OF THE

ASIATICK SOCIETY.

I.

An Account of the measurement of an Arc on the meridian comprehended between the latitudes 8° 9′ 38″.39 and 10° 59′ 48″.93 North, being a continuation of the grand meridional Arc, commenced in 1804, and extending to 14° 6′ 19″ North.

By Major WILLIAM LAMBTON,

33d Regiment Foot.

In a paper which I communicated to the *Asiatick* society, and which was published in the tenth volume of the Researches, I took an opportunity of noticing that a meridional arc had been measured upwards of three degrees in amplitude. Being in expectation that the detailed ac-

count of that measurement would be transmitted to the Royal Society by the honorable the Court of Directors; I have given no particulars of it here, but shall only notice the general results as combined with the operations hereafter mentioned. These meridional measurements being the chief foundation of the trigonometrical survey, which has been carried on under my direction for some years past, it is to be hoped that the *East-India* company will be desirous of having them published along with the general account of the survey. But such a work being arranged in a great measure according to the order of time, must exhibit what is purely scientific, in a detached and mutilated from; it is therefore my intention to collect, at some future period, all the particulars that regard the comparison of celestial and terrestrial arcs, and digest them in a manner better prepared for the learned reader. The present period is replete with splendid performances in practical science, and although their objects be different, yet there result from each of them certain facts that tend to throw new light on various philosophical subjects. The grand operations in *France*, conducted by the celebrated De Lambre and Mechain, have for their object the determination of a standard measure; but, to accomplish that, they have measured an arc on the meridian upwards of nine degrees in length. The chief intention of the great survey in *England*, under Col. Mudge, is to obtain a correct plan of the Island of *Great-Britain*, and the geographical positions of all known places, in latitude and longitude. In carrying this into effect, it was necessary to have a series of triangles in the direction of the meridian, from which has been deduced an arc of $2^{\circ}\ 50'\ 23''$, which is to be extended northerly. The principal object of my own labours, when this work was first proposed to the *Madras* government, was to connect the two coasts of *Coromandel* and *Malabar*, and to determine the latitudes

and longitudes, of the principal places, both on the coasts and in the interior. The original design has been vastly enlarged, and, in addition to the triangles carried across the Peninsula, between the latitudes of twelve and fourteen degrees, another series has been extended from *Tranquebar* and *Negapatam*, entirely across to *Paniany* and *Calicut*; and to render the skeleton complete, a meridional series has been carried down the middle of the Peninsula, terminating at the sea near *Cape Comorin*, from which have been extended other serieses, to the east and west, entirely along both the coasts. From the above mentioned meridional series, I have deduced an arc of nearly six degrees in amplitude. The members of the *Swedish* academy have likewise been performing a similar work; but the sole intention of that was, the measurement of a degree at the polar circle, as a test to the one executed by MAUPERTUIS and his associates. These various performances have afforded the learned world the most extensive and the most accurate data hitherto obtained, for determining a question of great importance in physical astronomy, viz. the dimensions and figure of the earth. This circumstance being involved in many abstruse speculations, relating to the precession of the equinoxes, the nutation of the earth's axis, the parallaxes of the moon, &c. &c. it has been found expedient, in order to make the theory agree with the observations of astronomers, to adopt a figure whose ellipticity was from $\frac{1}{300}$ to $\frac{1}{320}$, in place of $\frac{1}{230}$ given by Sir I. NEWTON; and various experiments, with pendulums in different latitudes, seemed to justify the measure. It will appear in the sequel of this memoir, how far the recent measurements may be relied on in computing according to the elliptick theory; and certainly, from the great length of the arcs and their remoteness from each other, more reliance may be placed in computation

drawn from them, than from any experiments made by such pendulums as have been generally used for those purposes.

The arc, which is the subject of this communication, is a continuation of the same meridian line, whose position was determined at the station of *Dodagoontah* in *Mysoor*, in 1805, and is the meridian on which the former arc was computed. The present arc commences at *Putchapolliam* station in *Coimbetoor*, where the former one terminated, and concludes at *Punnae* near *Cape Comorin*. The positions to the southward fall very favorably, and the place of observation at *Punnae* is only 98.2 feet east from the meridian of *Dodagoontah*. There is one station (*Permaul malli*) on a very lofty mountain, which has not yet been observed at, on account of the difficulty in getting at it; and besides, the season when I was in *Coimbetoor* was not favorable for ascending such high places. In consequence of this, there are four triangles wherein only two angles in each have been observed; an omission which at present must be dispensed with; but the base of verification near *Tinnivelly* will shew that no important error has crept into the operations.

The measurement of the base line in *Coimbetoor*, and the observations for the zenith distances of stars, were completed in the beginning of 1806; but I have recorded them at full length here, as being the commencement of this section of the grand arc. The base near *Tinnivelly* was measured early in the present year, and the triangles continued to the southern station near the sea beach, a few miles east from the lines of *Travancore*. At this station, I sat down to observe the same stars, which had been observed at *Putchapolliam*, and with equal success. Having finished there, I returned to *Palamcottah*, with an intention of making another set of observations, and for that purpose I erected a small observatory on the

rampart of the fort, to be secure against the high winds; but the badness of the weather, occasioned by the setting in of the west monsoon, rendered all my endeavours fruitless. I have, however, reason to hope that the observations which have been made at the extremities of the arc, will be thought satisfactory.

The length of the degree due to the middle point of this section of the arc, or latitude 9° 34′ 43″, is found to be 60473 fathoms nearly. Now it may be proper to notice here, what has already been noticed in giving an account of the former arc, that between *Dodagoontah*, in latitude 13°, and the station at *Bomasundrum*, in latitude 14°, there is a vein of iron ore, which was supposed to have affected the plummet, as some irregularity appeared to exist in the observations at those places. The arc *Putchapolliam* and *Dodagoontah* gave the length of the degree for latitude 11° 59′ 54″ equal 60529 fathoms, and the arc between *Putchapolliam* and *Bomasundrum* gave the degree only 60449 fathoms reduced to the same latitude on the elliptick hypothesis. Seeing such a disagreement, it was necessary to recur to the nature of the country, as both those stations are sufficiently remote from mountains to remove any apprehension of a disturbance from them. But since no doubt remained as to the existence of some disturbing cause, I attributed it to the effects of this bed of ore, and concluded that the plummet had been drawn to the northward while observing at *Dodagoontah*, and to the southward while at *Bomasundrum*, which would give the celestial arc between *Putchapolliam* and *Dodagoontah* too little, and that between *Putchapolliam* and *Bomasundrum* too great, the reverse of which would take place with respect to the length of the degrees in these two arcs. Being confident as to the accuracy of the observations at both places, and considering the circumstances just

mentioned, I thought it reasonable to take the mean of the two degrees, which gave 60490 fathoms nearly, for the length of the degree in latitude $11^{\circ}\ 59'\ 54''$.

Whatever may have been the cause of irregularity in the observations made at *Bomasundrum* and *Dodagoontah*, the errors occasioned thereby must be considerably reduced when the whole arc, including the present measurement, is taken into account. I shall therefore take notice here what the general result gives, by comparing the arcs *Punnae* and *Dodagoontah*, *Punnae* and *Bomasundrum*, and *Punnae* and *Paughur*, which last place was also a station of observation in the former part of the operations.

It appears from art. 8. that the celestial arc between *Punnae* and *Putchapolliam* is $2^{\circ}\ 50'\ 10''.54$; and the celestial arc between *Putchapolliam* and *Dodagoontah*, by the observations in 1805 and 6, was $2^{\circ}\ 0'\ 9''.79$; and therefore, the sum is $4^{\circ}\ 50'\ 20''.33$, equal to the celestial arc between *Punnae* and *Dodagoontah*. The terrestrial arc between *Punnae* and *Putchapolliam*, is 1029100.5 feet, to which add 727334.6 feet, the terrestrial arc between *Putchapolliam* and *Dodagoontah*, we have 1756435.1 feet or 292739.2 fathoms, which compared with $4^{\circ}\ 50'\ 20''.33$ will give the mean length of the degree, equal 60496 fathoms for latitude $10^{\circ}\ 34'\ 49''$, the middle point of the arc.

The former celestial arc between *Putchapolliam* and *Bomasundrum* was $3^{\circ}\ 0'\ 1''.88$, to which add $2^{\circ}\ 50'\ 10''.54$ gives $5^{\circ}\ 50'\ 12''.42$; and the terrestrial arc between *Putchapolliam* and *Bomasundrum* 1088275.8 feet, to which add 1029100.5 feet, gives 2117376.3 feet, or 352896 fathoms nearly, which compared with $5^{\circ}\ 50'\ 12''.42$, gives 60462 fathoms for the mean length of the degree in latitude $11^{\circ}\ 4'\ 44''$ nearly, the middle point of the arc.

AGAIN; the celestial arc between *Putchapolliam* and *Paughur* was observed to be $3^{\circ}\ 6'\ 37''.78$, and the celestial arc between *Punnae* and *Putchapolliam* is $2^{\circ}\ 50'\ 10''.54$, whose sum is $5^{\circ}\ 56'\ 48''.32$ for the whole celestial arc. The terrestrial arc between *Putchapolliam* and *Paughur* was 1128472 feet, to which add 1029100.5 feet, we have 2157572.5 feet, equal 359595.4 fathoms, and this compared with $5^{\circ}\ 56'\ 48''.32$ gives 60469 fathoms nearly, for latitude $11^{\circ}\ 8'\ 3''$ the middle point of the arc.

As the two last arcs are nearly of the same length, and the results differ but little, it has been thought sufficiently correct to take the mean of the two degrees as the measure due to the mean latitude of the two middle points, in which case we have 60466.3 fathoms for the length of the degree in latitude $11^{\circ}\ 6'\ 23''.5$.

IN order to get a mean result between the observations made at *Dodagoontah* and these two latter stations, the degree in latitude $10^{\circ}\ 34'\ 49''$ has been taken and used with the degree in latitude $52^{\circ}\ 2'\ 20''$ equal 60820 fathoms; and with these the ratio of the earth's diameters has been computed, and found to be as 1 to 1.0030359 (art. 2 appendix); and thence the length of the degree in latitude $11^{\circ}\ 6'\ 23''.5$ has been found to be 60498 fathoms: therefore the mean between this and 60465.5 is 60486.75 fathoms: or, to avoid decimals, it has been called 60487 fathoms for latitude $11^{\circ}\ 6'\ 24''$.

THIS mean measure has been used with the degree in latitude $52^{\circ}\ 2'\ 20''$ and the ratio of the earth's diameters again computed, and the polar and equatorial diameters are found to be as 1 : 1.0031429, and I have made use of this for determining the lengths of degrees in different latitudes, by which the latitudes of all the great stations of observations in

bringing down the grand arc, have been finally fixed. And here it may be proper to observe, that in the tenth volume of *Asiatick Researches*, I have mentioned the latitude of *Dodagoontah* to be $12^{\circ}\ 59'\ 59''.91$ as determined by nine stars from the *Greenwich* observations of 1802; and from that, the latitude of the observatory at *Madras* was deduced, and was found to be $13^{\circ}\ 4'\ 8''.7$. But if it be allowed that the plummet has been drawn to the northward while observing at *Dodagoontah*, the observations at that place would give the latitude less than it really is. Under this conviction, I have made *Punnae* the fixed latitude which was determined by eight of the same stars that were observed at *Dodagoontah*, and was found to be $8^{\circ}\ 9'\ 38''.39$, and by setting off from that parallel, and computing according to the lengths of the degrees given in art. 3, Appendix; the latitude of *Dodagoontah* is found to be $13^{\circ}\ 0'\ 1''.9$ which is 2 more than before, and therefore the latitude of the observatory at *Madras* as deduced from that of *Dodagoontah*, will be $13^{\circ}\ 4'\ 11''$ nearly.

After the deductions enumerated in this summary, the whole of the measurements both in *England*, *France*, and at the polar circle, have been compared, by using the degree in latitude $11^{\circ}\ 6'\ 24''$, being the most southern of the recent operations; and from these different data, three ellipticities have been computed, and the mean taken, which will give an ellipsoid whose polar and equatorial diameters are to each other as 1 : 1.003242 nearly. From this, and the degree above mentioned, various conclusions have been drawn, in the appendix to this memoir, to which I shall refer the reader, and proceed to give a detailed statement, of all the particulars which are the immediate subject of this paper.

W. LAMBTON.

Trichinopoly, Nov. 1st. 1809.

1. *Measurement of the Base Line in the Coimbetoor.*

THIS base has been measured with the same apparatus, and in the same manner as the base near *Bangalore;* an account of which has been given in the 10th volume of the *Asiatick Researches;* the whole operation has been conducted under my own immediate inspection.

Experiments made for comparing the Chains.

PREVIOUS TO THE MEASUREMENT.			AFTER THE MEASUREMENT.		
1806	Excess of the Old Chain.	REMARKS.	1806	Excess of the Old Chain.	REMARKS.
	DIVISIONS.			DIVISIONS.	
March 19th	19		April 19th	28	
at 6 A. M.	19		at 6 A. M.	26	
	17.5			27.75	
	17.25			28.25	
	17.5			27	
6 P. M.	18.5			25.5	
	18	The mean tempera-		23.25	The mean tempera-
	20			22.25	
	19.25	ture during these ex-		23.25	ture during these ex-
	18.5	periments was 86°.12		22.25	periments was 81°.1
	17			23.25	
	18			25.75	
	17.5		20th	24	
	17.5		at 6 A. M.	24	
				24.75	
				24.75	
Mean	18.18		Mean	25	

TABLE

Containing the particulars of the Measurement.

Number of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.	REMARKS.
				Ascents.	Descents.	Above.	Below.		
			FEET.	FEET.	FEET.	INCHES.	INCHES.		
1	100	0° 25′ 0″	.00264	0.7270		23.		100.2°	Commenced on the
2	300	1 5 30	.05445		5.7165	2.75		95.8	20th March 1806.
3	400	1 3 50	.06896		7.4280		2.5	103.4	
4	100	Level				1.1		115.2	
5	400	0 42 30	.01528	2.7430				77.7	
6	400	0 18 30	.00580		2.1540		6.5	94.	
7	300	0 51 40	.03387		4.5090		7.6	108.5	
8	200	1 20 0	.05416		4.6540		3.1	95.9	
9	300	1 51 0	.15636		9.6840		2.4	74.9	
10	500	0 27 25	.01590		3.9854	9.1		93.2	
11	100	1 29 5	.03357	2.5914		24.1		114.2	
12	300	0 43 35	.02412	3.8038				74.3	
13	500	Level					3.	87.	
14	200	1 1 25	.03192		3.5722	0.2		104.3	
15	300	0 10 10	.00129	0.8875		2.5		109.4	
16	100	2 13 55	.07587		3.8946		9.4	76.4	
17	100	0 5 30	.00013		0.1600	12.1		80.	
18	200	1 10 55	.04256	4.1252		7.5		87.6	
19	400	1 38 35	.16444	11.4677		5.2		98.4	
20	400	1 1 20	.06364	7.1347			8.5	112.0	
21	200	0 11 10	.00106		0.6497		7.5	75.6	
22	100	1 54 40	.05563		3.3354		8.5	80.4	
23	100	2 3 50	.06487		3.6012		4.2	81.8	
24	200	1 8 30	.03970	3.9850			19.3	90.6	
25	400	0 9 10	.00140		1.0673		1.7	101.5	
26	400	0 55 35	.05228		6.4677		9.2	95.6	
27	300	1 9 40	.06159		6.0790		2.1	80.6	
28	600	0 44 5	.04932	7.6945		17.		96.2	
29	500	1 3 35	.08550	9.2446		12.		106.4	
30	500	0 30 0	.01905	4.3650			9.2	76.8	
31	400	0 31 0	.01628	3.6080				84.1	
32	200	0 35 45	.01080		2.0795		7.8	93.1	
33	500	1 40 10	.21220		14.5641			102.2	
34	200	0 51 0	.02200		2.9660	10.5		113.9	
35	400	0 11 50	.00236	1.3767			11.6	79.1	
36	400	0 46 50	.03712	5.4487				93.3	
37	300	0 38 0	.01833	3.3150			14.9	109.7	
38	400	1 7 0	.07596	7.7960		10.		78.9	
39	400	0 40 0	.02708	4.6560				85.1	
40	400	0 33 15	.01872	3.8960			7.5	98.8	
41	400	0 17 15	.00504	2.0090				114.2	
42	400	0 46 25	.03648		5.4003		11.2	78.0	
43	500	0 57 30	.06995		8.3625			92.3	
44	300	0 45 25	.02619		3.9632			107.7	
45	200	0 51 40	.02258		3.0047			115.2	
46	100	0 44 0	.00819		1.2800			124.4	

Number of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.	REMARKS.
				Ascents.	Descents.	Above.	Below.		
			FEET.	FEET.	FEET.	INCHES.	INCHES.	°	
47	300	0 54 35	.03783	4.7638		23.5		77.0	
48	500	1 22 15	.14305	11.9612		9.4		88.	
49	200	0 50 50	.02186	2.9563				97.6	
50	300	0 30 0	.01143	2.6190				106.4	
51	400	0 48 55	.04052		5.6903			116.4	
52	100	0 37 0	.00579		1.0760			77.4	
53	300	0 30 0	.01143	2.6190		30.3		79.7	
54	300	0 10 0	.00126	0.8730			7.3	90.	
55	500	0 27 50	.01640	4.0458				100.4	
56	400	0 31 25	.01672	3.6563				109.9	
57	300	0 44 45	.02541	3.9052				77.6	
58	300	0 19 40	.00492	1.7170				89.8	
59	300	0 10 0	.00126		0.8730			100.5	
60	300	1 20 15	.08175		7.0027			108.7	
61	100	0 25 55	.00284	0.7536		7.5		117.6	
62	100	0 33 35	.00477	0.9769				122.4	
63	300	0 35 20	.01584	3.0830		28.7		77.7	
64	400	0 25 25	.01092	2.9563			5.6	82.5	
65	100	0 18 35	.00146		0.5409			89.4	
66	100	0 33 40	.00480		0.9793		9.	96.4	
67	200	1 40 0	.08460		5.8160			100.5	
68	200	1 44 0	.09152		6.0500		6.1	78.1	
69	100	0 4 45	.00010		0.1377	11.5		79.4	
70	200	1 37 15	.08002	5.6565		7.5		84.8	
71	400	1 41 5	.17292	11.7617				92.4	
72	200	1 40 0	.08460	5.8160				101.6	
73	100	2 16 15	.07853	3.9622		8.		110.6	
74	300	1 1 0	.04722		5.3220			77.9	
75	600	1 10 25	.12588		12.2885		9.7	86.5	
76	300	0 4 10	.00024		0.3625	16.4		99.4	
77	200	1 37 45	.08084		5.6855			110.	
78	100	0 5 55	.00015		0.1716	5.5		116.	
79	200	0 30 0	.00762	1.7460				76.4	
80	400	1 6 50	.07560	7.7767		11.7		85.1	
81	400	1 4 45	.07094	7.5350				95.8	
82	600	1 34 30	.22668	16.4910		12.		107.7	
83	400	1 0 0	.06092	6.9800			5.4	80.	
84	300	0 26 10	.00870		2.2825			87.6	
85	200	0 54 10	.02484		3.1517		7.7	96.7	
86	300	1 32 25	.07252		5.3858	3.8		99.9	
87	300	0 16 55	.00363	1.4747		15.5		111.2	
88	400	1 39 30	.16752	11.5740		8.1		79.4	
89	400	1 15 30	.09648	8.7820				81.8	
90	400	1 4 40	.07076	7.5253				89.7	
91	300	0 22 5	.00621	1.9273				95.9	
92	200	1 22 5	.05700	4.7748		17.8		104.8	
93	200	1 34 55	.07624	5.5212		9.5		111.5	
94	400	0 30 30	.01576	3.5500				74.4	
95	300	Level						79.9	
96	300	0 35 40	.01614		3.1120		10.6	83.7	

Number of the Hypothenuse.	Length of each in Feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.	REMARKS.
				Ascents.	Descents.	Above.	Below.		
			FEET.	FEET.	FEET.	INCHES.	INCHES.	°	
97	100	1 ° 6 ′ 35 ″	.01876		1.9369		34.3	93.2	
98	100	Level						95.2	
99	300	0 54 55	.03828	4.7927				77.8	
100	200	0 5 40	.00028		0.3287			79.4	
101	300	0 23 5	.00678		2.0143		8.4	88.7	
102	300	0 32 50	.01368	2.8655		10.6		98.8	
103	300	1 44 10	.13773	9.0895				104.8	
104	700	1 7 5	.13328	13.6599				79.1	
105	700	1 1 0	.11018	12.4180				89.5	
106	500	1 17 50	.12815	11.3208		7.8		98.2	Completed on the
107	200	0 5 30	.02158	2.9370			31.6	109.2	19th April, 1806.
	32300		4.85778	307.4020	178.7862	382.85	311.2	94.03	

N. W. end, above the S. W. end of the Base 134.8 Feet in perpendicular height.

At the commencement, the old chain exceeded the new one 18.18 divisions of the micrometer, equal .00728 feet. Therefore 323×100.00728 feet will be the measure in terms of the new chain - - - - - - - - - - - - = 32302.3514 Feet.

At the conclusion, the old chain exceeded the new one 25 divisions, and had therefore increased 6.82 divisions, equal .00273 feet. Hence $323 \times \frac{0.00273}{2} = 0.4409$ feet, the correction for the wear, which add - - - - - - - - + 0.4409

The sum of the deductions from col. 4th is 4.85778 feet, which being increased in the ratio of 100 to 100.0072 will be 4.8581 feet, which subtract - - - - - - - - - — 4.8581

Hence the apparent horizontal distance will be - - - 32297.9342

The correction for the expansion & reduced to the standard temperature of 62° will be $\frac{(94°.03-50°) \times .0074-(62°-50°) \times .01227}{12}$ $\times 32297.9342$ feet, which add - - - - - - - - - - + 4.7744

Hence the corrected measure of the Base for the temperature of 62° will be - - - - - - - - - - - - - 32302.7086

Which, being reduced to the level of the sea, will be - 32301.2769

The last reduction is applied to the S. E. end of the Base, which is nearly the mean height of all the hypothenuses, and is 925.5 feet above the level of the sea; which height was determined by bringing down the triangles from the station at *Dodagoontah*.

2. ANGLES

At the N. W. end of the Base Line.

BETWEEN	*AND*	°	′	″	
S. E. end of the Base.....	Naudkaunee hill.....	46	18	22.5 21.75	22.12
	Oodoormalli.....	87	3	52.25 54.5 56.25 53.25 52.25	53.7
	Hallagamalli.....	142	32	41 41 40.75 42.25	41.25
Naudkaunee hill.....	Oodoormalli.....	40	45	29.75 32.75	31.25
Oodoormalli.....	Hallagamalli.....	55	28	49 46.75 45 48 49	47.55
Hallagamalli	Shennimalli	77	17	19 14.75 15.75 14.75 14.	15.65

At the S. E. end of the Base Line.

N. W. end of the Base.....	Naudkaunee hill	77	29	12.25 10.25 12. 13.5	12.
	Oodoormalli.....	61	23	45.25 47.75 48.75 47.75 47.5	47.4

At the S. E. end of the Base (continued.)

BETWEEN	*AND*	°	′	″	″
Oodoormalli	Hallagamalli	36	30	18.25 14.25 15. 13. 16.	15.3
Hallagamalli	Shennimalli	50	27	50 52.5 49.75 47.5	49.94
Hallagamalli	Yaëlmatoor hill	88	44	35.75 27.5 29.5	30.92
Shennimalli	Yaëlmatoor hill	38	16	42. 39.5 37.75	39.75
Yaëlmatoor hill	Parmatty hill	67	51	2. 0.25 2.75	1.67
Hallagamalli	Purteemalli	86	0	11. 17.25	14.12
Parmatty hill	Purteemalli	117	24	25.5 24.5 17.25	22.42
	Rungamalli	58	53	40.25 33.5 29.	34.25
Purteemalli	Rungamalli	58	30	45.25 51. 48.25	48.17
	Putchapolliam Station	112	5	9.87	9.87
Yaëlmatoor hill	Putchapolliam Station	62	39	27. 29.5 25.25	27.25

At Naudkaunee Hill.

BETWEEN	*AND*	°	′	″	
N. W. end of the Base.....	S. E. end of the Base.....	56	12½	26. 26.25 24.75	25.67
	Oodoormalli.....	95	2	17. 14. 16.	15.67

At Oodoormalli.

N. W. end of the Base.....	S. E end of the Base.....	31	32	23. 19. 20.5 20.5	20.75
	Naudkaunee hill.....	44	12	15.5 14.25 11.75 14.75	14.06
	Hallagamalli.....	69	57	13.75 13.25 12.25	13.08
Hallagamalli.....	S. E. end of the Base.....	101	29	32.75 33.75 32.75	33.08

At Hallagamalli.

N. W. end of the Base.....	Oodoormalli.....	54	34	3.75 5. 5.25	4.67
S. E. end of the Base.....	Oodoormalli.....	42	0	12.5 14. 15.25	13.92
Shennimalli.....	N. W. end of the Base.....	47	48	24. 22.5	23.25

At Hallagamalli (continued.)

BETWEEN	AND	°	′	″	″
	S. E. end of the Base	60	22	15.25 10.75 13.75	13.25
S. E. end of the Base	Yaëlmatoor hill	47	31	18.75 24.	21.37
Yaëlmatoor hill	Parmatty hill	36	0	13. 10.25 9.	10.75
Parmatty hill	Parteemalli	63	49	38.5 36. 38.5 36.5 42.5	38.4
Kautpolliam (S. E. end of the Base)	Parteemalli	52	18	33.5 32.25 37.5	34.42

At Shennimalli.

		°	′	″	″
N. W. end of the Base	Hallagamalli	54	54	23.5 24.25 23.75	23.83
S. E. end of the Base	Hallagamalli	69	9	58.75 62. 61.75	60.83
	Yaëlmatoor hill	82	1	32.5 27.75 29.75	30.
Yaëlmatoor hill	Putchapolliam Station	92	57	34.75 35.25 35.75 37.	35.69

At Putchapolliam Station.

BETWEEN	AND	°	′	″		
Shennimalli	Yaëlmatoor hill	43	35	0.25		
			38	58.25		1.19
			39	3.5		
				2.75		
Yaëlmatoor hill	S. E. end of the Base	101	2	8.5		
				8.9		8.73
				8.8		

At Yaëlmatoor Hill.

S. E. end of the Base	Hallagamalli	43	44	10		
				8.5		9.06
				7		
				10.75		
	Shennimalli	59	41	46.5		
				44.25		45.58
				46.		
Shennimalli	Putchapolliam Station	43	23	25.75		23.25
				20.75		
S. E. end of the Base	Putchapolliam	16	18	23.25		
				21.		22.33
				22.75		

At Parmatty Hill.

Hallagamalli	Yaëlmatoor hill	48	16	14.5		
				11		10.75
				7.25		
				10.25		
Yaëlmatoor hill	S. E. end of the Base	60	9	41.25		
				40.25		39.75
				37.75		
				39.75		
S. E. end of the Base	Rungamalli	81	54	60.25		
				59.75		58.67
				56.		

At Purteemalli.

BETWEEN	AND	°	′	″	
Hallagamalli	Parmatty hill	69	25	39.5	37.33
				34.	
				38.5	
	S. E. end of the Base	41	41	14.	13.0
				13.5	
				11.5	
S. E. end of the Base	Parmatty hill	27	44	17.5	21.17
				25.5	
				20.5	
	Rungamalli	72	57	48.	51.38
				52.	
				51.	
				54.5	
Parmatty hill	Kurroomalli	56	39	13.5	13.8
				15.	
				13.	
S. E. end of the Base	Kurroomalli	84	23	28.5	29.13
				32.5	
				26.5	
				29.	
Rungamalli	Kurroomalli	11	25	31.5	35.8
				37.	
				40.5	
				35.5	
				34.5	
Kurroomalli	Permaul hill	77	20	47.5	49.21
				51.	
				50.5	
				47.	
				50.75	
				46.75	
				51.	
Hallagamalli	S. E. end of the Base	41	41	13.	
S. E. end of the Base	Parmatty hill	27	44	21.17	
Hallagamalli	Parmatty hill	69	25	34.17	
Ditto	Ditto (observed direct)	69	25	37.33	
	Mean	69	25	35.75	

At Purteemalli (continued.)

BETWEEN	AND	°	′	″
Parmatty hill	S. E. end of the Base	27	44	21.17
S. E. end of the Base	Kurroomalli	84	23	29.13
Kurroomalli	Parmatty hill	56	39	7.96
Ditto	Ditto (observed direct)	56	39	13.8
	Mean	56	39	10.88

At Kurroomalli.

Purteemalli	Parmatty hill	82	17	50.5	52.71	
				48.75		
				48.5		
				55.5		
				56.		
				57.		
	S. E. end of the Base	46	53	12.	12.8	
				15.5		
				15.		
				10.5		
				11.		
	Rungamalli	110	54	37.5	37.44	
				41.25		
				34.5		
				36.5		
	Permaul hill	57	57	29.	31.07	
				28.		
				31.		
				29.25		
				32.		
				33.		
				30.5		
				28.5		
				34.		
				35.5		
Permaul hill	Rissheemalli	47	45	25.5	30.5	
				30.		
				31.5		
				35.		

At Rissheemalli.

BETWEEN	AND	°	′	″	
Kurroomalli	Permaul hill	72	47	59	
				57	
				59.5	60.42
				64.5	
				61.5	
				62.	
	Referring flag	150	42	39	
				36.5	
				38.	
				37.5	
				37.	38.28
				39.	
				38.5	
				39.	
				40.	
Referring flag	Nagamalli	42	46	30	
				28.5	31.75
				34.	
				34.5	
	Suddragherry	4	40	14	
				16.	
				20.	16.75
				17.	
				18.5	
				15.	

Referring flag	Kurroomalli	150	42	38.28
Kurroomalli	Permaul hill	72	48	0.42
Referring flag	Permaul hill	77	54	37.86
do.	Suddragherry	4	40	16.75
Suddragherry	Permaul hill	82	34	54.61
Referring flag	Permaul hill	77	54	37.86
	Nagamalli	42	46	31.75
Nagamalli	Permaul hill	120	41	9.61
Referring flag	Suddragherry	4	40	16.75
do.	Nagamalli	42	46	31.75
Nagamalli	Suddragherry	38	6	15.

At Nagamalli.

BETWEEN	AND	°	′	″		
Rissheemalli	Permaul hill	36	19	22.5		
				20.		
				19.		
				20.25		20.17
				18.25		
				21.		
	Suddragherry	120	33	24.5		
				22.		
				23.5		23.38
				23.5		
Suddragherry	Sekundermalli	91	36	13.5		
				12.		
				13.5		14.5
				19.		
Permaul hill	Rissheemalli	36	19	20.17		
Rissheemalli	Suddragherry	120	33	23.38		
Suddragherry	Permaul hill	84	14	3.21		

At Suddragherry.

Rissheemalli	Permaul hill	34	42	51.		
				50.25		
				52.5		
				49.75		56.64
				64.75		
				64.5		
				63.75		
Permaul hill	Nagamalli	56	3	29.5		
				30.25		
				32.25		22.34
				12.5		
				12.5		
				17.		

At Suddragherrry (continued.)

BETWEEN	AND				
Rissheemalli	Nagamalli	21	20	22.25	
				23.5	
				25.5	
				23.	24.62
				25.	
				26.5	
				27.25	
				24.	
Nagamalli	Sekundermalli	25	48	40.25	
				40.5	
				40.5	40.85
				41.5	
				41.5	
Sekundermalli	Gopaulswamy Station	54	1	28.65	
Referring flag	Meenachiporam hill	56	3	37.25	
				36.	35.56
				33.5	
				35.5	
	Perrioormalli	104	18	29	
				33.	
				28.75	31.2
				31.25	
				34.	
Permaul hill	Rissheemalli	34	42	56.64	
Rissheemalli	Nagamalli	21	20	24.63	
Nagamalli	Permaul hill	56	3	21.27	
do.	do. (observed direct)	56	3	22.34	
	Mean	56	3	21.8	

Referring flag	Perrioormalli	104	18	31.2
	Meenachiporam hill	56	3	35.56
Meenachiporam hilli	Perrioormalli	48	14	55.64

At Sekundermalli.

BETWEEN	AND	°	′	″	″
Nagamalli	Suddragherry	65	36	3.	
				10.5	8.63
				10.	
				11.	
Gopaulswamy	Suddragherry	20	4	44.5	
				51.5	
				51.5	
				51.	49.8
				51.5	
				48.5	
				50.	
	Kooteapâra	42	6	10.5	
				11.	
				12.5	10.1
				6.5	
				10.	
Kooteapâra	Suddragherry	62	10	62.	
				63.	
				64.	59.4
				55.	
				53.	

At Gopaulswamy.

Suddragherry	Sekundermalli	105	53	45.5	
				47.5	
				42.75	45.55
				49.	
				43.	
Sekundermalli	Kooteapâra	79	22	15.5	
				14.	
				15.	
				15.75	
				16.5	15.36
				14.5	
				14.	
				15.5	
				17.5	

At Gopaulswamy (continued.)

BETWEEN	AND	°	′	″	
Kooteapâra	Meenachiporam	28	8	48.5	
				51.5	
				47.5	
				46.5	
				45.5	47.61
				46.5	
				47.	
				47.	
				48.5	
Kaulikautân	Meenachiporam	51	52	19.	
				21.	
				26.25	23.63.
				23.5	
				27.	
				25.	
Meenachiporam hill	Perrioormalli	55	43	45.5	
				50.5	
				51.75	
				49.	49.09
				49.5	
				50.	
				46.	
				50.5	

At Kooteapara.

Sekundermalli	Gopaulswamy	58	31	35.5	
				36.5	
				37.5	
				39.5	
				35.5	38.28
				39.75	
				42.5	
				39.5	
Gopaulswamy	Suddragherry	1	50	46.	
				46.5	
				45.5	
				43.5	45.
				44.5	
				44.5	
				44.5	

At Kooteapara (continued.)

BETWEEN	AND	°	′	″	″
Gopaulswamy	Kaulikautân	64	49	39.	36.5
				34.	
Kaulikautân	Meenachiporam	58	46	28.5	30.67
				29.	
				34.5	
				30.7	
Gopaulswamy	Meenachiporam	123	36	11.5	8.1
				3.5	
				7.5	
				8.5	
				9.5	
Meenachiporam hill	Gopaulswamy	123	36	8.1	
Gopaulswamy	Suddragherry	1	50	45.	
Suddragherry	Meenachiporam	121	45	23.1	
Sekundermalli	Gopaulswamy	58	31	38.28	
Gopaulswamy	Suddragherry	1	50	45.	
Suddragherry	Sekundermalli	60	22	23.28	

At Meenachiporam Hill.

		°	′	″	″
Kooteapâra	Gopaulswamy	28	15	7.	6.32
				7.75	
				7.5	
				7.5	
				8.	
				3.5	
				6.5	
Suddragherry	Kooteapâra	35	54	33.5	35.5
				34.	
				38.	
				35.	
				37.5	
				33.5	
				37.	

At Meenachiporam (continued.)

BETWEEN	AND	°	′	″	
Perrioormalli	Kaulikautân	11	12	57.5	56.5
				54.	
				58.	
	Gopaulswamy	68	40	38.75	37.25
				37.	
				36.	
	Suddragherry	61	1	0	5.63
				5.5	
				10.	
				7.	
	Kolanelloor Station	89	51	58.5	59.15
				57.25	
				61.	
				61.5	
				57.5	
Kaulikautân	Perrioormalli	11	12	56.5	
Perrioormalli	Gopaulswamy	68	40	37.25	
Gopaulswamy	Kaulikautân	57	27	40.75	
	Kooteapâra	28	15	6.82	
Kooteapâra	Kaulikautân	85	42	47.57	

At Kaulikautan.

Meenachiporam	Gopaulswamy	70	39	61.	59.5
				58.5	
				60.	
				58.5	
	Perrioormalli	127	22	30.5	29.13
				32.	
				27.	
				27.	

At Perrioormalli.

Meenachiporam	Kaulikautân	41	24	43.5	38.79
				43.5	
				43.25	
				32.	
				36.	
				34.5	

At Perrioormalli (continued.)

BETWEEN	AND	°	′	″		
Meenachiporam	Gopaulswamy	55	35	35.25		
				37.		
				34.5		40.05
				45.5		
				48.		
	Suddragherry	70	44	7.5		
				9.		8.67
				9.5		
	Vullunkota hill	72	53	36.5		
				39.5		35.5
				31.		
Vullunkota	Meenachiporam	72	53	35.5		
Meenachiporam	Suddragherry	70	44	8.67		
Suddragherry	Vullunkota	143	37	44.17		

At Kolanelloor Hill.

		°	′	″		
Meenachiporam	Perrioormalli	59	36	6.5		
				9.		7.19
				7.25		
				6.		
Perrioormalli	Vullunkota	48	44	13.5		
				16.5		
				15.5		15.9
				16.5		
				17.5		
Vullunkota	Vullanaud hill	46	53	60.		
				59.		
				61.5		
				61.		58.75
				56.		
				58.5		
				57.		
				57.		

At Vullunkota Hill.

BETWEEN	AND	°	′	″	
Perrioormalli	Kolanelloor hill	88	53	48.	
				47.5	48.33
				48.	
				50.	
Kolanelloor hill	Vullanaud hill	38	11	53.	
				50.	
				54.	52.6
				53.5	
				52.5	
Vullanaud hill	Kunnimapotha	70	48	22.5	
				22.	20.4
				19.5	
				17.5	

At Vullunkota.

Vullanaud hill	Coonatoor hill	46	20	18.25	
				13.	16.44
				18.5	
				16.	
Coonatoor hill	East end of the Base	47	27	36.5	
				32.5	32.25
				31.5	
				28.5	

At Vullanaud Hill.

Kolanelloor hill	Vullunkota	94	54	14.5	
				13.	12.13
				12.	
				9.	
Vullunkota	Kunnimapotha	57	50	33.5	
				31.5	
				49.	
				48.5	46.54
				51.	
				57.	
				55.25	

At Vullanaud Hill (continued.)

BETWEEN	AND	°	′	″		
Vullunkota	Coonatoor hill	24	4	23.		
Coonatoor hill	Taulaootpotha	37	2	32.5		
				34.25		
				34.25		29.17
				33.		
				20.5		
				20.5		
Kunnimapotha	Red hill station	49	24	34.5		
				36.		
				44.		39.6
				39.5		
				44.		

At Taulaootpotha.

Vullanaud hill	Coonatoor hill	80	23	41.		
				44.		
				45.5		40.4
				34.		
				37.5		
Coonatoor hill	Vullunkota hill	61	13	20.5		
				18.5		
				13.		
				20.		18.8
				19.5		
				20.5		
				19.5		
	W. end of the Base	45	19	25.5		
				22.		
				26.5		25.3
				26.		
				26.5		
Vullunkota	W. end of the Base	15	53	52.5		
				53.		
				51.		
				53.5		
				52.		
				54.		54.65
				52.5		
				57.5		
				60.5		
				60.		

At Taulaootpotha (continued.)

BETWEEN	AND					
W. end of the Base	E. end of the Base	73	9	36.		
				32.5		
				30.5		
				37.5		30.5
				35.5		
				21.		
				20.5		

At Coonatoor Hill.

Taulaootpotha	Vullanaud hill	62	33	56.	
				56.	
				46.5	
				52.5	53.67
				55.5	
				55.5	
Vullanaud hill	Vullunkota hill	109	35	26.5	
				23.	
				24.25	24.2
				21.5	
				25.75	
Vullunkota hill	Taulaootpotha	47	1	30.5	
				27.5	
				32.75	30.75
				31.25	
				31.75	
Taulaootpotha	W. end of the Base	41	14	28.5	
				28.5	30.
				31.5	
				31.5	
W. end of the Base	E. end of the Base	54	18	14.	
				17.5	
				16.	
				18.5	16.5
				14.5	
				20.5	
				14.5	
E. end of the Base	Vullunkota	60	5	16.	
				16.5	16.81
				18.25	
				16.5	

At the West end of the Base (Palamcottah.)

BETWEEN	AND	°	′	″	
Vullunkota	Taulaootpotha	110	52	49.5	
				49.	
				48.	
				41.5	
				44.5	
				44.	45.1
				44.	
				47.	
				45.	
				46.	
				42.5	
				40.	
Taulaootpotha	Coonatoor hill	93	26	9.	
				9.5	9.33
				9.5	
Coonatoor hill	East end of the Base	62	54	46.	
				46.5	
				42.	42.4
				38.5	
				39.	
East end of the Base	Taulaootpotha	30	31	38.	
				32.	
				32.	
				34.	36.82
				35.5	
				42.5	
				43.75	

At the East end of the Base.

Vullunkota	Coonatoor hill	72	27	14.	
				15.5	13.17
				10.	
Coonatoor hill	W. end of the Base	62	46	70.5	
				65.5	
				64.75	60.63
				54.	
				54.5	
				54.5	

At the East end of the Base (continued.)

BETWEEN	AND				
W. end of the Base	Taulaootpotha	76°	18	52.″5	
				55.5	
				53.5	53.″4
				54.5	
				51.	

At Kunnimapotha.

Vullunkota	Vullanaud Hill	51	20	53.	
				50.5	
				53.	
				52.	56.93
				63.5	
				64.	
				62.5	
Vullanaud Hill	Red Hill station	66	8	28.	
				29.5	
				29.5	
				30.	28.07
				25.5	
				27.	
				27.	
Red Hill station	Koodunkolum station	52	56	22.	
				22.	
				22.5	
				13.	17.17
				12.5	
				11.	

At Red Hill Station.

Vullanaud Hill	Kunnimapotha	64	26	56.5	
				54.5	
				52.5	54.4
				53.	
				55.5	
Kunnimapotha	Koodunkolum	73	48	18.	
				19.5	
				17.5	19.4
				20.5	
				21.5	

At Red Hill Station (continued.)

BETWEEN	AND	°	′	″	
Kunnimapotha	Munpotha	48	11	40.	40.42
				41.5	
				39.75	
Munpotha	Koodunkolum	25	36	40.5	40.5
				40.5	
				40.5	

At Munpotha.

Kunnimapotha	Red Hill Station	58	34	52.	41.1
				49.	
				46.5	
				30.5	
				27.5	
Red Hill Station	Koodunkolum Station	62	30	28.	37.33
				27.	
				31.5	
				33.5	
				51.	
				53.	
Koodunkolum Station	Punnae Station	23	24	17.	16.5
				19.5	
				17.5	
				17.	
				16.5	
				15.	
				16.	
				13.5	
Kunnimapotha	Punnae Station	144	29	37.	36.
				35.5	
				40.5	
				33.	
				35.	
				36.5	
				34.5	
Red Hill Station	Koodunkolum	62	30	37.33	
Koodunkolum	Punnae Station	23	24	16.5	
Punnae Station	Red Hill Station	85	54	53.83	
Kunnimapotha	Punnae Station	144	29	36.	
ditto	Red Hill Station	58	34	42.17	
ditto	ditto (observed direct)			41.1	
	Mean	58	34	41.64	

At Koodunkolum Station.

BETWEEN	AND				
Kunnimapotha	Red Hill Station	53	15	30.	
				30.5	28.13
				25.	
				27.	
Red Hill Station	Munpotha	91	52	48.5	
				45.	43.13
				37.5	
				41.5	
Munpotha	Punnae Station	59	7	22.	
				21.	
				21.	
				19.5	20.97
				16.	
				21.75	
				23.5	
				23.	
	Kunnimapotha	38	37	14.	
				17.	
				19.5	15.5
				12.5	
				14.5	
Punnae Station	Munpotha Station	59	7	20.97	
Munpotha Station	Kunnimapotha	38	37	15.5	
Kunnimapotha	Punnae Station	97	44	36.47	

At Punnae Station.

Koodunkolum	Munpotha	97	28	28.	
				28.	
				25.	
				22.	22.81
				27.	
				26.5	
				12.	
				14.	

3. *Description of the great Stations.*

PURMUTTY or *Molapolliam* hill is about one and an half miles N. E. from the village of *Purmutty*, and about ten miles south from *Kodimoodi*; at the foot of the hill on the west side is a small village *Molapolliam*, from whence the road (which is a causeway) leads to the summit of the hill, where there is a pagoda, on the platform of which is the station, marked by a small hollow in the *chunam*, about thirty feet S. West from the tower of the pagoda.

Shennimalli. A hill near a respectable village of that name, on the great road from *Erode* to *Daraporam*. The station is on the highest part of the hill, a few hundred feet N. W. from the pagoda. It is marked as usual with a platform and stone.

Yaëlmatoor Hill. A well known hill, about six miles E. N. E. from *Shennimalli*, with a pagoda near the top. The station is on a stone platform, a little way to the N. W. of the pagoda, on the highest part of the hill.

Hallagamalli. A hill with a pagoda on the top, about seven miles S. W. from *Shennimalli*. The station is on the platform of the pagoda.

Oodoormalli. A hill near the village of *Oodoor*, on the great road to *Daraporam*, and about twenty miles S. by W. from *Shennimalli*. There is a small pagoda on the east part of the hill, but the station is considerably to the westward of the pagoda, upon a rock, which has a circle marked upon it.

Base. N. W. end. This is a rising ground near the village of *Putchapolliam*, about five miles east from *Kongiam*. It is marked by a circular platform, built of brick and *chunam*, with a marked stone in the middle, which marks the extremity, as in the other base lines. The S. E. extremity of the base lies near the village of *Kautpolliam* and is marked in the same manner. Both these platforms have large stones at the bottom, fixed when the foundations were laid, and there are circles inserted, whose centers define the extremities of the line.

Putchapolliam station, is the great station of observation for continuing the meridian line, and is marked by a larger platform of brick, and marked in a similar manner to the other. It is a little to the eastward of the Base line, and nearly a mile from the N. W. extremity. This station was chosen for the sole purpose of observing zenith distances, being only seven hundred feet west from the meridian of *Dodagoonth* near *Bangalore*.

Naudkaunee Hill. A small hill about five miles S. W. from the S. E. end of the Base. The station is on a wall, which has been intended for a building.

Parteemalli, will be found about six miles S. E. from *Daraporam*, with the village of *Parteeoor* almost at the north foot of the hill. The station is the center of a large platfrom, marked on a stone by a circle.

Kurroomalli, is a great mountain, about seventeen miles N. W. from *Dindigul*, and four miles east from *Yeddacottah*, in the *Coimbetoor*. The station is on the northern and highest part of the ridge, on a circular platform, marked by a large stone with a circle and point on it.

Permaul Hill. This is a prominent point on the great mass of moun-

tains south of *Pyney* called the *Pyney* mountains; and is called *Permaul-malli* by the inhabitants of the mountain only. There is no station on this hill, though it is used as one of the principal points in the series of triangles extending southerly; there has been a flag on the hill, and the place where it stood is marked by a platform of earth.

Rissheemalli, is about twelve miles south from *Dindigul*, and five miles N. W. from *Ammanaigpettah*, a few miles to the westward of the great road leading to *Madura*. The road to the summit is on the east side of the hill, leading from the village of *Shulleeputty*. The station is on a circular platform (a few yards west of a stone pillar) and marked as usual.

Nagamalli Station. There is a well known range of hills west of *Madura*, nearly on the south bank of the *Vyga* river, called *Nagamalli*; the station is on that part of the range that lies nearly south of *Sholavundan*, marked on the rock.

Suddragherry. This is a stupendous mountain, about fifteen miles north from *Shevilipootoor*. The road to the station is on the south side from *Koolapanaikputty*. The station will be found on a bare top, in the center of a platform, marked by a circle inscribed on a stone, over which the stump of a tree is placed, supported by a pyramid of stones, to serve as a mark.

Sekundermalli. This is a well known rock, five miles S. W. from *Madura*, and close on the great road leading to *Palamcottah*. There is a mosque on the summit of the rock, and the station is on the platform, nearly in the center.

Gopaulswamy, a very remarkable rock, about five and a half miles S.

E. from *Toomichinaikpettah*, on a rising ground, covered with jungle; it is a double rock, and has a singular appearance at a distance: there is a pagoda on the western rock, and the station is on the top of the pagoda, between the tower and the S. E. corner.

Kooteapâra station, is on a rocky hill in the *Ramisseram* district, about six miles west from *Arupcota*, marked as usual on a rock.

Meenachiporam. This is a solid rock, about three and a half miles north from *Yettiaporam*, or *Etiapoor*, and nine miles east from *Kovilputty*; there is a small village called *Mullaputty* at the S. E. foot of the rock, and the village *Meenachiporam* (from which the name of the hill is derived) is about one mile north of the rock. The station is on a stone building on the rock, marked.

Kaulikautân. A hill with a pillar on the top, about three miles S. E. from *Kurroonelloor;* there is a platform about fifteen yards east from the pillar, and a marked stone in the middle of the platform defines the station.

Perrìoormalli, is three and a half miles N. W. from *Sungarnacoil*, in the *Tinnivelly* province; the road to the summit of the hill is on the east side, leading from a *Choultry*. It is a three topped hill, and the station is on the highest and easternmost top, where there is a platform marked as usual.

Kolanelloor station, is on a beautiful rising ground, in the plains of *Panjalamkoorchee*, about three miles west from *Wotapadaram*. There is a place of worship on this little eminence, shaded by a cluster of trees, and the station will be found on a platform, a little to the north of the trees, marked as usual.

Vullunkota, is a small hill, about seven miles N. W. from *Tinnivelly*, and about two miles south-west from *Modakoorchi*; the station will be found on a platform marked.

Vullanaud Hill. This is a conspicuous range, about ten miles east nearly from *Palamcottah*, and about one mile east from the village of *Vullanaud*. The station is on the highest peak (called *Womay's* peak) and is marked by a level spot with a stone, &c.

Taulaootpotha. This is nearly at the eastern extremity of the low range of hills that is seen about six miles north of *Palamcottah*, running east and west, whereof *Vullunkota* is the western extremity. There is a village about half a mile south of the hill called *Taulaoot*, from whence the hill derives its name; the station is defined by a large stone marked as usual, and can be pointed out by the inhabitants, though there is no platform.

Coonatoorpotha, is a small hill, about two miles S. W. from *Tinnivelly*, and nearly on the north bank of the *Tambrapurni* river. There are several village near this hill, but the village from which it derives its name is on the east side of the hill. A small platform on the hill, marked as usual, defines the station.

Base Line, west end, is about a mile and a half west from the village of *Shadooroypootoor*, and about five miles N. W. from *Tinnivelly*; it is marked by a large stone with a circle. The east end is about one hundred and fifty yards west from the village of and six miles N. E. from *Tinnivelly*, marked by a large stone.

Kunnimapotha. A small but steep hill, at the S. E. extremity of a range of hills that lies about two and an half miles nearly west from *Na-*

galancherry, and about five miles east from *Calcaud*. The station is on a platform marked.

Red Hill Station. This station is on the red sand hills, that lie about eight miles west from *Manapar*, and about two miles east from a small village called *Ittumpully*, whose inhabitants alone can trace the spot on the sand hill where the station was, and which is marked by five very long pickets, driven into the drift sand, four of which form a square of nearly three feet, and the fifth, being in the center of the square, defines the station.

Munpotha, is a small rocky hill, about four miles east from *Arambully*, and three miles south from *Punnagoody*. The road to the summit is on the east side of the hill. The station is on a large rock marked by a circle.

Koodunkolum station, is on a rising ground, about three miles S. W. from the village of that name, and three miles N. E. from *Pillikolum*. This ground is nearly a mile north from the sea shore, and is covered with a thick forest of thorn trees. The station will be found in the center of a high circular platform marked on a stone.

Punnae station, is the great station of observation at the southern extremity of the grand meridional arc, and is marked by a square building with two doors and two windows arched, and a solid pillar in the middle, on the top of which there is a large circular stone with a hole in the center. The building is on a rising ground, nearly a mile S. E. from the village of *Punnae*, about eight miles N. E. from *Cape Comorin*, and nearly seven hundred yards from the sea shore.

4. *Principal Triangles.*

N. W. end of the Base, from S. E. end of the Base 32301.28 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
1	N. W. end of the Base, ...	46° 18′ 22.″12				46° 18′ 22.″25	
	S. E. end of the Base, ...	77 29 12				77 29 12	
	Naudkaunee hill, ...	56 12 25.67				56 12 25.75	
		179 59 59.79				180 0 0	
	Naudkaunee hill, from { N. W. end of the Base, ...						37944.6
		S. E. end of the Base, ...					28103.1
2	N. W. end of the Base, ...	87 3 53.7	—0.″19			87 3 53	
	S. E. end of the Base, ...	61 23 47.4	—0.11			61 23 47	
	Oodoormalli, ...	31 32 20.75	—0.11			31 32 20	
		180 0 1.85		0.″41	+1.″44	180 0 0	
	Oodoormalli from { N. W. end of the Base, ...						54215.7
		S. E. end of the Base, ...					61671.1
3	N. W. end of the Base, ...	142 32 41.25	—0.77			142 32 40.75	
	S. E. end of the Base, ...	. . .				24 53 31.8	
	Hallagamalli, ...	. . .				12 33 47.45	
						180 0 0	
	Hallagamalli, from { N. W. end of the Base, ...						62505.7
		S. E. end of the Base, ...					90309.6

N. W. end of the Base from Naudkaunee hill 37944.6

4	N. W. end of the Base, ...	40 45 31.25				40 45 31	
	Naudkaunee, ...	95 2 15.67				95 2 15	
	Oodoormalli, ...	44 12 14.06				44 12 14	
		180 0 0.98				180 0 0	
	Oodoormalli from { N. W. end of the Base, ...						54212.9
		Naudkaunee hill, ...					35531.4

N. W. end of the Base from Oodoormalli 54214.3 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	N. W. end of the Base, ...	55° 28′ 47.″55	—0.″21			55° 28′ 45.″75	
	Oodoormalli, ...	69 57 13.08	—0.24			69 57 11.25	
	Hallagamalli, ...	54 34 4.67	—0.21			54 34 3.	
5		180 0 5.3		0.″66	+4.″64	180 0 0	
	Hallagamalli from { N. W. end of the Base, ...						62505.7
	Hallagamalli from { Oodoormalli, ...						54821.3

The above Base is the mean distance obtained by the Triangles N. W. and S. E. end of the Base, and *Oodoormalli*, and N. W. end of the Base, *Naudkaunee* hill and *Oodoormalli*.

S. E. end of the Base from Oodoormalli, 61671.1

	S. E. end of the Base, ...	36 30 15.3	—0.15			36 30 14.75	
	Oodoormalli, ...	101 29 33.08	—0.49			101 29 32.	
	Hallagamalli, ...	42 0 13.92	—0.14			42 0 13.25	
6		180 0 2.3		0.″78	+1.″52	180 0 0	
	Hallagamalli from { S. E. end of the Base, ...						90312.2
	Hallagamalli from { Oodoormalli, ...						54824.1

N. W. end of the Base from Hallagamalli 62505.7

	N. W. end of the Base, ...	77 17 15.65	—0.33			77 17 14.5	
	Hallagamalli, ...	47 48 23.25	—0.23			47 48 22.5	
	Shennimalli, ...	54 54 23.83	—0.25			54 54 23.	
7		180 0 2.73		0.″81	+1.″92	180 0 0	
	Shennimalli from { N. W. end of the Base, ...						56597.8
	Shennimalli from { Hallagamalli, ...						74520.2

Hallagamalli from Shennimalli 74520.2

	Hallagamalli, ...	60 22 13.25	—0.45			60 22 12.	
	Shennimalli, ...	69 10 0.83	—0.51			69 9 59.5	
	S. E. end of the Base, ...	50 27 49.94	—0.42			50 27 48.5	
8		180 0 4.02		1.″38	+2.″64	180 0 0	
	S. E. end of the Base from { Hallagamalli, ...						90308.9
	S. E. end of the Base from { Shennimalli, ...						83991.3

Shennimalli from S. E. end of the Base 83991.3 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Shennimalli,	° ′ ″ 82 1 30	—″0.51			° ′ ″ 82 1 31.5	
	S. E. end of the Base,	38 16 39.75	—0.32			38 16 41.	
	Yaëlmatoor hill,	59 41 45.58	—0.35			59 41 47.5	
9		179 59 55.33		″1.18	—″5.85	180 0 0.	
1	Yaëlmatoor hill from Shennimalli,						60265.1
	Yaëlmatoor hill from S. E. end of the Base,						96342.9

Hallagamalli from S. E. end of the Base 90310.2

	Hallagamalli,	47 31 21.37	—0.52			47 31 21.	
	S. E. end of the Base,	88 44 30.92	—1.0			88 44 30.25	
	Yaëlmatoor hill,	43 44 9.07	—0.53			43 44 8.75	
10		180 0 1.36		″2.05	—″0.69	180 0 0.	
	Yaëlmatoor hill from Hallagamalli,						103600.5
	Yaëlmatoor hill from S. E. end of the Base,						96346.5

The above Base is the mean distance obtained in the three triangles on the Bases, N. W. end of the Base from S. E. end of the Base; S. E. end of the Base from Oodoormalli; and Hallagamalli from Shennimalli.

Shennimalli from Yaëlmatoor hill 60265.1.

	Shennimalli,	92 57 35.69	—″0.45			92 57 35.5	
	Yaëlmatoor hill,	43 23 23.25	—0.20			43 23 23.25	
	Putchapolliam Station,	43 39 1.19	—0.20			43 39 1.25	
11		180 0 0.13		″0.85	—″0.72	180 0 0.	
	Putchapolliam Station from Shennimalli,						59977.2
	Putchapolliam Station from Yaëlmatoor hill,						87191.9

Yaëlmatoor hill from S. E. end of the Base 96344.75.

	Yaëlmatoor hill,	16 18 22.33	—″0.13			16 18 24.	
	S. E. end of the Base,	62 39 27.25	—0.04			62 39 27.5	
	Putchapolliam Station,	101 2 8.73	—0.39			101 2 8.5	
12		179 59 58.31		″0.56	—″2.25	180 0 0.	
	Putchapolliam Station from Yaëlmatoor hill,						87193.3
	Putchapolliam Station from S. E. end of the Base,						27561.2

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Yaëlmatoor hill from S. E. end of the Base = 96344.7 Feet.						
	Yaëlmatoor hill,	° ′ ″				° ′ ″	
	S. E. end of the Base,	67 51 1.67	—0.67			67 51 1	
	Parmatty hill,	60 9 39.75	—0.61			60 9 39	
13						180 0 0	
	Parmatty hill from Yaëlmatoor hill,						102873.
	Parmatty hill from S. E. end of the Base,						87510.9
	Hallagamalli from Yaëlmatoor hill = 130600.5.						
	Hallagamalli,	36 0 10.75	—0.72			36 0 10	
	Yaëlmatoor hill,	. . .				95 43 40	
	Parmatty hill,	48 16 10.75	—0.67			48 16 10	
14						180 0 0	
	Parmatty hill from Hallagamalli,						174127.5
	Parmatty hill from Yaëlmatoor hill,						102870.
	Hallagamalli from Parmatty hill=174127.5.						
	Hallagamalli,	63 49 38.4	—1.70			63 49 36.5	
	Parmatty hill,	. . .				46 44 49.5	
	Parteemalli,	69 25 35.75	—1.84			69 25 34.	
15						180 0 0.	
	Parteemalli from Hallagamalli,						135463.2
	Parteemalli from Parmatty hill,						166919.4
	Hallagamalli from S. E. end of the Base=90310.2.						
	Hallagamalli,	52 18 34.42	—0.62			52 18 33.8	
	S. E. end of the Base,	86 0 14.12	—1.07			86 0 13.4	
	Parteemalli,	41 41 13.	—0.61			41 41 12.8	
16		180 0 1.54		2.30	—0.76	180 0 0.	
	Parteemalli from Hallagamalli,						135462.6
	Parteemalli from S. E. end of the Base,						107456.0
	S. E. end of the Base from Parmatty hill = 87510.9.						
	S. E. end of the Base,	117 24 22.42	—1.85			117 24 20.5	
	Parmatty hill,	. . .				34 51 18.5	
	Parteemalli,	27 44 21.17	—0.13			27 44 21.	
17						180 0 0	
	Parteemalli from S. E. end of the Base,						107451.
	Parteemalli from Parmatty hill,						166913.7

S. E. end of the Base from Parmatty hill = 87510.9 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	S. E. end of the Base,	58° 53′ 34″.25	—0″.71			58° 53′ 33″.5	
	Parmatty hill,	81 54 58.67	—1.06			81 54 57.5	
	Rungamalli,	. . .				39 11 29.	
18						180 0 0	
	Rungamalli from	S. E. end of the Base					137109.5
		Parmatty hill					118571.5
	Parmatty hill from Parteemalli = 166916.55.						
	Parmatty hill	. . .				41 2 59.6	
	Parteemalli	56 39 10.88	—1.05			56 39 9.3	
	Kurroomalli	82 17 52.71	—1.6			82 17 51.1	
19						180 0 0	
	Kurroomalli from	Parmatty hill					140703.7
		Parteemalli					110614.8

The distance from Parmatty to Parteemalli, as a base in the above triangle, is a mean distance obtained by the 15th and 17th triangles.

S. E. end of the Base from Parteemalli = 107453.5.

	S. E. end of the Base	58 30 48.17	—0.95			58 30 47.2	
	Parteemalli	72 57 51.38	—1.15			72 57 50.2	
	Rungamalli	. . .				48 31 22.6	
20						180 0 0	
	Rungamalli from	S. E. end of the Base					137127.1
		Parteemalli					122303.1
	S. E. end of the Base	. . .				48 43 20.1	
	Parteemalli	84 23 29.13	—1.28			84 23 27.9	
	Kurroomalli	46 53 12.8	—0.76			46 53 12.	
21						180 0 0	
	Kurroomalli from	S. E. end of the Base					146491.2
		Parteemalli					110620.8

S. E. end of the Base from Parteemalli is a mean distance derived from the 16th and 17th triangles as a base.

Parteemalli from Rungamalli = 122303.1 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Parteemalli,	11° 25′ 35.″8	—0.″12			11° 25′ 35.″7	
	Rungamalli,	. . .	. .			57 39 47.5	
	Kurroomalli,	110 54 37.44	—0.66			110 54 36.8	
22						180 0 0.	
	Kurroomalli from { Parteemalli,						110621.6
	Kurroomalli from { Rungamalli,						25938.0

Parteemalli from Kurroomalli = 110619.0

	Parteemalli,	77 20 49.21	—1.39			77 20 47.8	
	Kurroomalli,	57 57 31.07	—1.05			57 57 30.	
	Permaul hill,	. . .				44 41 42.2	
23						180 0 0.	
	Permaul hill from { Parteemalli,						133318.9
	Permaul hill from { Kurroomalli,						153458.5

The above Base, Parteemalli from Kurroomalli is the mean distance, determined by the 19th and 22d Triangles.

Kurroomalli from Permaul hill = 153458.5

	Kurroomalli,	47 45 30.5	—1.11			47 45 29.5	
	Permaul hill,	. . .				59 26 31.5	
	Rissheemalli,	72 48 0.42	—1.43			72 47 59.	
24						180 0 0.	
	Rissheemalli from { Kurroomalli,						138332.1
	Rissheemalli from { Permaul hill,						118926.2

Permaul hill from Rissheemalli = 118926.2.

	Permaul hill,	. . .				22 59 32.	
	Rissheemalli,	120 41 9.61	—2.0			120 41 7.6	
	Nagamalli,	36 19 20.17	+0.19			36 19 20.4	
25						180 0 0	
	Nagamalli from { Permaul hill,						172665.4
	Nagamalli from { Rissheemalli,						78425.1

Permaul hill from Rissheemalli=118926.2.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Permaul hill,	. . .				62 42 12.4	
	Rissheemalli	82 34 54.61	—2.27			82 34 52.3	
	Suddragherry	34 42 56.64	—1.39			34 42 55.3	
26						180 0 0	
	Suddragherry from	Permaul hill					207077.6
		Rissheemalli					185571.9

Permaul hill from Nagamalli = 172665.4 Feet.

	Permaul hill,	° ′ ″ . . .				° ′ ″ 39 42 38.9	
	Nagamalli,	84 14 3.21	—2.45			84 14 0.8	
	Suddragherry,	56 3 21.8	—1.52			56 3 20.3	
27						180 0 0	
	Suddragherry from	Permaul hill					207082.6
		Nagamalli					132980.6

Suddragherry from Rissheemalli=185571.9.

	Suddragherry,	21 20 24.63	—0.13			21 20 24.5	
	Rissheemalli,	38 6 15.	+0.29			38 6 14.5	
	Nagamaulli,	120 33 23.38	—2.28			120 33 21.	
28		180 0 3.01		2.″13	+0.″88	180 0 0.	
	Nagamalli from	Suddragherry					132981.4
		Risshcemalli					78420.2

Suddragherry from Nagamalli=132981.

	Suddragherry	25 48 40.85	—0.″51			25 48 38.5	
	Nagamalli	91 36 14. 5	—1.07			91 36 13.5	
	Sekundermalli	62 35 8.63	—0.48			62 35 8.	
29		180 0 3.98		2.″06	—1.″92	180 0 0.	
	Sekundermalli from	Suddragherry					149745.0
		Nagamalli					64224.2

Suddragherry from Nagamalli as a Base in the last triangle, is a mean distance derived from the 27th and 28th triangles.

Measurement of the Base Line near Pallamcottah.

Experiments made for comparing the Chains.

PREVIOUS TO THE MEASUREMENT.			AFTER THE MEASUREMENT.		
1809	Excess of the Old Chain.	REMARKS.	1809	Excess of the Old Chain.	REMARKS.
MONTH.	DIVISIONS.		MONTH.	DIVISIONS.	
February 27th P. M.	30.		March 20th A. M.	39.	
	29.			39.5	
	31.5			39.	
	29.			40.	
	29.			39.	
	29.			39.	
	29.	The mean temperature during these experiments was 83.24°.		39.	The mean temperature during these experiments was 79.13°.
	29.			39.	
	29.5			39.	
28th A. M.	29.75			38.5	
	30.5			38.5	
	30.5			39.	
	29.			39.	
	30.5				
Mean	29.66		Mean	39.04	

TABLE containing the particulars of the Measurement.

No. of the Hypothenuse.	Length of each in feet.	Angles of Elevations and Depressions.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.	REMARKS.
				Ascents.	Descents.	Above.	Below.		
		° ′ ″	FEET.	FEET.	FEET.	INCHES.	INCHES.	°	
1	500	0 11 54	.00300		1.73	30.7		97.88	Commenced on the 28th
2	600	0 11 30	.00336	2.01		3.6		80.03	February, 1809.
3	400	0 30 0	.01524	3.49		8.0		96.15	
4	100	0 13 18	.00075		0.39		12.5	106.2	
5	100	0 22 15	.00210	0.65		5.8		112.6	
6	600	0 27 0	.01848	4.71		16.0		76.67	
7	600	Level					2.8	100.13	
8	500	0 13 55	.00405	2.02		6.8		100.8	
9	500	0 21 22	.00970	3.11		5.		91.6	
10	500	0 7 15	.00110		1.05			94.52	
11	400	0 32 36	.01800	3.79		21.		87.6	
12	700	0 13 57	.00560	2.84			2.1	97.8	
13	700	0 5 21	.00084	1.09				85.1	
14	700	0 5 51	.00098	1.19			3.3	109.2	
15	700	0 16 37	.00812	3.38			3.	82.3	
16	600	0 18 3	.00828	3.15			7.5	106.4	
17	700	0 6 42	.00133	1.36			2.0	96.3	
18	600	0 12 48	.00420	2.24			8.8	83.3	
19	500	0 19 3	.00770	2.77			5.9	99.2	
20	700	Level					6.5	91.4	
21	400	0 2 30	.00012		0.29			78.8	
22	700	0 2 30	.00021		0.51	3.8		96.5	
23	600	0 12 21	.00390	2.16		6.2		105.5	
24	700	0 13 39	.00553	2.78			1.1	81.	
25	800	0 2 48	.00032	0.65			9.2	86.1	
26	700	0 15 48	.00735	3.22		4.2		108.4	
27	600	0 3 18	.00030	0.58			2.	83.7	
28	600	0 26 57	.01842	4.7		4.0		87.3	
29	900	0 15 30	.00913	4.06			2.5	109.2	
30	500	0 22 12	.01045	3.23			0.5	84.3	
31	700	0 9 24	.00259	1.91			7.2	94.	
32	700	0 22 7	.01449	4.50			5.6	100.8	
33	500	0 20 0	.00845	2.91				76.0	
34	700	0 5 39	.00098		1.15		8.5	81.9	
35	600	0 11 39	.00345	2.03		2.3		97.9	
36	700	0 12 48	.00490	2.61			0.6	92.1	
37	700	0 21 4	.01316	4.29		4.5		79.9	
38	900	0 13 30	.00697	3.53			17.7	100.5	
39	800	0 34 42	.04072	8.08		14.8		87.9	
40	700	0 27 48	.02289	5.66		2.5		85.8	
41	800	0 5 42	.00112	1.33			8.6	96.9	
42	1000	0 5 30	.00130	1.60			2.8	81.8	
43	700	0 17 30	.00906	3.56		10.5		93.9	
44	1200	0 28 21	.04080	9.90		3.25		88.9	
45	1100	0 10 0	.00462	3.20		0.3		89.7	
46	900	0 11 45	.00526	3.08			5.35	98.	
47	600	0 13 39	.00474	2.38			2.2	104.5	Completed on the 18th
Descent from the termination of the Base to the ground.							32.0		March, 1809.
	30500		.35406	119.75	5.12	153.25	160.25	92.9	

West end of the Base, above the East end of the Base, is perpendicular height 114.05 Feet.

At the commencement, the old chain exceeded the new one 29.66 divisions of the micrometer, equal to .01188 feet. Therefore 305×100.01188 feet, will be the measure in terms of the new chain - - - - - - - - - - - - = 30503.6243 Feet.

At the conclusion, the old chain exceeded the new one 39.04 divisions, and had therefore increased 9.38 divisions, equal to .00376 feet. Hence $305 \times \frac{.00376}{2} = 0.5731$ feet, the correction for the wear, which add - - - - - - - - + 0.5731

The sum of the deductions from col. 4th is 0.35406 feet, which being increased in the ratio of 100 to 100.01188 will be .35410 feet, which subtract - - - - - - - - — 0.3541

Hence the apparent horizontal distance will be - - - 30503.8433

The correction for the expansion and reduced to the standard temperature of 62°. will be $\frac{(92.9-50)\times.0074-(62-50)\times.01237}{12}$ $\times 30503.8433$ feet, which add - - - - - - - - - - + 4.2965

Hence, the corrected measure of the Base, for the temperature of 62°. will be - - - - - - - - - - - - - 30508.1398

Which being reduced to the level of the sea, by taking the mean height of the Base, and which is 435.86 feet above the level of the sea; will be - - - - - - - - 30507.5

The triangles have been brought down from *Suddragherry* and *Sekundermalli*, for the purpose of ascertaining the height of this Base above the Sea, which was necessary to reduce it. After the reduction, the triangles commenced at this Base, and have been carried back in the following order, to bring out the same distance *Suddragherry* from *Sekundermalli*.

West end of the Base from East end of the Base = 30507.5 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	W. end of the Base, ...	62° 54′ 42.4″	—0.07″			62° 54′ 42.″	
	E. end of the Base, ...	62 47 0.63	—0.07			62 47 1.	
	Coonatoor hill, ...	54 18 16.5	—0.07			54 18 17.	
30		179 59 59.53		0.″21	—0.″68	180 0 0.	
	Coonatoor hill from { W. end of the Base, ...						33405.8
		E. end of the Base, ...					33444.1
	W. end of the Base, ...	30 31 36.82				30 31 36.	
	E. end of the Base, ...	76 18 53.4				76 18 53.	
	Taulaootpotha, ...	73 9 30.5				73 9 31.	
31		180 0 0.72				180 0 0	
	Taulaootpotha from { W. end of the Base, ...						30969.7
		E. end of the Base, ...					16190.35

W. end of the Base from Taulaootpotha = 30969.7

	W. end of the Base, ...	110 52 45.1				110 52 45.	
	Taulaootpotha, ...	15 53 54.65				15 53 54.5	
	Vullunkotapotha, ...	. . .				53 13 20.5	
32						180 0 0.	
	Vullunkota from { W. end of the Base, ...						10591.7
		Taulaootpotha, ...					36126.4

E. end of the Base from Coonatoor hill = 33444.1.

	E. end of the Base, ...	72 27 13.17	—0.11			72 27 12.5	
	Coonatoor hill, ...	60 5 16.81	—0.08			60 5 16.	
	Vullunkota, ...	47 27 32.25	—0.11			47 27 31.5	
33		180 0 2.23		0.″30	+1.″93	180 0 0.	
	Vullunkotapotha from { E. end of the Base, ...						39345.
		Coonatoor hill, ...					43279.6

W. end of the Base from Coonatoor hill = 33105.8 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	W. end of the Base,	93° 26′ 9.33	—0.11			93° 26′ 7.7	
	Coonatoor hill,	41 14 30.	—0.06			41 14 28.5	
	Taulaootpotha,	45 19 25.3	—0.06			45 19 23.8	
34		180 0 4.63		0.23	+4.43	180 0 0.	
	Taulaootpotha from { W. end of the Base,						30969.7
	Taulaootpotha from { Coonatoor hill,						46894.2

Coonatoor hill from Vullunkota = 43279.6

	Coonatoor hill,	47 1 30.75	—0.11			47 1 30.6	
	Vullunkota,	. . .				71 45 10.7	
	Taulaootpotha,	61 13 18.8	—0.11			61 13 18.7	
35						180 0 0.	
	Taulaootpotha from { Coonatoor hill,						46895.3
	Taulaootpotha from { Vullunkota,						36127.8

Vullunkota from Taulaootpotha = 36126.4

	Vullunkota,	. . .				71 45 10.7	
	Taulaootpotha,	61 13 18.8	—0.11			61 13 18.7	
	Coonatoor hill,	47 1 30.75	—0.11			47 1 30.6	
36						180 0 0.	
	Coonatoor hill from { Vullunkota,						13278.
	Coonatoor hill from { Taulaootpotha,						46893 6

Coonatoor hill from Taulaootpotha, = 46894.33

	Coonatoor hill,	62 33 53.67	—0.23			62 33 52.6	
	Taulaootpotha,	80 23 40.4	—0.32			80 23 39.3	
	Vullanaud hill,	37 2 29.17	—0.21			37 2 28.1	
37		180 0 3.24		0.76	+2.48	180 0 0.	
	Vullanaud hill from { Coonatoor hill,						76755.9
	Vullanaud hill from { Taulaootpotha,						69092.0

The distance, Coonatoor hill from Taulaootpotha as a Base in the above triangle, is the mean deduced from the 34th, 35th and 36 triangles.

Coonatoor hill from Vullanaud hill = 76755.9

	Coonatoor hill,	109 35 24.2	—0.58			109 35 22.7	
	Vullanaud hill,	24 4 23.	—0.11			24 4 21.9	
	Vullunkota,	46 20 16.44	—0.05			46 20 15.4	
38		180 0 3.64		0.74	+2.90	180 0 0.	
	Vullunkota from { Coonatoor hill,						43278.4
	Vullunkota from { Vullanaud hill,						99960.0

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Vullanaud hill from Vullunkota = 99960 Feet.						
39	Vullanaud hill	94° 54′ 12.13	—1.10			94° 54′ 10.7	
	Vullunkota hill	38 11 52.6	—0.46			38 11 51.6	
	Kolanelloor hill	46 53 58.75	—0.45			46 53 57.7	
		180 0 3.48		2.01	+1.47	180 0 0.	
	Kolanelloor hill from { Vullanaud hill						84657.3
	Kolanelloor hill from { Vullunkota						136101.6
	Vullunkota from Kolanelloor = 136101.6.						
10	Vullunkota	88 53 48.4	—2.4			88 53 46.	
	Kolanelloor hill	48 44 15.9	—1.26			48 41 14.6	
	Perrioormalli	. . .				42 21 59.4	
						180 0 0.	
	Perrioormalli from { Vullunkota						152154.4
	Perrioormalli from { Kolanelloor						202377.5
	Kolanelloor from Perrioormalli = 202377.5.						
41	Kolanelloor	59 36 7.19	—1.07			59 36 6.1	
	Perrioormalli	. . .				30 31 56.9	
	Meenachiporam hill	89 51 59.15	—2.13			89 51 57	
						180 0 0.	
	Meenachiporam from { Kolanelloor hill						102813.5
	Meenachiporam from { Perrioormalli						171556.9
	Perrioormalli from Meenachiporam = 171556.9.						
42	Perrioormalli	70 44 8.67	—2.99			70 41 5.7	
	Meenachiporam hill	61 1 5.63	—2.62			61 1 3	
	Suddragherry	48 14 55.64	—2.4			48 14 51.3	
		180 0 9.94		8.01	+1.93	180 0 0.	
	Suddragherry from { Perrioormalli						204679.3
	Suddragherry from { Meenachiporam hill						220878.85
43	Perrioormalli	55 35 40.05	—2.13			55 35 38.	
	Meenachiporam	68 40 37.25	—2.47			68 40 35.	
	Gopaulswamy	55 43 49.09	—2.14			55 43 47.	
		180 0 6.39		6.71	—1.35	180 0 0.	
	Gopaulswamy from { Perrioormalli						196767.8
	Gopaulswamy from { Meenachiporam						174274.5

Perrioormalli from Meenachiporam hill = 174556.9 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Perrioormalli,	41° 24′ 38.″79	+0.″83			41° 24′ 38.″5	
	Meenachiporam,	11 12 56.5	—0.04			11 12 55.5	
	Kaulikautân,	127 22 29.13	—1.96			127 22 26.	
44		180 0 4.42		1.″17	+3.″25	180 0 0.	
	Kaulikautân from Perrioormalli,						42722.3
	Kaulikautân from Meenachiporam hill,						145290.4

Meenachiporam hill from Kaulikautân = 145290.4

	Meenachiporam hill,	85 42 47.57	—1.57			85 42 46.	
	Kaulikautân hill,	. . .				35 30 44.25	
	Kooteapâra,	58 46 30.67	—0.95			58 46 29 75	
45						180 0 0.	
	Kooteapâra from Meenachiporam hill,						98692.8
	Kooteapâra from Kaulikautân hill,						169427 5
	Meenachiporam,	57 27 40.75	—1.61			57 27 39.7	
	Kaulikautân,	70 39 59.5	—1.9			70 39 58.2	
	Gopaulswamy,	51 52 23.63	—1.56			51 52 22.1	
46		180 0 3.88		5.07	—1.19	180 0 0.	
	Gopaulswamy hill from Meenachiporam hill,						174281.
	Gopaulswamy hill from Kaulikautân hill,						155704.3

Meenachiporam from Gopaulswamy hill = 174277.5

	Meenachiporam hill,	28 15 6.82	+0.12			28 15 6.8	
	Gopaulswamy hill,	28 8 47.61	+0.12			28 8 47.5	
	Kooteapâra,	123 36 8 1	—2 17			123 36 5.7	
47		180 0 2 53		1.93	+0.″60	180 0 0.	
	Kooteapâra from Meenachiporam hill,						98704.7
	Kooteapâra from Gopaulswamy hill,						99043.8

By referring to the 43d and 45th triangles, the distance Meenachiporam from Gopaulswamy will be found common to both, the mean of which is assumed as the Base in the above triangle.

Meenachiporam from Suddragherry = 220878.85

	Meenachiporam,	35 51 35.5	+0.38			35 51 35.9	
	Suddragherry,	. . .				22 20 4.3	
	Kooteapâra,	121 45 23.1	—3.32			121 45 19.8	
48						180 0 0.	
	Kooteapâra from Meenachiporam hill,						98714.35
	Kooteapâra from Suddragherry,						152355.8

Kaulikautân from Kooteapâra = 169427.5 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
	Kaulikautân, ...	. . .				35 9 15.4	
	Kooteapâra, ...	64 49 36.5	—1.11			64 49 35.4	
	Gopaulswamy, ...	80 1 12.71	—1.5			80 1 11.2	
49						180 0 0.	
	Gopaulswamy from {Kaulikautân, ...						155691.9
	Gopaulswamy from {Kooteapâra, ...						99050.5

Kooteapâra from Gopaulswamy = 99047.15

	Kooteapâra, ...	58 31 38.28	—0.88			58 31 37.4	
	Gopaulswamy, ...	79 22 15.36	—1.22			79 22 14.1	
	Sekundermalli, ...	42 6 10.1	—0.81			42 6 8.5	
50		180 0 3.74		2.91	+0.83	180 0 0.	
	Sekundermalli from {Kooteapâra, ...						145195.8
	Sekundermalli from {Gopaulswamy, ...						125997.6

The above Base, Kooteapâra from Gopaulswamy, is the mean obtained by the 47th and 49th Triangles.

Suddragherry from Kooteapâra = 152355.8

	Suddragherry, ...	. . .				57 26 40.4	
	Kooteapâra, ...	60 22 23.28	—1.56			60 22 21.7	
	Sekundermalli, ...	62 10 59.4	—1.53			62 10 57.9	
51						180 0 0.	
	Sekundermalli from {Suddragherry, ...						149740.7
	Sekundermalli from {Kooteapâra, ...						145195.

Sekundermalli from Gopaulswamy = 125997.6

	Sekundermalli, ...	20 4 49.8	—0.31			20 4 49.5	
	Gopaulswamy, ...	105 53 45.55	—1.15			105 53 44.5	
	Suddragherry, ...	54 1 28.65	—0.08			54 1 26.	
52		180 0 4.		1.54	+2.46	180 0 0.	
	Suddragherry from {Sekundermalli, ...						149741.
	Suddragherry from {Gopaulswamy, ...						53455.9

In the two last triangles, the distance *Sekundermalli* from *Suddragherry* will be found common: then, by taking the mean and referring to the 29th triangle, it will appear, that there is a difference of $4\frac{1}{10}$ feet, in the same side *Suddragherry* from *Sekundermalli*; from whence it may be inferred, that had the base been computed from bringing down the triangles from the northward, it would have exceeded the measurement by 10 inches nearly.

Triangles continued to the South extremity of the Arc.

Vullanaud hill from Vullankotapotha = 99960 Feet.

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Vullanaud hill, ...	57 50 46.54	—0.77			57 50 45.3	
	Vullunkota, ...	70 48 20.4	—0.92			70 48 19.	
	Kunnimapotha, ...	51 20 56.93	—0.74			51 20 55.7	
53		180 0 3.87		2.43	+1.44	180 0 0.	
	Kunnimapotha from { Vullanaud hill, ...						120880.1
	Kunnimapotha from { Vullunkota, ...						108363.9

Vullanaud hill from Kunnimapotha = 120880.1

	Vullanaud hill, ...	49 24 39.6	—0.81			49 24 39.	
	Kunnimapotha, ...	66 8 28.07	—0.94			66 8 27.3	
	Red hill Station, ...	64 26 54.4	—0.92			64 26 53.7	
54		180 0 2.07		2.67	—0.60	180 0 0.	
	Red hill Station from { Vullanaud hill, ...						122534.5
	Red hill Station from { Kunnimapotha, ...						101747.0

Kunnimapotha from Red hill Station = 101747.

	Kunnimapotha, ...	52 56 17.17	—0.71			52 56 15.3	
	Red hill Station, ...	73 48 19.4	—0.92			73 48 18.4	
	Koodunkolum, ...	53 15 28.13	—0.72			53 15 26.3	
55		180 0 4.7		2.35	+2.35	180 0 0.	
	Koodunkolum Station from { Kunnimapotha, ...						121934.1
	Koodunkolum Station from { Red hill Station, ...						101321.5

Number.	TRIANGLES.	Observed Angles.	Difference.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		Kunnimapotha from Red hill Station = 101747. Feet.					
	Kunnimapotha	° ′ ″				° ′ ″	
	Red hill Station	48 11 40.42	—0.6			73 13 39.2	
	Munpotha	58 34 41.64	—0.66			48 11 39.8	
56						58 34 41.	
						180 0 0.	
	Munpotha from Kunnimapotha						88877.
	Munpotha from Red hill Station						114159.9
		Red hill Station from Koodunkolum = 101321.5.					
	Red hill Station	25 36 40.5	—0.29			25 36 40.3	
	Koodunkolum	91 52 43.13	—0.62			91 52 42.6	
	Munpotha	62 30 37.33	—0.28			62 30 37.1	
57		180 0 0.96		1.19	—0.23	180 0 0.0	
	Munpotha from Red hill Station						114155.95
	Munpotha from Koodunkolum						49371.8
		Koodunkolum from Munpotha = 49371.8.					
	Koodunkolum	59 7 20.97	—0.04			59 7 21.	
	Munpotha	23 24 16.5	—0.05			23 24 16.5	
	Punnae Station	97 28 22.81	—0.12			97 28 22.5	
58		180 0 0.28		0.21	+0.07	180 0 0.	
	Punnae Station from Koodunkolum						19779.5
	Punnae Station from Munpotha						42737.2

For the purpose of reducing the terestrial arc, the following angles, with their including sides, have been used, to obtain sides more conveniently situated with the meridian of *Dodagoontah* station, to which the whole Arc is reduced.

The angle at the South East end of the base, between *Parteemalli* and *Putchapolliam* station, corrected for the chords, equal 112° 5′ 9″.2 with the including sides, *Parteemalli* from S. E. end of the base, equal 107454.5 feet, and S. E. end of the base from *Putchapolliam*, = 27561.2 feet; hence the distance *Parteemalli* from *Putchapolliam* = 120553.6 feet, and the observed angle at the S. E. end of the base = 112° 5′ 9″.87.

With the internal angle at *Perrioormalli*, equal 143° 37′ 32″.7 corrected for the chords, and the including sides, *Perrioormalli* from *Suddragherry*, equal 204679.3 feet, and *Perrioormalli* from *Vullunkota*, equal 152154.4 feet; by which the distance from *Suddragherry* to *Vullunkota* is found 339403.5 feet. The observed angle at *Perrioormalli* = 143° 37′ 44″.17.

The internal angle of *Munpotha*, corrected for the chords, equal 144° 29′ 34″.42, with the including sides, *Kunnimapotha* from *Munpotha*, equal 88877 feet, and *Munpotha* from *Punnae* station, equal 42737.2 feet; the direct distance from *Kunnimapotha* to *Punnae* station is found 126133.4 feet. Again, with the internal angle at *Koodunkolum*, corrected for the chords, equal 97° 44′ 36″, and the included sides *Koodunkolum* from *Kunnimapotha*, equal 121934.1 feet, and *Koodunkolum* from *Punnae* station, equal 19779.5 feet, the same direct distance from *Kunnimapotha* to *Punnae* station is found 126131.4 feet; the mean of which is 126132.4 feet. The angle at *Kunnimapotha* between *Koodunkolum* and *Punnae* station, corrected for an observed one, is 8° 56′ 21″,39, which is used in reducing the Arc.

5. *Reduction of the distances to the Meridian of Dodagoontah Station.*

The length of the Arc comprehended by the parallels of *Putchapolliam* and *Punnae* Station.

Stations at	Names of Places.	Bearings referred to the Meridian of Dodagoontah.	Distances.	Distances on the		Distances from Putchapolliam on the	
				Perpendicular.	Meridian.	Perpendicular.	Meridian.
			FEET.	FEET.	FEET.	FEET.	FEET.
Putchapolliam Station,	Parteemalli,	7° 56′ 29″.74 S.W.	120553.6	16656.1 W.	119397.4 S.	166561. W.	119397.4 S.
Parteemalli,	Permaul Hill,	1 54 37.23 S.W.	133318.9	4444.2 W.	133244.8 S.	21100.3 W.	252642.2 S.
Permaul Hill,	Suddragherry,	11 14 52.96 S.E.	207080.1	40392.4 E.	203102.5 S.	19292.1 E.	455744.7 S.
Suddragherry,	Vullunkota,	3 13 50.25 S.W.	339403.5	19127.1 W.	338864.1 S.	165. E.	794608.8 S.
Vullunkota,	Kunnimapotha,	0 10 35.28 S.W.	108363.9	333.8 W.	108363.3 S.	168.8 W.	902972.1 S.
Kunnimapotha,	Punnae Station,	0 27 21.16 S.E.	126132.4	1003.6 E.	126128.4 S.	834.8 E.	1029100.5 S.

6. ZENITH distances of Stars, observed at *Putchapolliam* and *Punnae Station*, with their corrections for precession, nutation, aberration and the semi-annual solar equation, back to the beginning of the year 1805.

Observations at Putchapolliam.

δ HYDRAE.

Nearest point on the Limb, 4° 40′. South.

1806. Month.	Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
April 13	E.	4° 37′ 37″.74	24.52	4° 37′ 13″.22	93°	93°
14	W.	4 37 26.49	24.5	4 37 1.99	90	91
16	E.	4 37 36.24	24.45	4 37 11.79	93	92
17	W.	4 37 28.11	24.42	4 37 3.69	93	92
18	E.	4 37 35.24	24.40	4 37 10.84	93	93
19	W.	4 37 30.99	24.37	4 37 6.62	95	94
20	E.	4 37 36.49	24.34	4 37 12.15	93	93
21	W.	4 37 27.49	24.31	4 37 3.18	93	93
22	E.	4 37 35.24	24.29	4 37 10.95	85	85
23	W.	4 37 28.44	24.26	4 37 4.18	96	96
				Mean	92.4	92.2

ε HYDRÆ.

Nearest point on the Limb, 3° 55′ South.

April 13	E.	3 52 33.74	25.31	3 52 8.43	93	93
14	W.	3 52 24.49	25.29	3 51 59.20	90	91
17	E.	3 52 36 74	25.21	3 52 11.53	93	92
18	W.	3 52 25.99	25.88	3 52 0.11	93	93
19	E.	3 52 32 69	25.16	3 52 7.53	95	94
21	W.	3 52 26.74	25.10	3 52 1.64	93	93
22	E.	3 52 35.49	25.08	3 52 10.41	85	85
23	W.	3 52 25.54	25.04	3 52 0. 5	96	96
				Mean	92.25	92.13

α CANCRI.

Nearest point on the Limb, 1° 35′ North.

1806 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	14	W.	1 36 10.13	24.51	1 36 34.64	89	91
	17	E.	1 36 4.25	24.42	1 36 28.67	93	92
	18	W.	1 36 8.26	24.38	1 36 32.64	93	93
	19	E.	1 36 3.03	24.34	1 36 27.37	95	94
	20	W.	1 36 12.13	24.31	1 36 36.44	93	93
	21	E.	1 36 3.13	24.27	1 36 27.4	93	92
	22	W.	1 36 10.	24.23	1 36 34.23	95	94
	23	E.	1 36 3.53	24.19	1 36 27.72	96	96
					Mean	93.37	93.13

o LEONIS.

Nearest point on the Limb, 0° 15′ South.

			° ′ ″	″ −	° ′ ″		
April	9	E.	0 13 52.87	29.96	0 13 22.91	89	88
	10	W.	0 13 43.24	29.93	0 13 13.31	90	89
	11	E.	0 13 51.87	29.89	0 13 21.98	90	89
	14	E.	0 13 51.09	29.78	0 13 21.31	86	87
	17	E.	0 13 52.67	29.65	0 13 23.02	91	92
	18	W.	0 13 42.62	29.61	0 13 13.01	93	91
	19	W.	0 13 41.99	29.57	0 13 12.42	92	93
	20	W.	0 13 42.62	29.53	0 13 13.09	91	92
	21	E.	0 13 53.25	29.49	0 13 23.76	93	91
	22	W.	0 13 41.62	29.45	0 13 12.17	93	92
	23	E.	0 13 53.75	29.41	0 13 24.34	94	94
	24	W.	0 13 42.37	29.36	0 13 13.01	93	92
	25	E.	0 13 52.25	29.32	0 13 22.93	92	92
	26	W.	0 13 41.5	29.27	0 13 12.23	95	94
					Mean	91.43	91.14

REGULUS.

Nearest point on the Limb, 1° 55′ North.

				″ +	° ′ ″		
April	11	E.	1 54 36.25	31.58	1 55 7.83	90	89
	12	W.	1 54 43.	31.53	1 55 14.53	87	87
	13	E.	1 54 32.8	31.48	1 55 4.28	88	89
	14	W.	1 54 42.45	31.43	1 55 13.88	86	87
	17	E.	1 54 36.75	31.28	1 55 8.03	91	91
	18	W.	1 54 45.5	31.23	1 55 16.73	91	90
	19	E.	1 54 34.8	31.18	1 55 5.98	92	92
	20	W.	1 54 45.25	31.12	1 55 16.37	91	92
	21	E.	1 54 36.62	31.07	1 55 7.69	91	91
	22	W.	1 54 46.25	31.02	1 55 17.27	92	92
	23	E.	1 54 34.87	30.97	1 55 5.84	93	93
	24	W.	1 54 43.87	30.92	1 55 14.79	91	91
					Mean	90.25	90.33

9 LEONIS.

Nearest point on the Limb, 5° 30′. North.

1806. Month.	Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	″ +	° ′ ″	°	°
April 10	W.	5 29 16.5	35.35	5 29 51.85	87	87
11	E.	5 29 11.	35.27	5 29 46.27	86	85
12	W.	5 29 17.87	35.19	5 29 53.06	84	84
13	E.	5 29 8.62	35.10	5 29 43.72	83	85
14	W.	5 29 17.2	35.02	5 29 52.22	84	85
17	E.	5 29 9.87	34.77	5 29 44.64	90	91
18	W.	5 29 18.87	34.69	5 29 53.56	89	89
19	E.	5 29 12.5	34.60	5 29 47.10	91	91
20	W.	5 29 18.87	34.52	5 29 53.39	89	89
21	E.	5 29 11.	34.44	5 29 45.44	90	90
22	W.	5 29 18.75	34.35	5 29 53.10	88	88
23	E.	5 29 7.25	34.26	5 29 41.51	91	91
24	W.	5 29 18.	34.17	5 29 52.17	89	89
				Mean	87.77	88.

β LEONIS.

Nearset point on the Limb, 4° 40′ North.

			+			
April 10	W.	4 39 19.4	37.17	4 39 56.57	85	84
11	E.	4 39 13.67	37.09	4 39 50.76	85	84
12	W.	4 39 23.87	37.0	4 40 0.87	83	84
13	E.	4 39 12.87	36.91	4 39 49.78	83	84
14	W.	4 39 24.5	36.82	4 40 1.32	83	84
17	E.	4 39 15.	36.56	4 39 51.56	90	91
18	W.	4 39 21.9	36.47	4 39 58.37	88	88
19	E.	4 39 12.8	36.38	4 39 49.18	79	79
20	W.	4 39 24.5	36.28	4 40 0.78	88	88
21	E.	4 39 15.	36.19	4 39 51.19	89	89
23	W.	4 39 22.37	36.01	4 39 58.38	88	89
24	E.	4 39 13.25	35.91	4 39 49.16	89	89
26	W.	4 39 22.5	35.72	4 39 58.22	86	86
				Mean	85.85	86.08

ε VIRGINIS.

Nearest point on the Limb, 1° 0′ *North.*

1806 Month.	Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	″ +	° ′	°	°
April 24	E.	1 0 12.	37.01	1 0 49.01	86	86
26	W.	1 0 21.95	36.81	1 0 58.76	85	85
27	E.	1 0 13.75	36.71	1 0 50.46	83	82
28	W.	1 0 22.63	36.61	1 0 59.24	85	86
30	E.	1 0 12.38	36.41	1 0 48.79	83	82
May 1	W.	1 0 23.	36.32	1 0 59.32	83	83
				Mean	84.17	84.

δ SERPENTIS.

Nearest point on the Limb, 0° 10′ *North.*

			″ +			
April 19	E.	0 11 40.13	28.58	0 12 8.71	84	84
20	W.	0 11 51.63	28.47	0 12 20.1	82	82
21	E.	0 11 42.13	28.36	0 12 10.49	83	83
22	W.	0 11 51.23	28.24	0 12 19.47	83	83
23	E.	0 11 40.49	28.13	0 12 8.62	83	83
27	W.	0 11 50 36	27.63	0 12 17.99	81	81
30	E.	0 11 41.38	27.24	0 12 8 62	81	81
May 1	W.	0 11 51.58	27.11	0 12 18.69	82	82
				Mean	82.38	82.37

α SERPENTIS.

Nearest point on the Limb, 3° 55′ *South.*

			″ −			
April 21	E.	3 57 15.76	26.76	3 56 49.	83	83
22	W.	3 57 8.33	26.66	3 56 41.67	83	83
23	E.	3 57 15.51	26.56	3 56 48.95	83	83
27	W.	3 57 7.26	26.15	3 56 41.11	81	81
30	E.	3 57 12.18	25.81	3 56 46.37	81	81
May 1	W.	3 57 6.51	25.70	3 56 40.81	82	82
				Mean	82.17	82·17

γ SERPENTIS.

Nearest point on the Limb, 5° 20′ *North.*

1806 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	19	E.	5 18 3.37	26.93	5 18 30.3	84	84
	20	W.	5 18 14.74	26.79	5 18 41.53	82	82
	21	E.	5 18 4.97	26.65	5 18 31.62	83	83
	22	W.	5 18 14.67	26.50	5 18 41.17	82	83
	23	E.	5 18 5.12	26.36	5 18 31.48	83	83
	27	W.	5 18 14.62	25.75	5 18 40.37	81	81
	30	E.	5 18 5.39	25.28	5 18 30.67	81	81
May	1	W.	5 18 15.92	25.11	5 18 41.03	81	81
					Mean	82.13	82.25

α HERCULIS.

Nearest point on the Limb, 3° 35′ *North.*

				+			
April	27	E.	3 37 14.98	16.37	3 37 31.35	80	80
	28	W.	3 37 21.93	16.22	3 37 38.15	83	83
	30	E.	3 37 16.26	15.89	3 37 32.15	80	80
May	1	W.	3 37 23.76	15.73	3 37 39.49	81	80
	2	E.	3 37 15.51	15.58	3 37 31.09	81	81
					Mean	81.2	80.8

α OPHIUCHI.

Nearest point on the Limb, 1° 40′ *North.*

				+			
April	24	E.	1 42 41.51	14.26	1 42 55.77	82	82
	25	W.	1 42 50.76	14.13	1 43 4.89	83	82
	27	E.	1 42 40.26	13.84	1 42 54.1	80	80
	28	W.	1 42 48.26	13.69	1 43 1.95	83	83
	30	E.	1 42 40.76	13.40	1 42 54.16	80	80
May	1	W.	1 42 50.51	13.24	1 43 3.75	81	80
	2	E.	1 42 42.26	13.09	1 42 55.35	81	81
					Mean	81.43	81.14

ε AQUILÆ.

Nearest point on the Limb, 2° 35′ *North.*

1806 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	12	W.	2 35 11.75	3.81	2 35 15.56	76	75
	13	E.	2 35 7.	3.72	2 35 10.72	78	79
	14	W.	2 35 15.25	3.62	2 35 18.87	79	80
	15	E.	2 35 6.5	3.54	2 35 10.04	76	75
	16	W.	2 35 12.6	3.44	2 35 16.04	78	78
	17	E.	2 35 8.5	3.33	2 35 11.83	77	77
	18	W.	2 35 15.	3.23	2 35 18.23	80	79
	20	E.	2 35 7.5	2.99	2 35 10.49	79	79
	21	W.	2 35 17.5	2.87	2 35 20.37	80	80
	24	E.	2 35 7.	2.50	2 35 9.5	80	80
	25	W.	2 35 15.75	2.37	2 35 18.12	81	81
	26	E.	2 35 6.88	2.23	2 35 9.11	82	82
	28	W.	2 35 15.	1.85	2 35 16.85	81	82
	30	E.	2 35 7.25	1.65	8 35 8.9	80	80
May	1	W.	2 35 17.38	1.49	2 35 18.87	80	80
	2	E.	2 35 7.	1.34	2 35 8.34	80	80
					Mean	79.06	79.2

γ AQUILÆ.

Nearest point on the Limb, 0° 50′ *South.*

				″ +	° ′ ″		
April	20	W.	0 50 42.37	3.58	0 50 45.95	80	80
	21	W.	0 50 43.5	3.69	0 50 47.19	80	80
	22	E.	0 50 48.5	3.79	0 50 52.29	81	80
	23	E.	0 50 50.13	3.91	0 50 54.04	81	81
	24	E.	0 50 50.	4.04	0 50 54.04	80	80
	26	W.	0 50 42.5	4.30	0 50 46.80	82	81
	27	E.	0 50 50.25	4.43	0 50 54.68	80	80
	28	W.	0 50 42.38	4.56	0 50 46.94	81	81
	29	E.	0 50 47.25	4.69	0 50 51.94	80	80
	30	W.	0 50 41.	4.84	0 50 45.84	80	80
May	1	W.	0 50 41.13	4.98	0 50 46.11	81	81
	2	E.	0 50 48.63	5.12	0 50 53.75	80	79
					Mean	80.5	80.25

ATAIR.

Nearest point on the Limb, 2° 40 South.

1806 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometer. Upper	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	18	W.	2 37 44.24	4.95	2 37 49.19	80	79
	19	E.	2 37 48.44	5.05	2 37 53.49	80	79
	21	W.	2 37 44.24	5.26	2 37 49.5	80	80
	22	E.	2 37 46.99	5.38	2 37 52.37	81	80
	23	W.	2 37 43.74	5.50	2 37 49.24	81	81
	24	E.	2 37 48.74	5.62	2 37 54.36	80	80
	25	W.	2 37 42.37	5.75	2 37 48.12	82	82
	26	E.	2 37 48.37	5.88	2 37 54.25	82	81
	27	W.	2 37 40.62	6.01	2 37 46.63	80	80
	28	E.	2 37 50.87	6.14	2 37 57.01	81	81
	29	W.	2 37 41.24	6.28	2 37 47.52	80	80
	30	E.	2 37 46.87	6.41	2 37 53.28	80	80
May	1	W.	2 37 42.74	6.56	2 37 49.30	81	81
	2	E.	2 37 48.49	6.71	2 37 55.20	80	79
					Mean	80.57	80.21

β AQUILÆ.

Nearest point on the Limb, 5° 5 South.

				″ +			
April	22	E.	5 3 49.24	5.55	5 3 54.79	81	80
	23	W.	5 3 37.62	5.66	5 3 43.28	81	81
	24	E.	5 3 49.5	5.79	5 3 55.29	80	80
	25	W.	5 3 40.5	5.90	5 3 46.4	82	82
	26	E.	5 3 47.75	6.02	5 3 53.77	82	81
	27	W.	5 3 40.75	6.15	5 3 46.9	80	81
	28	E.	5 3 49.37	6.28	5 3 55.65	81	80
	29	W.	5 3 40.	6.42	5 3 46.42	80	80
	30	E.	5 3 49.12	6.55	5 3 55.67	80	80
May	1	W.	5 3 41.37	6.69	5 3 48.06	81	81
	2	E.	5 3 47.37	6.83	5 3 54.2	80	79
					Mean	80.73	80.5

β DELPHINI.

Nearest point on the Limb, 2° 55 North.

				—			
May	2	E.	2 55 47.5	9.93	2 55 37.57	79	79
	4	W.	2 55 58.25	10.23	2 55 48.02	74	74
					Mean	76.5	76.5

Observations at Punnae Station.

δ HYDRÆ.

Nearest point on the Limb, 1° 45 *South.*

1809 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
				—			
April	12	E.	1° 48′ 11″.01	1′ 5″.14	1° 47′ 5″.87	84°	84°
	14	E.	1 48 8.51	1 5.08	1 47 3.43	86	85
	16	W.	1 48 1.26	1 5.02	1 46 56.24	85	84
	17	E.	1 48 9.51	1 4.99	1 47 4.52	84	83
	18	W.	1 47 58.76	1 4.96	1 46 53.8	85	84
	19	W.	1 47 58.89	1 4.92	1 46 53.97	84	84
	20	W.	1 47 57.01	1 4.89	1 46 52.12	84	84
	23	E.	1 48 10.26	1 4.78	1 47 5.48	83	83
	24	W.	1 47 59.26	1 4.74	1 46 54.52	84	84
	25	E.	1 48 10.76	1 4.72	1 47 6.04	85	85
	26	W.	1 48 1.26	1 4.68	1 46 56.58	87	87
					Mean	84.64	84.28

ε HYDRÆ.

Nearest point on the Limb, 1° 5′ *South.*

				—			
April	12	E.	1 3 10.87	1′ 7″.53	1 2 3.34	84	84
	13	W.	1 2 57.74	1 7.5	1 1 50.24	84	83
	14	E.	1 3 9.24	1 7.47	1 2 1.77	86	85
	16	W.	1 3 1.74	1 7.4	1 1 54.34	85	84
	17	E.	1 3 10.37	1 7.36	1 2 3.01	84	83
	18	W.	1 3 0.24	1 7.33	1 1 52.91	85	84
	19	E.	1 3 10.87	1 7.30	1 2 3.57	84	84
	20	W.	1 2 59.87	1 7.26	1 1 52.61	84	84
	21	E.	1 3 10.39	1 7.23	1 2 3.16	81	81
	23	W.	1 3 1.87	1 7.15	1 1 54.72	83	83
	24	E.	1 3 10.24	1 7.12	1 2 3.12	84	84
	25	W.	1 2 59.37	1 7.09	1 1 52.28	85	85
	26	E.	1 3 13.24	1 7.05	1 2 6.19	87	87
					Mean	84.23	83.92

α CANCRI.

Nearest point on the Limb, 4° 25′ North.

1809 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
				+			
			° ′ ″	′ ″	° ′ ″	°	°
April	12	E.	4 25 25.	1 8.12	4 26 33.12	84	84
	13	W.	4 25 38.13	1 8.08	4 26 46.21	84	83
	14	E.	4 25 27.63	1 8.04	4 26 35.67	86	85
	16	W.	4 25 36.13	1 7.97	4 26 44.1	85	84
	17	E.	4 25 25.	1 7.92	4 26 32.92	84	83
	18	W.	4 25 34.13	1 7.87	4 26 42.0	85	84
	19	E.	4 25 25.5	1 7.83	4 26 33.33	84	84
	20	W.	4 25 35.63	1 7.79	4 26 43.42	84	84
	21	E.	4 25 27.	1 7.75	4 26 34.75	81	81
	23	W.	4 25 32.25	1 7.65	4 26 39.9	83	83
	24	E.	4 25 26.75	1 7.61	4 26 34.36	84	84
	25	W.	4 25 35.5	1 7.57	4 26 43.07	85	85
	26	E.	4 25 25.88	1 7.52	4 26 33.4	87	87
					Mean	84.23	83.92

o LEONIS.

Nearest point on the Limb, 2° 35′ North.

				+			
			° ′ ″	′ ″			
April	12	E.	2 35 25.13	1 20.13	2 36 45.26	84	84
	13	W.	2 35 36.63	1 20.09	2 36 56.72	84	83
	14	E.	2 35 23.63	1 20.04	2 36 43.67	85	84
	16	W.	2 35 34.13	1 19.94	2 36 54.07	85	84
	17	E.	2 35 23.88	1 19.90	2 36 43.78	84	83
	18	W.	2 35 34.5	1 19.85	2 36 54.35	84	83
	19	E.	2 35 23.50	1 19.80	2 36 43.3	84	84
	20	W.	2 35 34.5	1 19.75	2 36 54.25	84	84
	23	E.	2 35 23.25	1 19.61	2 36 42.86	83	83
	24	W.	2 35 35.38	1 19.55	2 36 54.93	83	83
	25	E.	2 35 24.5	1 19.50	2 36 44.	84	84
	26	W.	2 35 35.75	1 19.45	2 36 55.2	85	85
	27	E.	2 35 24.25	1 19.40	2 36 43.65	85	86
	28	W.	2 35 36.88	1 19.35	2 36 56.23	86	87
	29	E.	2 35 23.63	1 19.30	2 36 42.93	84	85
	30	W.	2 35 36.63	1 19.25	2 36 55.88	87	87
May	2	E.	2 35 23.38	1 19.15	2 36 42.53	84	84
	3	W.	2 35 38.	1 19.09	2 36 57.09	82	82
	5	E.	2 35 25.5	1 18.97	2 36 44.47	84	84
	6	W.	2 35 34.75	1 18.93	2 36 53.68	84	84
	7	E.	2 35 25.88	1 18.87	2 36 44.75	84	84
					Mean	84.14	84.24

REGULUS.

Nearest point on the Limb, 4° 45′ North.

1809 Month.	Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	′ ″ +	° ′ ″	°	°
April 12	E.	4 43 51.87	1 24.53	4 45 16.4	84	84
13	W.	4 44 2.	1 24.48	4 45 26.48	84	83
14	E.	4 43 49.87	1 24.42	4 45 14.29	83	82
16	W.	4 43 59.37	1 24.31	4 45 23.68	85	84
17	E.	4 43 49.87	1 24.25	4 45 14.12	84	83
18	W.	4 44 2.	1 24.19	4 45 26.19	83	82
20	E.	4 43 49.	1 24.07	4 45 13.07	83	83
24	W.	4 43 59.5	1 23.82	4 45 23.32	82	83
25	E.	4 43 51.12	1 23.77	4 45 14.89	82	83
26	W.	4 44 0.5	1 23.70	4 45 24.2	82	83
27	E.	4 43 48.87	1 23.63	4 45 12.5	84	84
28	W.	4 44 0.37	1 23.57	4 45 23.94	84	85
29	E.	4 43 48.37	1 23.52	4 45 11.89	83	84
30	W.	4 44 1.62	1 23.45	4 45 25.07	85	85
May 2	E.	4 43 48.87	1 23.33	4 45 12.2	83	83
3	W.	4 44 2.87	1 23.27	4 45 26.14	82	82
5	E.	4 43 49.12	1 23.14	4 45 12.26	84	84
6	W.	4 44 1.87	1 23.08	4 45 24.95	83	83
7	E.	4 43 50.87	1 23.02	4 45 13.89	83	83
8	W.	4 44 2.87	1 22.96	4 45 25.83	82	82
				Mean	83.25	83.25

9 LEONIS.

Nearest point on the Limb, 8° 20′ North.

				+			
April	17	E.	8 18 17.37	1 31.94	8 19 49.31	83	82
	18	W.	8 18 28.87	1 31.85	8 20 0.72	83	82
	19	E.	8 18 20.74	1 31.76	8 19 52.5	83	83
	20	W.	8 18 28.87	1 31.67	8 20 0.54	83	83
	23	E.	8 18 15.87	1 31.40	8 19 47.27	82	82
	24	W.	8 18 28.89	1 31.30	8 20 0.19	82	83
	25	E.	8 18 15.37	1 31.22	8 19 46.59	82	83
	26	W.	8 18 31.87	1 31.12	8 20 2.99	82	83
	28	E.	8 18 17.37	1 30.94	8 19 48.31	84	85
	29	W.	8 18 26.87	1 30.84	8 19 57.71	83	83
	30	E.	8 18 17.39	1 30.75	8 19 48.14	85	85
May	3	W.	8 18 32.	1 30.48	8 20 2.48	82	82
	4	E.	8 18 18.12	1 30.39	8 19 48.51	82	83
	5	W.	8 18 33.24	1 30.30	8 20 3.54	82	83
	6	E.	8 18 18.74	1 30.22	8 19 48.96	82	82
	7	W.	8 18 31.62	1 30.13	8 20 1.75	82	83
					Mean	82.62	82.87

β LEONIS.

Nearest point on the Limb, 7° 30′ North.

1809 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
				+			
April	12	E.	7° 28′ 22.″87	1′ 34.″7	7° 29′ 57.″57	84°	84°
	13	W.	7 28 37.37	1 34.61	7 30 11.98	84	83
	14	E.	7 28 25.87	1 34 51	7 30 0.38	83	82
	16	W.	7 28 34.24	1 34.33	7 30 8.57	83	82
	17	E.	7 28 21.37	1 34.24	7 29 55.61	83	82
	18	W.	7 28 32.12	1 34.14	7 30 6.26	83	82
	19	E.	7 28 25.24	1 34.04	7 29 59.28	82	82
	20	W.	7 28 33.62	1 33.93	7 30 7.55	81	81
	23	E.	7 28 25.87	1 33.64	7 29 59.51	82	82
	24	W.	7 28 35.37	1 33.54	7 30 8.91	82	83
	25	E.	7 28 26.87	1 33.44	7 30 0.31	81	82
	26	W.	7 28 35.87	1 33.34	7 30 9.21	82	83
	28	E.	7 28 25.87	1 33.14	7 29 59.01	84	85
	29	W.	7 28 38.87	1 33.04	7 30 11.91	83	83
	30	E.	7 28 22.87	1 32.93	7 29 55.8	82	82
May	2	W.	7 28 38.97	1 32.74	7 30 11.71	81	82
	4	W.	7 28 37.87	1 32.54	7 30 10.41	82	83
	5	E.	7 28 24.12	1 32.44	7 29 56.56	82	83
	6	W.	7 28 38.87	1 32.34	7 30 11.21	82	82
	7	E.	7 28 25.47	1 32.25	7 29 57.72	82	82
					Mean	82.38	82.48

ε VIRGINIS.

Nearest point on the Limb, 3′ 50″ North.

				+			
April	18	W.	3 49 36.62	1 31.18	3 51 7.8	82	81
	19	E.	3 49 26.	1 31.09	3 50 57.09	82	82
	20	W.	3 49 35.	1 30.99	3 51 5.99	80	81
	23	E.	3 49 26.	1 30.69	3 50 56.69	82	82
	25	W.	3 49 35.37	1 30.49	3 51 5.86	81	82
	26	E.	3 49 25.87	1 30.38	3 50 56.25	82	83
	28	W.	3 49 38.	1 30.17	3 51 8.17	83	84
	29	E.	3 49 26.	1 30.07	3 50 56.07	83	83
	30	W.	3 49 39.	1 29.97	3 51 8.97	82	82
May	3	E.	3 49 27.87	1 29.64	3 50 57.51	82	82
	4	W.	3 49 38.25	1 29.54	3 51 7.79	81	82
	5	E.	3 49 26.75	1 29.43	3 50 56.18	82	82
	6	W.	3 49 37.12	1 29.32	3 51 6.44	81	82
	7	E.	3 49 28.6	1 29.21	3 50 57.81	81	82
					Mean	81.71	82.14

δ SERPENTIS.

Nearest point on the Limb, 3 North.

1809 Month.		Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	18	W.	3 1 30.76	57.96	3 2 28.72	80	79
	19	E.	3 1 20.13	57.85	3 2 17.98	80	80
	20	W.	3 1 29.26	57.75	3 2 27.01	80	80
	23	E.	3 1 20.63	57.39	3 2 18.02	81	81
	24	W.	3 1 29.63	57.27	3 2 26.9	81	81
	25	E.	3 1 20.13	57.14	3 2 17.27	80	80
	26	W.	3 1 29.13	57.01	3 2 26.14	82	82
	27	E.	3 1 20.13	56 89	3 2 17.02	83	83
	28	W.	3 1 32.26	56.76	3 2 29.02	84	84
	29	E.	3 1 20.13	56.63	3 2 16.76	83	83
	30	W.	3 1 32.51	56.5	3 2 29.01	83	83
May	3	E.	3 1 19.13	56.09	3 2 15.22	80	80
	5	W.	3 1 32.38	55.81	3 2 28.19	82	82
	6	E.	3 1 20.63	55.66	3 2 16.29	81	81
	7	W.	3 1 32.63	55.52	3 2 28.15	81	81
					Mean	81.33	81.33

α SERPENTIS.

Nearest point on the Limb, 1 5 South.

				−			
April	18	W.	1 7 26.26	53.59	1 6 32.67	80	79
	19	E.	1 7 36.39	53.51	1 6 42.88	80	80
	20	W.	1 7 25.26	53.41	1 6 31.85	80	80
	23	E.	1 7 33.64	53.11	1 6 40.53	81	81
	24	W.	1 7 25.76	53.02	1 6 32.74	81	81
	25	E.	1 7 36.01	52.92	1 6 43.09	80	80
	26	W.	1 7 24.51	52.81	1 6 31.7	82	82
	27	E.	1 7 35.89	52.70	1 6 43.19	83	83
	28	W.	1 7 24.26	52.59	1 6 31.67	84	84
	29	E.	1 7 36.14	52.48	1 6 43.66	83	83
	30	W.	1 7 22.89	52.36	1 6 30.53	83	83
May	3	E.	1 7 35.01	52.01	1 6 43.	80	80
	5	W.	1 7 23.26	51.78	1 6 31.48	81	82
	6	E.	1 7 34.01	51.66	1 6 42.35	81	81
	7	W.	1 7 22.01	51.53	1 6 30.48	81	81
					Mean	81.33	81.33

γ SERPENTIS.

Nearest point on the Limb, 8° 5′ *North.*

1809. Month.	Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	″ +	° ′ ″	°	°
April 18	W.	8 7 52.26	51.43	8 8 43.69	80	79
19	E.	8 7 42.39	51.3	8 8 33.69	80	80
20	W.	8 7 52.14	51.16	8 8 43.3	80	80
23	E.	8 7 40.51	50.72	8 8 31.23	81	81
24	W.	8 7 52.89	50.57	8 8 43.46	81	81
25	E.	8 7 42.26	50.43	8 8 32.69	80	80
26	W.	8 7 56.39	50.27	8 8 46.66	82	82
27	E.	8 7 43.64	50.11	8 8 33.75	83	83
28	W.	8 7 55.89	49.96	8 8 45.85	84	84
29	E.	8 7 42.39	49.80	8 8 32.19	83	83
30	W.	8 7 56.64	49.64	8 8 46.28	83	83
May 3	E.	8 7 44.14	49.14	8 8 33.28	80	80
6	W.	8 7 56.89	48.64	8 8 45.53	81	81
7	E.	8 7 46.26	48.47	8 8 34.73	80	81
				Mean	81.36	81.29

α HERCULIS.

Nearest point on the Limb, 6° 30′ *North.*

			+			
April 15	W.	6 27 26.74	22.65	6 27 49.39	81	81
16	E.	6 27 13.74	22.54	6 27 36.28	81	80
17	W.	6 27 26.61	22.43	6 27 49.04	79	78
18	E.	6 27 14.74	22.31	6 27 37.05	80	79
19	W.	6 27 25.11	22.17	6 27 47.28	79	79
21	E.	6 27 12.74	21.91	6 27 34.65	77	77
23	W.	6 27 25.61	21.64	6 27 47.25	80	80
24	E.	6 27 13.37	21.5	6 27 34.87	80	80
25	W.	6 27 25.61	21.35	6 27 46.96	79	79
26	E.	6 27 14.74	21.21	6 27 35.95	82	82
27	W.	6 27 27.24	21.07	6 27 48.31	83	83
28	E.	6 27 13.74	20.91	6 27 34.65	83	83
29	W.	6 27 27.74	20 75	6 27 48.49	83	83
30	E.	6 27 13.61	20.59	6 27 34.2	83	83
				Mean	80.5	80.29

α OPHIUCHI.

Nearest point on the Limb, 4′ 35″ North.

1809. Month.	Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
			+			
April 12	E.	4 32 45.74	16.12	4 33 1.86	80	79
13	W.	4 32 58.37	16.03	4 33 14.40	82	81
14	E.	4 32 46.87	15.93	4 33 2.8	82	81
15	W.	4 32 57.74	15.83	4 33 13.57	81	80
16	E.	4 32 45.24	15.72	4 33 0.96	81	80
17	W.	4 32 57.24	15.61	4 33 12.85	79	78
18	E.	4 32 47.24	15.49	4 33 2.73	80	79
19	W.	4 32 57.87	15.38	4 33 13.25	79	79
20	E.	4 32 44.24	15.26	4 32 59.5	79	79
21	W.	4 32 56.87	15.13	4 33 12.	77	77
23	E.	4 32 44.74	14.87	4 32 59.61	80	80
24	W.	4 32 55.29	14.74	4 33 10.03	80	80
25	E.	4 32 46.74	14.61	4 33 1.35	79	79
26	E.	4 32 47.24	14.47	4 33 1.71	82	82
27	W.	4 32 58.24	14.33	4 33 12.57	83	83
28	W.	4 32 59.74	14.19	4 33 13.93	83	83
29	E.	4 32 47.71	14.04	4 33 1.78	83	83
30	W.	4 32 59.74	13.89	4 33 13.63	83	83
				Mean	80.72	80.33

ε AQUILÆ.

Nearest point on the Limb, 5′ 25″ North.

			—			
April 13	W.	5 25 50.5	18.	5 25 32.5	82	81
28	E.	5 25 36.13	19.71	5 25 16.42	82	83
29	W.	5 25 51.13	19.85	5 25 31.28	82	82
30	E.	5 25 36.88	20.01	5 25 16.87	82	82
May 1	W.	5 25 52.5	20.15	5 25 32.35	79	79
3	E.	5 25 35.	20.45	5 25 14.55	78	78
6	W.	5 25 51.63	20.92	5 25 30.71	81	81
8	E.	5 25 37.63	21.26	5 25 16.37	80	80
				Mean	80.75	80.75

γ AQUILÆ.

Nearest point on the Limb, 2° *North.*

1809 Month.	Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	—	° ′ ″	°	°
April 28	W.	1 59 59.5	35.85	1 59 23.65	82	83
29	E.	1 59 51.87	35.98	1 59 15.89	82	82
May 3	E.	1 59 48.37	36.54	1 59 11.83	78	78
4	W.	1 59 58.75	36.69	1 59 22.06	79	80
6	E.	1 59 51.5	36.99	1 59 14.51	80	81
7	W.	1 59 57.5	37.15	1 59 20.35	80	81
9	E.	1 59 49.25	37.46	1 59 11.79	81	80
				Mean	80.29	80.71

ATAIR.

Nearest point on the Limb, 0° 10′ *North.*

			—			
April 28	W.	0 13 1.39	39.5	0 12 21.89	82	83
29	E.	0 12 50.46	39.63	0 12 10.83	82	82
30	W.	0 13 0.89	39.76	0 12 21.13	82	82
May 3	E.	0 12 49.01	40.19	0 12 8.82	78	78
4	W.	0 13 0.01	40.33	0 12 19.68	79	80
6	E.	0 12 48.79	40.63	0 12 8.16	80	81
7	W.	0 12 59.26	40.78	0 12 18.48	80	81
9	E.	0 12 49.51	41.10	0 12 8.41	81	80
				Mean	80 4	80.88

β AQUILÆ.

Nearest point on the Limb, 2° 15′ *South.*

1809 Month.	Face.	Observed Zenith distance.	Corrections.	Correct Zenith distance.	Thermometers. Upper	Lower.
		° ′ ″	″ +	° ′ ″	°	°
April 28	W.	2 13 4.61	37.89	2 13 42.5	82	83
May 3	E.	2 13 11.87	38.55	2 13 50.42	78	78
4	W.	2 13 1.87	38.70	2 13 40.57	79	80
6	E.	2 13 12.62	38.97	2 13 51.59	80	81
9	E.	2 13 10.12	39.43	2 13 49.55	81	80
				Mean	80	80.4

δ DELPHINI.

Nearest point on the Limb, 5° 45′ *North.*

May	6	W.	5 46 51.13	— 51.21	5 45 59.92	80	81
	7	E.	5 46 37.5	51.37	5 45 46.13	78	80
	9	W.	5 46 49.63	51.68	5 45 57.95	80	80
					Mean	79.34	80.34

7. MEANS of the zenith distances, taken on the right and left arcs corrected for refraction, equation of the sectorial tube, and the mean runs of the micrometor.

Zenith distances at Putchapolliam.

δ HYDRÆ.

1806 MONTH.	Left Arc.	1806 MONTH.	Right Arc.	MEAN.	
April 13	4° 37′ 13.22″	April 14	4° 37′ 1.99″	Mean, ...	4° 37′ 7.86″
16	11.79	17	3.69	Refraction, &c. &c. ..	+ 4.79
18	10.84	19	6.62		
20	12.15	21	3.18	Zenith distance, ...	4 37 12.65
22	10.95	23	4.18		
Mean	4 37 11.79	Mean	4 37 3.93		

ε HYDRÆ.

April 13	3 52 8.43	April 14	3 51 59.2	Mean, ...	3 52 4.92
17	11.53	18	52 0.11	Refraction, &c. &c. ..	+ 4.05
19	7.53	21	1.64		
22	10.41	23	0.5	Zenith distance, ...	3 52 8.97
Mean	3 52 9.48	Mean	3 52 0.36		

α CANCRI.

April 14	1 36 34.64	April 17	1 36 28.67	Mean, ...	1 36 31.14
18	32.64	19	27.37	Refraction, &c. &c. ..	+ 1.5
20	36.44	21	27.4		
22	34.23	23	27.72	Zenith distance, ...	1 36 32.64
Mean	1 36 34.49	Mean	1 36 27.79		

α LEONIS.

1806	Left Arc.	1806	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 9	0 13 22.91	April 10	0 13 13.31	0 13 17.82
11	21.98	18	13.01	Refraction, &c. &c. ..... + 0.34
14	21.31	19	12.42	
17	23.02	20	13.09	Zenith distance, ... 0 13 18.16
21	23.76	22	12.17	
23	24.34	24	13.01	
25	22.93	26	12.23	
Mean	0 13 22.89	Mean	0 13 12.75	

REGULUS.

April 12	1 55 14.53	April 11	1 55 7.83	1 55 11.1
14	13.88	13	4.28	Refraction, &c. &c. .....+ 1.89
18	16.73	17	8.03	
20	16.37	19	5.98	Zenith distance,.....1 55 12.99
22	17.27	21	7.69	
24	14.79	23	5.84	
Mean	1 55 15.59	Mean	1 55 6.61	

β LEONIS.

April 10	5 29 51.85	April 11	5 29 46.27	5 29 48.77
12	53.06	13	43.72	Refraction, &c. &c. .....+ 5.49
14	52.22	17	44.64	
18	53.56	19	47.10	Zenith distance,.....5 29 54.26
20	53.39	21	45.44	
22	53.1	23	41.51	
24	52.17			
Mean	5 29 52.76	Mean	5 29 44.78	

β LEONIS.

1806	Left Arc.	1806	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 10	4 39 56.57	April 11	4 39 50.76	4 39 54.74
12	60.87	13	49.78	Refraction, &c. &c. .....+ 4.66
14	61.32	17	51.56	
18	58.37	19	49.18	Zenith distance,.....4 39 59.4
20	60.78	21	51.19	
23	58.38	24	49.16	
26	58.22			
Mean	4 39 59.22	Mean	4 39 50.27	

ε VIRGINIS.

April 26	1 0 58.76	April 24	1 0 49.01	1 0 54.26
28	59.24	27	50 46	Refraction, &c. &c..... + 0.94
May 1	59.32	30	48.79	
Mean	1 0 59.10	Mean	1 0 49.42	Zenith distance..... 1 0 55.20

δ SERPENTIS.

April 20	0 12 20.1	April 19	0 12 8.71	0 12 14.09
22	19.47	21	10.49	Refraction, &c. &c. ..... + 0.06
27	17.99	23	8.62	
May 1	18.69	30	8.62	Zenith distance 0 12 14.15
Mean	0 12 19.06	Mean	0 12 9.11	

α SERPENTIS.

April 21	3 56 49.	April 22	3 56 41.67	3 56 44.65
23	48.95	27	41.11	Refraction, &c. &c..... + 3.81
30	46.37	May 1	40.81	
Mean	3 56 48.11	Mean	3 56 41.20	Zenith distance... ... 3 56 48.46

γ SERPENTIS.

1806	Left Arc.	1806.	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 20	5 18 41.53	April 19	5 18 30.3	5 18 36.02
22	41.17	21	31.62	Refraction, &c. &c. .... + 5.39
27	40.37	23	31.48	
May 1	41.03	30	30.67	Zenith distance, ... 5 18 41.41
Mean	5 18 41.03	Mean	5 18 31.02	

α HERCULIS.

April 28	3 37 38.15	April 27	3 37 31.35	3 37 35.17
May 1	39.49	30	32.15	Refraction, &c. &c. .... + 3.41
		May 2	31.09	
				Zenith distance, ... 3 37 38.58
Mean	3 37 38.82	Mean	3 37 31.53	

α OPHIUCHI

April 25	1 43 4.89	April 24	1 42 55.77	1 42 59.19
28	1.95	27	54.1	Refraction, &c. &c. .... + 1.5
May 1	3.75	30	54.16	
		May 2	55.35	Zenith distance, ... 1 43 0.69
Mean	1 43 3.53	Mean	1 42 54.85	

ε AQUILÆ.

April 12	2 35 15.56	April 13	2 35 10.72	2 35 13.87
14	18.87	15	10.04	Refraction, &c. &c. .... + 2.57
16	16.04	17	11.83	
18	18.23	20	10.49	Zenith distance, ... 2 35.16.44
21	20.37	24	9.50	
25	18.12	26	9.11	
28	16.85	30	8.9	
May 1	18.87	May 2	8.34	
Mean	2 35 17.86	Mean	2 35 9.87	

γ AQUILÆ.

1806	Left Arc.	1806	Right Arc.	MEAN.
MONTH.		MONTH.		
April 22	° ′ ″ 0 50 52.29	April 20	° ′ ″ 0 50 45.95	° ′ ″ 0 50 49.96
23	54.04	21	47.19	Refraction, &c. &c. . . . . + 0.78
24	54.04	26	46.8	
27	54.68	28	46.94	Zenith distance 0 50 50.74
29	51.94	30	45.84	
May 2	53.75	May 1	46.11	
Mean	0 50 53.46	Mean	0 50 46.47	

ATAIR.

April 19	2 37 53.49	April 18	2 37 49.19	2 37 51.38
22	52.37	21	49.5	Refraction, &c. &c. . . . . + 2.75
24	54.36	23	49.24	
26	54.25	25	48.12	Zenith distance 2 37 54.13
28	57.01	27	46.63	
30	53.28	29	47.52	
May 2	55.2	May 1	49.3	
Mean	2 37 54.28	Mean	2 37 48.48	

δ AQUILÆ.

April 22	5 3 54.79	April 23	5 3 43.28	5 3 50.55
24	55.29	25	46.4	Refraction, &c. &c. . . . . + 5.13
26	53.77	27	46.9	
28	55.65	29	46.42	Zenith distance, ... 5 3 55.68
30	55.67	May 1	48.06	
May 2	54.2			
Mean	5 3 54.9	Mean	5 3 46.21	

β DELPHINI.

May 4	2 55 48.02	May 2	2 55 37.57	2 55 42 80
				Refraction, &c. &c. . . . . + 2.88
Mean	2 55 48.02	Mean	2 55 37.57	Zenith distance, ... 5 55 45.68

Observations at Punnae Station.

δ HYDRÆ.

1809	Left Arc.	1809	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 12	1 47 5.87	April 16	1 46 56.24		1 46 59.8
14	3.43	18	53.8	Refraction, &c. &c. ..	+ 1.57
17	4.52	19	53.97		
23	5.48	20	52.12	Zenith distance, ...	1 47 1.37
25	6.04	24	54.52		
		26	56.58		
Mean	1 47 5.07	Mean	1 46 54.54		

ε HYDRÆ.

April 12	1 2 3.34	April 13	1 1 50.24		1 1 58.15
14	1.77	16	54.31	Refraction, &c. &c. ..	+ 1.16
17	3.01	18	52.91		
19	3.57	20	52.61	Zenith distance, ...	1 1 59.31
21	3.16	23	54.72		
24	3.12	25	52.28		
26	6.19				
Mean	1 2 3.45	Mean	1 1 52.85		

α CANCRI.

April 13	4 26 46.21	April 12	4 26 33.12		4 26 38.53
16	41.10	14	35.67	Refraction, &c. &c. ..	+ 4.38
18	42.0	17	32.92		
20	43.42	19	33.33	Zenith distance, ...	4 26 42.91
23	39.90	21	31.75		
25	43.07	24	34.36		
		26	33.4		
Mean	4 26 43.12	Mean	4 26 33.94		

o LEONIS.

1809 MONTH.	Left Arc.	1809 MONTH.	Right Arc.	MEAN.	
	° ′ ″		° ′ ″		° ′ ″
April 13	2 36 56.72	April 12	2 36 45.26		2 36 49.49
16	54.07	14	43.67	Refraction, &c. &c. ..	+ 2.58
18	54.35	17	43.78		
20	51.25	19	43.3	Zenith distance, ...	2 36 52.07
24	54.93	23	42.86		
26	55.2	25	41.		
28	56.23	27	43 65		
30	55.88	29	42.93		
May 3	57.09	May 2	42.53		
6	53.68	5	44.47		
		7	44.75		
Mean	2 36 55.24	Mean	2 36 43.74		

REGULUS.

April 13	4 45 26.48	April 12	4 45 16.40		4 45 19.26
16	23.68	14	14.29	Refraction, &c. &c. ..	+ 4.83
18	26.19	17	14.12		
21	23.32	20	13.07	Zenith distance, ...	4 45 24.09
26	24.2	25	14.89		
28	23.94	27	12.5		
30	25.07	29	11.89		
May 3	26.14	May 2	12.2		
6	24.95	5	12.26		
8	25.83	7	13.89		
Mean	4 45 24.98	Mean	4 45 13.55		

ϑ LEONIS.

April 18	8 19 60.72	April 17	8 19 49.31		8 19 54.97
20	60.54	19	52.5	Refraction, &c. &c. ..	+ 8.47
24	60.19	23	47.27		
26	62.99	25	46.59	Zenith distance, ...	8 20 3.44
29	57.71	28	48.31		
May 3	62.48	30	48.14		
5	63.51	May 4	48.51		
7	61.75	6	48.96		
Mean	8 20 1.24	Mean	8 18 48.70		

β LEONIS.

1809	Left Arc.	1809	Right Arc.	MEAN.	
MONTH.	° ′ ″	MONTH.	° ′ ″		° ′ ″
April 13	7 30 11.98	April 12	7 29 57.57		7 30 3.97
16	8.57	14	60.38	Refraction, &c. &c.....	+ 7.61
18	6.26	17	55.61		
20	7.55	19	59.28	Zenith distance,.....	7 30 11.58
24	8.91	23	59.51		
26	9.21	25	60.31		
29	11.91	28	59.01		
May 2	11.71	30	55.80		
4	10.41	May 5	56.56		
6	11.21	7	57.72		
Mean	7 30 9.77	Mean	7 29 58.17		

ε VIRGINIS.

April 18	3 51 7.8	April 19	3 50 57.09		3 51 2.04
20	5.99	23	56.69	Refraction, &c. &c.....	+ 3.91
25	5.86	26	56.25		
28	8.17	29	56.07	Zenith distance,.....	3 51 5.95
30	8.97	May 3	57.51		
May 4	7.79	5	56.18		
6	6.44	7	57.81		
Mean	3 51 7.29	Mean	3 50 56.78		

δ SERPENTIS.

April 18	3 2 28.72	April 19	3 2 17.98		3 2 22.41
20	27.01	23	18.02	Refraction, &c. &c.....	+ 2.95
24	26.9	25	17.27		
26	26.14	27	17.02	Zenith distance,.....	3 2 25.36
28	29.02	29	16.76		
30	29.01	May 3	15.22		
May 5	28.19	6	16.29		
7	28.15				
Mean	3 2 27.89	Mean	3 2 16.94		

α SERPENTIS.

1809	Left Arc.	1809	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 19	1 6 42.88	April 18	1 6 32.67	1 6 37.16
23	40.53	20	31.85	Refraction, &c. &c. ..... + 0.94
25	43.09	24	32.74	
27	43.19	26	31.7	Zenith distance, ... 1 6 38.10
29	43.66	28	31.67	
May 3	43.0	30	30.53	
6	42.35	May 5	31.48	
		7	30.48	
Mean	1 6 42.67	Mean	1 6 31.64	

γ SERPENTIS.

April 18	8 8 43.69	April 19	8 8 33.69	8 8 39.02
20	43.3	23	31.23	Refraction, &c. &c. ..... + 7.95
24	43.46	25	32.69	
26	46.66	27	33.75	Zenith distance, ... 8 8 46.97
28	45.85	29	32.19	
May 30	46.28	May 3	33.28	
6	45.53	7	34.73	
Mean	8 8 44.97	Mean	8 8 33.08	

α HERCULIS.

April 15	6 27 49.39	April 16	6 27 36.28	6 27 41.74
17	49.04	18	37.05	Refraction, &c. &c. ..... + 6.61
19	47.28	21	34.65	
23	47.25	24	34.87	Zenith distance, ... 6 27 48 35
25	46.96	26	35.95	
27	48.31	28	34.65	
29	48.49	30	34.2	
Mean	6 27 48.10	Mean	6 27 35.38	

α OPHIUCHI.

1809	Left Arc.	1809	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 13	4 33 14.4	April 12	4 32 61.86	4 33 7.14
15	13.57	14	62.8	Refraction, &c. &c. ..... + 4.72
17	12.85	16	60.96	
19	13.25	18	62.73	Zenith distance, ... 4 33 11.86
21	12.00	20	59.5	
24	10.03	23	59.61	
27	12.57	25	61.35	
28	13.93	26	61.71	
30	13.63	29	61.78	
Mean	4 33 12.91	Mean	4 33 1.37	

ε AQUILÆ.

April 13	5 25 32.5	April 28	5 25 16.42	5 25 23.88
29	31.28	30	16.87	Refraction, &c. &c. ..... + 5.37
May 1	32.35	May 3	14.55	
6	30.71	8	16.37	Zenith distance, ... 5 25 29.25
Mean	5 25 31.71	Mean	5 25 16.05	

γ AQUILÆ.

April 28	1 59 23.65	April 29	1 59 15.89	1 59 17.76
May 4	22.06	May 3	11.83	Refraction, &c. &c. ..... + 2.01
7	20.35	6	14.51	
		9	11.79	Zenith distance, ... 1 59 19.77
Mean	1 59 22.02	Mean	1 59 13.50	

ATAIR.

1809	Left Arc.	1809	Right Arc.	MEAN.
MONTH.	° ′ ″	MONTH.	° ′ ″	° ′ ″
April 28	0 12 21.89	April 29	0 12 10.83	0 12 14.68
30	21.13	May 3	8.82	Refraction, &c. &c. ..... + 0.01
May 4	19.68	6	8.16	
7	18.48	9	8.41	Zenith distance,.....0 12 14.69
Mean	0 12 20.29	Mean	0 12 9.06	

β AQUILÆ.

May 3	2 13 50.42	April 28	2 13 42.5	2 13 46.03
6	51.59	May 4	40.57	Refraction, &c. &c..... + 2.37
9	49.55			Zenith distance,.....2 13 48.40
Mean	2 13 50.52	Mean	2 13 41.54	

β DELPHINI.

May 6	5 45 59.92	May 7	5 45 46.13	5 45 52.53
9	57.95			Refraction, &c. &c. ..... + 5.75
Mean	5 45 58.93	Mean	5 45 46.13	Zenith distance,..... 5 45 58.28

8. *AMPLITUDE*

of the Arc between *Putchapolliam* and *Punnae*.

STARS.	ZENITH DISTANCES AT PUTCHAPOLLIAM.	ZENITH DISTANCES AT PUNNAE.	AMPLITUDE.
δ Hydræ,	4° 37′ 12″.65 S.	1° 47′ 1″.37 S.	2° 50′ 11″.28
ε Hydræ,	3 52 8.97 S.	1 1 59.31 S.	9.66
α Cancri,	1 36 32.64 N.	4 26 42.91 N.	10.27
o Leonis,	0 13 18.16 S.	2 36 52.07 N.	10.23
Regulus,	1 55 12.99 N.	4 45 24.06 N.	11.07
ϑ Leonis,	5 29 54.26 N.	8 20 3.44 N.	9.18
β Leonis,	4 39 59.4 N.	7 30 11.59 N.	12.19
ε Virginis,	1 0 55.2 N.	3 51 5.95 N.	10.75
δ Serpentis,	0 12 14.15 N.	3 2 25.36 N.	11.21
α Serpentis,	3 56 48.46 S.	1 6 38.1 S.	10.36
α Herculis,	3 37 38.58 N.	6 27 48.35 N.	9.77
α Ophiuchi,	1 43 0.69 N.	4 33 11.86 N.	11.17
ε Aquilæ,	2 35 16.44 N.	5 25 29.25 N.	12.81
γ Aquilæ,	0 50 50.74 S.	1 59 19.77 N.	10.51
Atair,	2 37 54.13 S.	0 12 14.69 N.	8.82
β Aquilæ,	5 3 55.68 S.	2 13 48.4 S.	7.28
β Delphini,	2 55 45.68 N.	5 45 58.28 N.	12.6
		Mean	2 50 10.54

Celestial Arc between the parallels of

Putchapolliam and *Punnae* Station, ...2° 50′ 10″.54

Terrestrial Arc, ...1029100.5 Feet.

Mean length of one degree, ... 60473 Fath.

Latitude of the middle point,....9° 34′ 44″

9. LATITUDE of *Punnae* station, at the south extremity of the arc, deduced from the foregoing zenith distances of eight principal stars, whose declinations and annual variations are given in the *Greenwich* observations for the year 1802.

STARS.	FOR THE BEGINNING OF 1805.		LATITUDE.
	MEAN DECLINATION.	CORRECT Z. DISTANCE.	
Regulus,	12° 54′ 58.93″ N.	4° 45′ 24.09″ N.	8° 9′ 34.84″ N.
β Leonis,	15 39 45.28	7 30 11.59 N.	33.7
α Serpentis,	7 3 0.3	1 6 38.1 S.	38.4
α Herculis,	14 37 30.96	6 27 48.35 N.	42.61
α Ophiuchi,	12 42 50.91	4 33 11.86 N.	39.05
γ Aquilæ,	10 8 58.34	1 59 19.77 N.	38.57
Atair,	8 21 53.53	0 12 14.69 N.	38.84
β Aquilæ,	5 55 52.71	2 13 48.4 S.	41.11
		Mean	8 9 38.39

APPENDIX.

1. AS I am at present uncertain whether the particulars of the northern part of the grand arc have been communicated to the public, I will here subjoin the former conclusions, and combine what was before done with what appears in the preceding paper, in order to inform those readers who are interested in speculations of this nature, that I have not been remiss in promoting objects of general science, while occupied in the more humble task of correcting the erroneous and imperfect geography of the southern part of the Peninsula. Being in possession of the best *English* instruments, and traversing from sea to sea, through six degrees of latitude, I have always considered the measurement of a meridian arc a necessary part of the general work, as well as an acceptable offering to the mathematician and astronomer; especially at a time when similar performances have been carrying on in *France* and *England*, and at the polar circle. I regret that the whole detailed account cannot now appear under one view, as it would swell a volume to too great a size, or preclude more valuable matter from being admitted. I shall therefore confine myself to the simple results, and combine them with those given in the preceding memoir.

In the arc north of *Putchapolliam*, there were three stations of observation, besides the station at *Putchapolliam*, viz. *Dodagoontah*, in latitude 13° nearly, at *Bomasundrum*, which is nearly 14°, and at *Paughur*, which is upwards of 14 6.

The celestial Arc between *Putchapolliam* and *Dodagoontah* was 2° 0′ 9.79
Between *Putchapolliam* and *Bomasundrum* was.....3 0 1.88
Between *Putchapolliam* and *Paughur* was.....3 6 37.78

And if to each of these we add 2° 50′ 10.54 which is the celestial arc between *Punnae* and *Putchapolliam*, we shall have the three following arcs, viz.

Punnae and *Dodagoontah*.....4° 50′ 20.33
Punnae and *Bomasundrum*.....5 50 12.42
Punnae and *Paughur*.....5 56 48.32

The former terestrial arcs were as follows, viz.

Between *Putchapolliam* and *Dodagoontah*.....727334.6 Feet.
Between *Putchapolliam* and *Bomasundrum*..... 1088275.8
Between *Putchapolliam* and *Paughur*.....1128472.

Hence, by adding to each of these 1029100.5 feet, we shall have the three terestrial arcs as follows, viz.

	Feet.	Fathoms.
Punnae and *Dodagoontah*,.....	1756435.1 or	292739.2
Punnae and *Bomasundrum*, ...	2117376.3 or	352896.
Punnae and *Paughur*, ...	215772.5 or	359595.4

Hence, by comparing the respective arcs, we shall have the mean length of the degree due to the latitudes of their respective middle points, as follows:

Arcs.	Lat. Middle point.	Degree in Fathoms.
Punnae and *Dodagoontah*, ...	10° 34′ 49″	60496
Punnae and *Bomasundrum*, ...	11 4 44	60462
Punnae and *Paughur*, ...	11 8 3	60469

And, as the two latter arcs give the degree nearly the same, and the latitudes of their middle points differing but little, we may take the mean of the two degrees, as due to the mean latitude of the two middle points, and this will give 60465.5 fathoms due to the latitude of 11° 6′ 23.5″.

2. In order to obtain a mean result between the observations made at *Dodagoontah*, and those at the stations at *Paughur*, and *Bomasundrum*, it will be necessary to determine the ratio of the earth's diameters by using the degree deduced from one or other of these arcs; and some other degree deduced from recent measurements in northern latitudes. I shall therefore take the degree as given by the observations at *Punnae* and *Dodagoontah*, whose middle point is in 10° 34′ 49″, and use it with that determined by Col. Mudge, for latitude 52° 2′ 20″, in order to which it will be necessary to obtain formulæ expressing the ratio of the diameters in terms of these degrees and the latitudes to which they apply. That this may be general, let m and m' denote the meridional degrees in latitudes l and l', and let a and b express the equatorial and polar diameters. Then from conic sections and the nature of curvature, it is known that $\frac{a^2\ b^2}{2\sqrt{\text{Cos.}^2\ l'.\ a^2 + \text{Sin.}^2\ l'.\ b^2}^{\ 3}}$ is the radius of curvature of the elliptic meridian in latitude l', and $\frac{a^2\ b^2}{2\sqrt{\text{Cos.}^2\ l.\ a^2 + \text{Sin.}^2\ l.\ b.^2}^{\ 3}}$ the radius of curvature in latitude l, on that or any other meridian on the same ellipsoid. And since the degrees are as their radii of curvature, we shall have,

$$m' : m :: \frac{a^2\ b^2}{2\sqrt{\text{Cos.}^2\ l'.\ a^2 + \text{Sin.}^2\ l'.\ b.^2}^{\ 3}} : \frac{a^2\ b^2}{2\sqrt{\text{Cos.}^2\ l.\ a^2 + \text{Sin.}^2\ l.\ b.^2}^{\ 3}}$$ that is

$$m' : m :: \sqrt{\text{Cos.}^2 l.\ a^2 + \text{Sin.}^2\ l.\ b^2}^{\ 3} : \sqrt{\text{Cos.}^2\ l'.\ a^2 + \text{Sin.}^2\ l'.\ b^2}^{\ 3}$$ or

$m'^{\frac{2}{3}} : m^{\frac{2}{3}} :: \text{Cos.}^2\, l.\, a.^2 + \text{Sin}^2\, l.\, b^2 : \text{Cos.}^2\, 'l.\, a^2 + \text{Sin.}^2\, 'l.\, b^2$ which reduced gives $\frac{b}{a} = \left(\frac{\text{Cos}^2\, l - \text{Cos}^2\, 'l.\overline{\frac{m'}{m}}^{\frac{2}{3}}}{\text{Sin}^2\, 'l.\overline{\frac{m'}{m}}^{\frac{2}{3}} - \text{Sin}^2\, l}\right)^{\frac{1}{2}}$ a general expression for the ratio of the diameters.

Now if $m' = 60820$ fathoms, $m = 60496$ fathoms, and if $'l$ and l be $52^\circ\ 2'\ 20''$ and $10^\circ\ 34'\ 49''$ respectively, then $\frac{b}{a} = \left(\frac{\text{Cos.}^2\ 10^\circ\ 34'\ 49'' - \text{Cos.}^2\ 52^\circ\ 2'\ 20''.\overline{\frac{60820}{60496}}^{\frac{2}{3}}}{\text{Sin.}^2\ 52^\circ\ 2'\ 30''\overline{\frac{60820}{60496}}^{\frac{2}{3}} - \text{Sin.}^2\ 10^\circ\ 34'\ 49''}\right)^{\frac{1}{2}}$ $= \frac{1}{1.0030359}$ nearly, which call $\frac{1}{1+e}$, e being the ellipticity .0030359.

3. HAVING obtained the ratio of the diameters to each other, let the length of a degree on such a spheroid be computed for latitude $11^\circ\ 6'\ 23''.5$. Then to get the formula from what is just demonstrated, we have $\frac{1}{1+e} = \left(\frac{\text{Cos}^2\, l - \text{Cos}^2\, 'l.\overline{\frac{m'}{m}}^{\frac{2}{3}}}{\text{Sin}^2\, 'l.\left(\frac{m'}{m}\right)^{\frac{2}{3}} - \text{Sin}^2\, l}\right)^{\frac{1}{2}}$ or $\frac{1}{\overline{1+e}^2} = \frac{\text{Cos}^2 l - \text{Cos}^2 'l.\left(\frac{m'}{m}\right)^{\frac{2}{3}}}{\text{Sin}^2 'l.\left(\frac{m'}{m}\right)^{\frac{2}{3}} - \text{Sin}^2 l}$ which reduced gives

$m' : m :: \sqrt{\text{Cos.}^2\, l.\ (1+e.)^2 - \text{Sin.}^2\, l.}^{\,3} : \sqrt{\text{Cos.}^2\, 'l.(1+e.)^2 - \text{Sin.}^2\, 'l.}^{\,3}$

and if $m = 60496$ fathoms, and l, $'l$ be $10^\circ\ 34'\ 49''$ and $11^\circ\ 6'\ 23''.5$ respectively, we have $m' = 60496\left(\frac{\text{Cos.}^2\ (10^\circ\ 34'\ 49'').\overline{1.003036}^2 - \text{Sin.}^2\ 10^\circ\ 34'\ 49''}{\text{Cos.}^2\ (11^\circ\ 6'\ 23''.5).\overline{1.003036}^2 - \text{Sin.}^2\ 11^\circ\ 6'\ 23''.5}\right)^{\frac{3}{2}} =$ 60498 fathoms, for the meridional degree in latitude $11^\circ\ 6'\ 23''.5$, on the ellipsoid whose polar is to its equatorial diameter as 1 to 1.003036; and this I call the degree in that latitude resulting from the arc *Punnae* and *Dodagoontah*. But the degree in the same latitude, deduced from the arcs *Punnae* and *Paughur*, *Punnae* and *Bomasundrum*[1] is 60465.5 nearly, which must therefore apply to a different ellipsoid. But the mean between this and 60498 is $60486\frac{3}{4}$; or, to avoid fractions, we may take 60487 fathoms for the length of the degree in latitude $11^\circ\ 6'\ 24''$, or the mean length of the degree for the arc $5^\circ\ 53'\ 30''$, whose middle point

is in latitude $11^{\circ}\ 6'\ 24''$. Hence, by substituting 60487 for m, and $11^{\circ}\ 6'\ 24''$ for l, in the formula given in article 2, and retaining the rest of the data, we get $\frac{b}{a} = \frac{1}{1.003143}$ which gives the ellipticity resulting from the measurements in *England* and in *India*, $\frac{1}{318.13}$ nearly.

SINCE $m' : m :: \sqrt{\text{Cos.}^2 l' (1+e)^2 - \text{Sin.}^2 l'}^{\,3} : \sqrt{\text{Cos.}^2 l (1+e)^2 - \text{Sin.}^2 l}^{\,3}$ and $m = m' \left(\frac{\text{Cos.}^2 l' (1+e)^2 - \text{Sin.}^2 l'}{\text{Cos.}^2 l (1+e)^2 - \text{Sin.}^2 l} \right)^{\frac{3}{2}}$; and if $l' = 5^{\circ}\ 2'\ 20''$, $m = 60820$ fathoms, and $1 + e. = 1.003143$; then, by substituting for l, the latitudes $8^{\circ}\ 30'$, $9^{\circ}\ 30'$, $10^{\circ}\ 30'$, $11^{\circ}\ 30'$, &c. we shall obtain the value of m for these respective latitudes, as follows:

l.	m.	
$8^{\circ}\ 30'$	60479	*Nearly.*
9 30	60481	
10 30	60484	
11 30	60488	
12 30	60492	
13 30	60497	

LATITUDES of the great stations of observation as deduced from the above measures of degrees.

Latitude of *Punnae* station as determined in art. 9,	8°	$9'$	$38''.39$
Latitude of *Putchapolliam* station,	10	59	47.47
Latitude of *Dodagoontah* station,	13	0	1.9

THE latitude of *Dodagoontah* by the observations in 1805, was $12^{\circ}\ 59'\ 59''.91$, which is less by nearly $2''$ than the latitude here given. The latitude of the observatory at *Madras*, as deduced from that of *Dodagoontah*, determined in 1805, was $13^{\circ}\ 4'\ 8''.7$. Hence, if the present latitude be made use of, it will give the latitude of the observatory at *Madras* $13^{\circ}\ 4'\ 11''$ nearly.

4. THE late measurements from *Dunkirk* to *Barcelona*, by the *French*

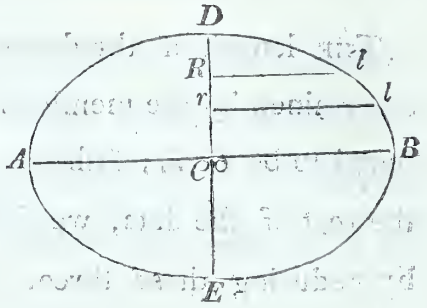
mathematicians, gave the length of the degree 60783 fathoms nearly, for the latitude $46^\circ\ 11'\ 57''$; and if this be substituted for m in the above formula (2) the ratio of the polar to the equatorial diameters will be that of 1 to 1.003370, and therefore the ellipticity $\frac{1}{296.74}$ nearly.

THE length of the degree at the polar circle in latitude $66^\circ\ 20'\ 12''$ as determined by the members of the *Swedish* academy in 1802 and 3, was found to be 60955 fathoms; and by substituting this for m and retaining the rest of the data, we shall have the ellipticity $\frac{1}{311.17}$ nearly. Hence, by reducing these three, the mean ellipticity will be $\frac{1}{308.4}$ nearly, or the polar to the equatorial diameter as 1 : 1.0032423, the mean result of all the recent measurements.

5. IN order to determine the actual values of a and b, let m denote the meridional degree in latitude l, as before where the radius of curvature is $\frac{a^2\ b^2}{2\sqrt{\text{Cos.}^2\ l.\ a^2+\text{Sin.}^2\ l.\ b^2}^3}$ and if A denote the arc (57°. &c.) equal radius, we shall have $m\ A = \frac{a^2\ b^2}{2\sqrt{\text{Cos.}^2\ l.\ a^2+\text{Sin.}^2\ l.\ b^2}^3}$, from which arises $a^2\ b^2 = 2\ A\ m\ \sqrt{\text{Cos.}^2\ l.\ a^2+\text{Sin.}^2\ l.\ b^2}^3$; and dividing by a^4, we get $\frac{b^2}{a^2} = \frac{2\ A\ m}{a}\left(\text{Cos.}^2\ l.+\text{Sin.}^2\ l.\ \frac{b^2}{a^2}\right)^{\frac{3}{2}}$; that is $\frac{1}{1+e}^2 = \frac{2\ A\ m}{a}\left(\text{Cos.}^2\ l.+\text{Sin.}^2\ l.\ \frac{1}{1+e}^2\right)^{\frac{3}{2}}$ which being reduced gives $\frac{1}{2}\ a = \frac{m\ A\ \sqrt{\text{Cos.}^2\ l.\ (1+e)^2+\text{Sin.}^2\ l.}^3}{1+e}$, the semi equatorial diameter. Hence if $m = 60487$, $l = 11^\circ\ 6'\ 24''$ and $1+e$ equal 1.0032423, and these substituted in the last formula, we shall have $\frac{1}{2}\ a = 3486906$ fathoms; and as $1.0032423 : 1 :: \frac{1}{2}\ a : \frac{\frac{1}{2}\ a}{1.0032423} = 3475638$ fathoms, equal $\frac{1}{2}\ b$. And since $\frac{1}{2}\ a$ is the radius of the equatorial circle, then $\frac{\frac{1}{2}\ a}{A} = \frac{3486906}{57.295\ \&c.} = 60858$ fathoms, the measure of the degree of longitude at the equator.

6. SINCE $m' : m :: \sqrt{\text{Cos.}^2\ l.+\frac{1}{1+e}^2\ \text{Sin.}^2\ l.}^3 : \sqrt{\text{Cos.}^2\ l.+\frac{1}{1+e}^2\ \text{Sin.}^2\ l.}^3$ (3); and when m is at the equator, and therefore $\text{Sin.}^2\ l. = 0$ and Cos.^2

$l = 1$ (Rad.) then $m' : m :: \overline{1+e}^{3} : \sqrt{\text{Cos.}^2 l.\ (1+e)^2 + \text{Sin.}^2 l}^{3}$, and $m = \frac{m' \sqrt{\text{Cos.}^2 l.\ (1+e)^2 + \text{Sin.}^2 l}^{3}}{\overline{1+e}^{3}} = \frac{60487 \sqrt{\text{Cos.}^2 (11^{\circ}\ 6'\ 24'').\ 1.0032423}^{2} + \text{Sin.}^2\ 11^{\circ}\ 6'\ 24''}^{3}}{\overline{1.0032423}^{3}}$ $= 60465$ fathoms, the measure of the meridional degree at the equator.



7. Let d and $'d$ be the measures of two degrees of longitude in the latitudes of l and $'l$, then $r\,l$ and $R\,'l$ will represent the radii of curvature of d and $'d$ respectively. But $R\,'l$ is expressed by $\frac{a^2 \cdot \text{Cos.}^2 'l}{2\sqrt{\text{Cos.}^2 'l.\ a^2 + \text{Sin.}^2 'l.\ b^2}} = \frac{a^2}{2\sqrt{a^2 + \text{tang.}^2 'l.\ b^2}}$ and for the same reason $r\,l = \frac{a^2}{2\sqrt{a^2 + \text{tang.}^2\ l.\ b^2}}$ Hence $\frac{a^2}{2\sqrt{a^2+\text{tang.}^2\ l.\ b^2}} : \frac{a^2}{2\sqrt{a^2+\text{tang.}^2 'l.\ b^2}} :: d : 'd$ or $\sqrt{a^2+\text{tang.}^2 'l.\ b^2} : \sqrt{a^2+\text{tang.}^2\ l.\ b^2} :: d : 'd$ that is $\sqrt{\overline{1+e}^{2} + \text{tang.}^2 'l} : \sqrt{\overline{1+e}^{2} + \text{tang.}^2\ l.} :: d : 'd$. And when d is at the equator, and therefore tang.^{2} $l = o$; then $\sqrt{\overline{1+e}^{2} + \text{tang.}^2 'l} : 1+e :: d : 'd$; and therefore $'d = \frac{d\,(1+e)}{\sqrt{\overline{1+e}^{2} + \text{tang.}^2 'l}}$ a general formula. Let $l = 10^{\circ}$, $d = 60858$ fathoms, as in article 5, and $1+e$ as before; then $'d = \frac{60858\ (1.003242)}{\sqrt{\overline{1.003242}^{2} + \text{tang.}^2\ 10^{\circ}}} = 59940$ From this formula a table of degrees of longitude on this spheroid, may be computed, from the equator to the pole.

8 Let p be the degree perpendicular to the meridian in latitude l, and p' that in latitude l'. Then, these being as their respective verticals or radii of curvature, we have $p : p' :: \frac{a^2}{2\sqrt{\text{Cos.}^2\ l.\ a^2 + \text{Sin.}^2\ l.\ b^2}} : \frac{a^2}{2\sqrt{\text{Cos.}^2 l'.\ a^2 + \text{Sin.}^2 'l.\ b^2}}$ that is $p : p' :: \sqrt{\text{Cos.}^2 l'.\ a^2 + \text{Sin.}^2\ l.\ b^2} : \sqrt{\text{Cos.}^2\ l.\ a^2 + \text{Sin.}^{\ 2}\ l.\ b^2}$; that is $p : p' :: \sqrt{\text{Cos.}^2 'l.\ (1+e)^2 + \text{Sin.}^2 'l} : \sqrt{\text{Cos.}^2\ l.\ (1+e)^2 + \text{Sin.}^2 l}$; and when p is at the equator, and therefore Sin.^{2} $l = o$, and Cos.^{2} $l = 1$ (Rad.) then $p : p' :: \sqrt{\text{Cos.}^2\ l.\ (1+e)^2 + \text{Sin.}^2 'l} : 1+e$. Hence $p' = \frac{p\,(1+e)}{\sqrt{\text{Cos.}^2 'l.\ (1+e)^2 + \text{Sin.}^2 'l}}$

THEN if $l'=10^{\circ}$, and $p=60858$ fathoms, being the same at the equator as the degree of longitude d,

THEN $p' = \frac{60858\ (1.003242)}{\sqrt{\text{Cos.}^2\ 10^{\circ}\ (1.003242)^2 + \text{Sin.}^2\ 10^{\circ}}} = 60863$ fathoms.

SUPPOSE $l'=12^{\circ}\ 55'\ 10''$, which was the latitude in which the perpendicular arc was measured in 1805. (*Asiatick Researches*, Volume 10.) Then $p' = \frac{60858\ (1.003242)}{\sqrt{\text{Cos.}^2\ (12^{\circ}\ 55'\ 10'').\ (1.003242)^2 + \text{Sin.}^2\ (12^{\circ}\ 55'\ 10'')}} = 60869$ fathoms, which exceeds the degree given by the measured arc by 121 fathoms.

THE perpendicular degree determined by the arc between *Carangooly* and *Karnatighur*, in 1802. (see *Asiatick Researches*, Volume 8,) was 61061 fathoms for latitude $12^{\circ}\ 32'\ 12''$. Now the mean between this and the perpendicular degree, measured in 1805, for latitude $12^{\circ}\ 55'\ 10''$, will be, 60909 fathoms, and the mean of the latitudes will be $12^{\circ}\ 48'\ 41''$; which latitude, being substituted in the above, we shall have the value of $p'=60868$ fathoms, which falls short of the above mean, 41 fathoms: but how far this mean may be relied on, is yet a matter of uncertainty, for I never had much confidence in the accuracy of the perpendicular arc measured in 1802.

9 FROM the formula in the two last articles, it appears that the perpendicular degree p', and the degree of longitude $'d$, in any latitude $'l$, will be to each other as $\frac{1}{\sqrt{\text{Cos.}^2\ l'.\ (1+e)^2 + \text{Sin.}^2\ l'}}$: $\frac{1}{\sqrt{(1+e)^2 + \text{tang.}^2\ 'l}}$ because p and d are equal at the equator. Hence, p' : $'d$ :: $\sqrt{(1+e)^2 + \tan.^2\ 'l}$: $\sqrt{\text{Cos.}^2\ 'l\ (1+e)^2 + \text{Sin.}^2\ 'l}$ and $'d = p' \left(\frac{\overline{1+e}^{\ 2}.\ \text{Cos.}^2\ 'l + \text{Sin.}^2\ 'l}{\overline{1+e}^{\ 2} + \text{tang.}^2\ 'l}\right)^{\frac{1}{2}}$ whence p' being known, $'d$ may be found.

10. The equatorial diameter of this ellipsoid, has already been shewn

to be 6973812 fathoms (5) $= a$, the transverse axis of an elliptic meridian, and therefore the periphery of the circumscribing circle, or the circle whose diameter is a, will be $a \times 3.1415$ &c. and if $d = 1 - \frac{b^2}{a^2}$, then $1 : 1 - \frac{d}{2^2} - \frac{3d^2}{2^2 4^2}$ &c. $:: a \times 3.1415$ &c. $: a \times 3.1415$ &c. $(1 - \frac{d}{2^2} - \frac{3d^2}{2^2 4^2}$ &c.) $=$ the periphery of the elliptic meridian: hence $\frac{6973812 \times 3.1415 \text{ &c.} (1 - \frac{d}{2^2} - \frac{3d^2}{2^2 4^2} \text{ &c.})}{4}$ $=5465790$ fathoms for the length of the quadrantal arc: and this reduced to inches and divided by 10.000000 will give 39.3537 *English* inches for the measure of the *French* metre at the temperature of 62°.

By Borda's experiments, the equivalent to the *French* metre in *English* inches is 39.371, the standard temperature of the metre being at 32°, and that of the *English* at 62°, so that the metre according to this ellipsoid, falls short of that given by the *French* mathematicians, near $\frac{17}{100}$th of an *English* inch, or $\frac{1}{25}$th of a *French* line, and the quadrantal arc will fall short 2403 fathoms, or $10\frac{121}{165}$ miles, in the whole circumference.

10. *Latitudes and Longitudes*

of the great stations, and some principal places, as deduced from the Meridional Arc.

NAMES OF PLACES.	Latitudes.	Longitudes from Madras Observatory.	Longitudes from Greenwich.
* Shennimalli,	11° 9′ 27″	2° 39′ 58″ W.	77° 38′ 42″ E.
* Yaëlmatoor hill,	11 12 6	2 30 12	77 48 18
* Hallagamalli,	11 0 52	2 48 54	77 29 36
* Kautpolliam, *(or S. E. End of the base.)*	10 56 43	2 34 22	77 44 8
* Putchapolliam station,	10 59 47	2 37 47	77 40 43
* Parmatty hill,	10 58 31	2 19 48	77 58 42
* Parteemalli,	10 40 2	2 40 35	77 37 55
Rungamalli,	10 38 56	2 20 8	77 58 22
* Kurroomalli,	10 35 26	2 22 39	77 55 51
Darapooram, *(Fort.)*	10 44 34	2 43 13	77 35 17
Pyney hill and pagoda,	10 26 22	2 43 58	77 34 32
* Permaul hill,	10 18 1	2 41 20	77 37 10
* Rissheemalli,	10 12 34	2 22 12	77 56 18
Dindigul, *(Flag Staff.)*	10 21 38	2 17 21	78 1 9
* Nagamalli,	10 0 1	2 18 54	77 59 36
* Suddragherry,	9 44 26	2 34 34	77 43 56
Madura, *(N. E. Pagoda.)*	9 55 15	2 7 52	78 10 38
* Sekundermalli,	9 52 37	2 10 57	78 7 33
* Kooteapâra,	9 28 52	2 14 33	78 3 57
* Meenachiporam hill,	9 12 39	2 16 23	78 2 7
* Perrioormalli,	9 12 21	2 45 29	77 33 1
* Gopaulswamy hill,	9 39 24	2 27 13	77 51 17
Shevelipootoor, *(pagoda.)*	9 30 36	2 37 13	77 41 17
Sungarnacoil, *(pagoda.)*	9 10 18	2 43 12	77 35 18
* Vullunkota hill,	8 48 23	2 37 45	77 40 45
Yettiaporam, *(or Eliapoor palace.)*	9 8 57	2 15 16	78 3 14
* Kolanelloor hill,	8 55 39	2 16 14	78 2 16
Tutacorin, *(Flag Staff.)*	8 48 0	2 5 40	78 12 50
* Vullanaud hill,	8 42 54	2 22 3	77 56 27
Palamcottah, *(Flag Staff.)*	8 43 31	2 30 56	77 47 34
Tinnivelly, *(pagoda.)*	8 43 45	2 33 51	77 44 39
* Coonatoor hill,	8 41 52	2 34 48	77 43 42
* W. End of the base,	8 47 6	2 36 33	77 41 57
* East end of the base,	8 46 21	2 31 32	77 46 58
* Taulaootpotha,	8 49 1	2 31 47	77 46 43
* Kunnimapotha,	8 30 28	2 37 49	77 40 41
* Red hill station,	8 22 39	2 22 49	77 55 41
Tirchundoor, *(pagoda.)*	8 29 50	2 7 23	78 11 7
* Koodunkolum,	8 10 34	2 34 30	77 44 0
* Munpotha,	8 16 2	2 40 37	77 37 53
Kalcaud, *(pagoda.)*	8 31 1	2 42 7	77 36 23
Nagalancherri,	8 29 34	2 35 41	77 42 49
* Punnae station,	8 9 37	2 37 39	77 40 51
Kootapooli, *(Romish church.)*	8 8 51	2 39 8	77 39 22

Note. All places marked with the Asterisk (*) are great stations.

11. *Elevations and Depressions.*

CONTAINED Arcs, terrestrial refractions, together with the heights, above the level of the Sea, of the principal stations.

Stations at.	Stations observed.	Apparent Elevations and Depressions.	Contained Arcs.	Refraction.	Elevation above the Sea. Stations.	Heights.
						FEET.
S. E. end of the Base,	Parteemalli,	0 4 42 E.	17 45	1/13	Parteemalli,	1308.4
Parteemalli,	Kautpolliam,	0 19 49 D.				
S. E. end of the Base,	Parmatty hill,	0 8 7 D.	14 24	1/13	Parmatty hill,	880.1
Parmatty hill,	S. E. end of the Base,	0 4 34 D.				
S. E. end of the Base,	Hallagamalli,	0 11 49 E.	14 52	1/17	Hallagamalli,	1407.6
Hallagamalli,	S. E. end of the Base,	0 24 54 D.				
Parteemalli,	Permaul hill,	2 26 28 E.	22 2	1/15	Permaul hill,	7367.6
Parteemalli,	Kurroomalli,	0 32 42 E.	18 13	1/14	Kurroomalli,	2612.2
Kurroomalli,	Parteemalli,	0 48 20 D.				
Kurroomalli,	Rissheemalli,	0 31 9 D.	22 52	1/14	Rissheemalli,	1759.8
Rissheemalli,	Kurroomalli,	0 11 13 E.				
Rissheemalli,	Nagamalli,	0 34 2 D.	12 58	1/11	Nagamalli,	1105.8
Nagamalli,	Rissheemalli,	0 23 17 E.				
Rissheemalli,	Suddragherry,	0 32 24 E.	30 39	1/12	Suddragherry,	4219.6
Suddragherry,	Rissheemalli,	0 58 44 D.				
Suddragherry,	Permaul hill,	0 37 54 E.	34 14	1/12	Permaul hill,	7359.3
Suddragherry,	Perrioormalli,	1 1 16 D.	33 49	1/12	Perrioormalli,	1429.
Perrioormalli,	Suddragherry,	0 32 28 E.				
Nagamalli,	Sekundermalli,	0 2 6 D.	10 46	1/5	Sekundermalli,	1121.
Sekundermalli,	Nagamalli,	0 3 42 D.				
Sekundermalli,	Gopaulswamy,	0 28 21 D.	20 47	1/8	Gopaulswamy,	747.8
Gopaulswamy,	Sekundermalli,	0 2 23 E.				
Sekundermalli,	Kooteapara,	0 26 3 D.	24 0	1/8	Kooteapara,	412.1
Kooteapara,	Sekundermalli,	0 7 32 E.				
Perrioormalli,	Meenachiporam,	0 32 57 D.	28 44	1/10	Meenachiporam,	344.1
Meenachiporam,	Perrioormalli,	0 9 47 E.				
Meenachiporam,	Kolanelloor hill,	0 4 54 D.	17 0	1/7	Kolanelloor hill,	376.5
Kolanelloor hill,	Meenachiporam hill,	0 8 7 D.				
Kolanelloor hill,	Vullanaud hill,	0 22 35 E.	13 59	1/7	Vullanaud hill,	1051.7
Vullanaud hill,	Kolanelloor hill,	0 32 16 D.				
Perrioormalli,	Vullunkota,	0 28 56 D.	25 8	1/9	Vullunkota,	591.7
Vullunkota,	Perrioormalli,	0 8 54 E.				
Vullunkota,	Coonatoor hill,	0 9 58 D.	7 9	1/9	Coonatoorpotha,	496.9
Coonatoor hill,	Vullunkota hill,	0 5 5 E.				
Vullunkota,	West end of the Base,	1 47 11 D.	1 45	1/7	W. end of the base,	263.3
West end of the Base,	Vullunkota,	1 45 57 E.				
Vullunkota,	East end of the Base,	0 41 8 D.	6 29	1/4	E. end of the base,	145.1
East end of the Base,	Vullunkota,	0 36 54 E.				
Vullanaud hill,	Taulaootpotha,	0 28 45 D.	11 23	1/5	Taulaootpotha,	538.9
Taulaootpotha,	Vullanaud hill,	0 22 17 E.				
Vullunkota,	Kunnimapotha,	0 2 59 D.	17 55	1/8	Kunnimapotha,	798.9
Kunnimapotha,	Vullunkota,	0 10 25 D.				

Stations at.	Stations observed.	Apparent Elevations and Depressions.	Contained Arcs.	Refraction.	Elevations above the Sea.	
					Stations.	Heights.
		° ′ ″				Feet.
Kunnimapotha,.....	Kullikolum hill,....	0 17 22 D.	9.42″	1/6	Kullikolum hill,..	464.4
Kullikolum,.....	Kunnimapotha,....	0 11 15 E.				
Kullikolum,.....	Red hill station,....	0 15 15 D.	12.42	1/11	Red hill Station,..	236.
Red hill Station,....	Kollikolum,.....	0 5 6 E.				
Red hill Station,....	Koodunkolum,.....	0 8 43 D.	16.43	1/9	Koodunkolum,...	165.8
Koodunkolum,.....	Red hill station, ...	0 3 58 D				
Koodunkolum,.....	Punnae Station,.....	0 19 58 D.	3.15	1/4	Punnae Station,...	55.
Punnae station,.....	Koodunkolum,.....	0 18 41 E.				
Punnae Station above the low water mark by measurement, ...						41.8
Difference or Error, ...						10.2

II.

On the Maláyu Nation, with a translation of its Maritime Institutions.

By THOMAS RAFFLES, Esq.

THE opinion that the *Malays* possess no records whatever of their laws and customs, and that they are solely governed by long established customs and usages, handed down by memory or tradition, seems to have been much strengthened by the observations contained in MARSDEN's account of *Sumatra*. This being the only standard book in the *English* language, which contains a detailed account of any of the eastern isles, appears by many to have been considered as applying, generally, to all the countries denominated *Malayan*, whereas the island of *Sumatra*, though exhibiting an almost inexhaustible fund for research and enquiry, can only be considered as one of the almost innumerable islands, and by no means the greatest in population or in extent, which compose that unparallelled *Archipelago* in which the *Maláyu* nation is established.

THE island of *Sumatra*, as well as the islands of *Jawa*, *Tana Ugi* or *Bugis* land, *(Celebes) Súlu*, and the *Moluccas*, which with *Borneo* compose what may be properly termed the *Malayan groupe*, are peopled by nations radically distinct from the *Malays*, who speak languages entirely different, and use various written characters, original and peculiar to each. These nations are governed by their several laws and institutions; and if we except the state of *Menangcábaw* on the island of *Sumatra*, it is on the shores of these islands only, and in the *Malay* peninsula, that the *Malays* are to be found. Whatever may have been the origin of the *Maláyu* nation, the primary population of these various and extensive islands, could never, according to any natural inference, have proceeded from the *Malays*, though the reverse may probably have been the case, whatever may have been borrowed from a more foreign source.

NOTWITHSTANDING, therefore, the idea of Mr. MARSDEN,* that the various dialects of the *Maláyu* tongue have experienced such changes, with respect to the purposes of intercourse, that they may be classed into several languages differing considerably from each other; I cannot but consider the *Maláyu* nation, as one people, speaking one language, though spread over so wide a space, and preserving their character and customs, in all the maritime states lying between the *Súlu* seas, and the southern ocean, and bounded longitudinally by *Sumatra* and the western side of *Papua* or *New Guinea*.

THE *Maláyu* language, may no doubt be traced to a still further extent, and particularly among the South sea islands, but as that point more naturally belongs to a dissertation on the origin of the nation and its

* MARSDEN, on the traces of the *Hindu* languages and literature. Page 223, Vol. 4. *Asiatick Researches*.

language, it need not be attended to here, where the subject is only alluded to, in order to fix those boundaries to which the *Malayu* law extends, and for establishing such distinctions and general definitions, as may assist in its explanation, and more ready comprehension.

The laws and customs of the *Malays*, may be considered, either separately, or as they have reference to those of the more ancient and original inhabitants of the eastern islands, with whom they are now so intimately connected. What may be termed, the proper laws and customs of the *Maláyu* nation, as it at present exists, will first be adverted to.

Independent of the laws of the *Korán*, which are more or less observed in the various *Malay* states, according to the influence of their *Arabian* and *Muhammedan* teachers, but seldom, further than they affect matters of religion, marriage and inheritance; the *Malay* states possess several codes of laws denominated *Undang Undang*, or *Institutions*, of different antiquity and authority, compiled by their respective sovereigns: and every state of any extent possesses its own *Undang Undang*. Throughout the whole, there appears a general accordance, and where they differ it is seldom beyond what situation, superior advantages, and authority have naturally dictated. Many of the *Undang Undang*, contain the mere regulations for the collection of the duties for trade, and the peculiar observations of the port, while others ascend to the higher branches of civil and criminal law.

From the comparative rude and uncivilized character of the *Malay* nation, neither learned disquisition nor very close coincidence is to be looked for; but simple ideas simply expressed, may illustrate character better, than scientific arrangement or refined composition. And in this point of

view, however local or particular the subject may be, the Institutions and Regulations of so extensive a maritime nation must be interesting.

Considering therefore that a translation of these codes, digested and arranged according to one general plan, might be as useful in facilitating and ensuring a more secure intercourse, among this extraordinary and peculiar nation, as it might be interesting in illustrating the unjustly degraded character of so extensive a portion of the human race, hitherto so little known either with respect to what they are or what they were; I have long been engaged, as far as the severe duties of my public situation would admit, in collecting *Malay* manuscripts of every description, and in particular, copies of the *Undang Undang Maláyu*, which, with the various collections of *Âddat*, or immemorial customs, and what may be usefully extracted from the *Sejáreh Maláyu*, and *Âkal Maláyu*, or annals and traditions of the *Malays*, comprize what may be termed the whole body of the *Malay* laws, customs and usages, as far as they can be considered as original, under the heads of government, property, slavery, inheritance and commerce.

On the eastern side of *Sumatra*, the *Malay* states of *Achí*, *Siác*, and *Palembang*, may be considered as of the most importance. From these states I have procured one copy of the *Undang Undang Achí*, with a short account of the *Undang Undang Siác*. Further copies of these, as well as of the institutions of *Palembang*, I have reason to believe are within my reach.

The laws of *Achí* are peculiar, on account of the severity of the criminal law; and although it may be presumed that they were borrowed from the more ancient inhabitants of the island, they are interesting, in as

far as they may have been generally adopted by the *Malay* in the straits of *Maláca*, and may have given rise to that sanguinary disposition, by which the *Malays* are usually supposed to be characterized.

Those of *Siác* have a peculiar interest, from the long established connection between that state and the *Menangcábaws* in the interior of *Sumatra*. The *Siác* river takes its rise in the *Menangcábaw* country, and has obviously been the principal outlet from the rich and pupulous countries in the interior, of which so little is known.

The *Malay* customs and usages on the west coast of *Sumatra*, I apprehend to be so much blended with those of the more original inhabitants of the island, that even if there was a state among them of sufficient importance to have its own institutions, it would scarcely deserve consideration, in the general arrangement of what is purely *Malayan*, and they are consequently little attended to.

Of the *Malay Peninsula*, the principal states entitled to notice on the western side, are those of *Kedeh*, *Maláca* and *Johór*; and on the eastern, those of *Tringáno*, *Patáni* and *Pahang*. From these I have obtained and collected several copies of the *Undang Undang Kedeh*, the *Undang Undang Maláca*, and the *Undang Undang Johór*. The states on the eastern side of the peninsula, with the exception of *Patáni*, which has been considerably influenced by the *Siamese*, seem generally to have admitted the superiority of the *Malay* government, first established at *Sín'hapúra*, and afterwards at *Johór*.

On the island of *Borneo*, the several *Malay* states have regulations and institutions peculiar to each, though not differing in any material degree from those of the peninsula. Some of these I have already obtained in whole, and others in part.

THE *Maláca* code stated to have been compiled during the reign of Sultan MUHAMMED SHAH, of which I have three copies, treats principally of commercial and maritime usages, and in these branches may form the text of a *Digest of the Malay Laws;* whilst the institutions of *Johór*, from the intimate connection which appears always to have existed between *Maláca* and the southern part of the peninsula, may be useful as a supplement on these points; at the same time that it will branch out into civil and criminal law generally, and the general principles of communication between the different states.

THE *Kedeh* code may in like manner form the text for such parts of the Institutions as may be most applicable to the intercourse of *Europeans*, and tend best to a general understanding of the character and usages of the *Malay* countries in the immediate vicinity of the *British* settlements. This state, until the establishment of the *English* at *Pulau Pénang*, possessed a respectable commerce, and still retains its *Malayan* government and institutions applicable to internal affairs; though reduced in external importance.

THE institutions of the smaller states, as of *Salingór*, *Pérak* and others, may only require notice as far as they differ from the general code of the superior states.

WITH respect to the internal regulations of government, police, property, and what in all *Malay* codes occupies so large a share, slavery; the *Malay* states on the peninsula have been selected, as well on account of their connection with the *English* government at *Penang* and *Maláca*, as for the still more important reason, in a philosophical point of view, of the *Malays*, being according to the theory I have laid down, to be found

here the least adulterated in their character, usages and manners. They are bounded by the *Siamese*, to the north, whose encroachments and establishments in the peninsula, as they have from time to time taken place, may easily be defined. The *Malays* seem here to have occupied a country previously unappropriated ; for if we except an inconsiderable race of *Caffries*, who are occasionally found near the mountains, and a few tribes of the *Orang benúa*, there does not exist a vestige of a nation anterior to the *Malays*, in the whole peninsula.

As the population of the *Malay Peninsula* has excited much interest, my attention has been particularly directed to the various tribes stated to be scattered over the country.

Those on the hills are usually termed *Samang*, and are woolly headed; those on the plain, *Orang benúa*, or people belonging to the country ; the word *benúa* being applied by the *Malays* to any extensive country, as *benúa China*, *benúa Keling:* but it appears to be only a sort of *Malay* plural to the *Arabic* word *ben* or *beni*, signifying a tribe. The early adventurers from *Arabia* frequently make mention in their writings of the different tribes they met with to the eastward, and from them most probably the *Malays* have adopted the term *Orang benúa*.

I had an opportunity of seeing two of these people from a tribe in the neighbourhood of *Maláca;* it consisted of about sixty people, and the tribe was called *Jókóng*. These people, from their occasional intercourse with the villages dependent on *Maláca*, speak the *Maláyu* language sufficiently to be generally understood. They relate that there are two other tribes, the *Orang benúa* and the *Orang Udái*. The former appear the most interesting as composing the majority ; the latter is only another name for the *Samang*, or *Caffries*.

From the vicinity of the *Jókóng* tribe to *Maláca*, and intercourse with its inhabitants, they may have adopted many *Malay* words not originally in their language; but the following short specimen may perhaps tend to illustrate their connection with the other tribes of the peninsula, and to evince how far they possess a peculiar language. They are not circumcised, and they appear to have received some instruction regarding *Nabi Ísa*, or as they pronounce it *Isher*. They, however, have no books, nor any word for God, whom they designate by the *Portuguese Déos*. The men are well formed, rather short, resembling the *Malay* in countenance, but having a sharper and smaller nose. They marry but one wife, whether rich or poor, and appear to observe no particular ceremony at their nuptials. The consent of the girl and that of the parents being obtained, the couple are considered as man and wife.

The *Jókóng* language in general coincides with *Malay*, as in the following instances:

Earth,	*Tana.*	Belly,	*Purút.*
Fire,	*Apí.*	Sun,	*Mata hárí.*
Fish,	*Ican.*	Mouth,	*Mulút.*
Bird,	*Burung.*	Eye-brow,	*Kening.*
Eye,	*Mata.*	Old,	*Tuha.*
Nose,	*Idung.*	Good,	*Baík.*
Teeth,	*Gigi.*		

The numerals are also the same as in *Malay*.

In the following instances it differs from the *Malay*:

Moon,	*Hantu jahat.*	The bad [spirit.	Arrow,	*Tamian.*	
Stars,	*Cheóng.*		House,	*Cherónguc.*	
Water,	*Yehó.*		Hair,	*Bulu útah.*	Feathers of [the head.
Tiger,	*Kahoïng.*		Head,	*Utah.*	

Dog,	*Koyope.*	Wild hog,	*Chonkòkh.*
Bear,	*Sehó.*	Devil,	*Cholcng.*
Elephant,	*Brinkil.*	Evil spirit which blasts the produce of the earth,	*Hantu bilir.*
Rhinoceros,	*Risaki.*		
Arm,	*Wúngún.*		
Foot,	*Tomén.*		
Child,	*Merbodo.*	God,	*Déos.* Evidently *Portu-*
Infant,	*Opayĕt.*		*[guese.*

As the relation that may have existed between the state of *Menangcábaw*, on the island of *Sumatra*, and that so called, on the *Malay Peninsula*, is not generally known, the following translation of a *Maláyu* MS. to which I give some credit, may tend to elucidate it. The fact related is without date or authority, but it is in a great degree confirmed by the general history of *Johór*, and the present state of the country in the neighbourhood, as well as by the existence at this day, of another *Malay* state of considerable extent, situated in the interior of the peninsula, and deriving its authority from *Menangcábaw* in *Sumatra*. The state alluded to is that of *Rembaw*, inland of *Maláca*, the *Raja* of which as well as his officers, receive their authority and appointments from *Sumatra*. The communication is carried on in the *Malay Peninsula* through the river *Lingi*, in the neighbourhood of *Maláca*, and that of *Siac*, on the *Sumatra* side. The *Malays* of *Rembaw*, with whom I have had frequent communication, adopt the broad dialect of the *Malays* of *Sumatra*, changing the *á* at the end of a word into *o;* this peculiarity may be still observed among many of the inhabitants of the southern part of the peninsula.

"MANY years ago the *Raja* of *Johór* had an only daughter, the fame "of whose beauty reached the ears of the illustrious son of the *Raja* of

" *Menangcábaw*, whose residence is at *Pegarúyung* in *Pulau Pérechek*,* " and whose power is mighty. The young prince enamoured with the " enchanting descriptions of this beauty, entreated his father's permission " to make a voyage to *Johór* for his recreation, and the *Rája* his father " was pleased to comply with his request.

" The young prince accordingly embarked from the shores of *Pulau* " *Pérechek*, attended by a numerous retinue, suited to his high rank and " splendid fortune.

" On the arrival of the *Práhus* or vessels in the straits† of *Johór*, the " prince was desirous of immediately proceeding up the river, but the " *Rája* of *Johór* alarmed at the unexpected appearance of so large a fleet " with a royal standard, refused him admittance. The prince determined " on proceeding, entered the river, and being opposed by the *Johór* " *Práhus*, a severe battle ensued, in which the men of *Johór* were de- " feated and obliged to retreat in confusion.

" On the result of the action being made known to the *Rája* of *Johór*, " he assembled his nobles and officers of state and advised with them as " to the conduct that should be pursued. Fearful that the men of *Johór*, " worsted in the first engagement, might not have power or courage to " stand in a second, it was the unanimous opinion, that the prince should " be invited to proceed up the river on friendly terms; and the prince was " accordingly invited.

" The prince lost no time in proceeding with his suite up the river,

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* The island of *Sumatra*.

† These straits are called *Sálat Tebrau*, " the staits of *Tebrau*." The continent and country of *Johór*, being on one side, and *Pulau Mírambung* on the other.

" and when he landed from the royal *Práhu*, he was received as a *Rája* " high in rank. The *Rája* of *Johór*, then enquired of him the business " that had brought him to *Johór*, and what were his wishes: to which the " prince replied that he was enamoured of his daughter, and came to " solicit her in marriage. The *Rája* having consulted with his nobles " and officers of state, agreed to the marriage, and a place was allotted for " the residence of the prince and his followers. In a short time the " prince was married to the daughter of the *Rája*, and they lived to- " gether in the district that had been allotted to them, and their hap- " piness increased every day; but how long did this last?

" The prince soon became delighted with his princess, and so pleased " with the attentions of the *Rája* of *Johór*, and the enclosed village or " district allotted to him, which now bore the name of *Campúng Menang-* " *cábaw*, that he thought not of returning to the territories of his royal " father, but remained in *Johór* with his followers, many of whom mar- " ried with the women of *Johór*, so that their numbers increased daily.

" The *Rája* of *Johór* having afterwards conferred on the prince the " title of *Tang depertúhan kichil*, and in consequence given him consider- " able power and authority in *Johór*, the prince exerted it with great " severity. The increasing consequence of the prince, added to his " severity, alarmed *Rájah* Mu'da of *Johór*, who assembled all his friends " and adherents, who were very numerous, and consulted with them as to " the measures that should be taken. Hurt and enraged that the power of " government was almost entirely taken out of the hands of the men of " *Johór*, and that a stranger should assume nearly the whole authority, " they respectfully submitted the circumstances to the serious considera- " tion of the *Rája*, requesting that the whole of the *Menangcábaws*

" might be removed from *Johór*, otherwise they would be soon enslaved
" by them.

" The *Rája* listened not to their request, and *Rája* Mu'da became
" more enraged. He again assembled his friends and adherents, and
" the number of those who were dissatisfied with the *Menangcábaws*
" being allowed to remain in *Johór* became very great. They unani-
" mously agreed, to the amount of above eight hundred, to proceed with
" long *Creeses* into the enclosure of the *Menangcábaws* and put them to
" death. This resolution being fixed at mid-day, they were desirous of
" securing from danger the daughter of the *Rája:* and accordingly,
" previous to the attack, a few men entered the enclosure at sun-set,
" unobserved, and brought the princess in safety to *Rája* Mu'da.

" The prince, entering the apartment in which he expected to find the
" princess, searched in vain for her. Aware of the enmity of *Rája*
" Mu'da, he instantly assembled all the *Menangcábaw* men. The *Gong*
" was sounded and all were in arms.

" Accompanied by all the *Menangcábaw* men who were in the en-
" closure at the time, the prince sallied forth in search of his princess.
" No sooner were they without the enclosure, than *Rája* Mu'da, hearing
" their approach, advanced against them: a severe battle ensued, which
" lasted from before mid-night, until day-light next morning, and in which
" four hundred of the men of *Johór* were slain. In the morning the
" prince retired within the enclosure of the village, and was closely fol-
" lowed by the remaining force of *Rája* Mu'da. These, however, were
" soon slain to a man by the *Menangcábaws*, and *Rája* Mu'da alone
" escaped with his life, having taken the precaution of retiring to his
" house unobserved, before day-light.

" The prince, exasperated at the treacherous conduct of the men of " *Johór*, and offended that the *Rája* should permit *Rája* Mu'da thus " openly to attack him, proceeded the next morning with all his men, in " order to give battle to the *Rája* himself, to revenge the ill treatment " he had received, and if possible, to recover the princess his wife. A se- " vere engagement took place, which lasted all day, and in the darkness " of the night the men of *Johór* fled in every direction. The *Rája* " escaped to *Tringáno*, and *Rája* Mu'da, with his family, took shelter in " a neighbouring wood.

" Intimation of the place of *Rája* Mu'da's retreat being conveyed " to the prince, he immediately proceeded thither, and completely sur- " rounded him. *Rája* Mu'da, finding himself in this extremity, and no " hope of escape left, put his family to death, one by one, in order that " they might not fall into the hands of the enemy. After which he went " forth from the interior of the wood, and endeavored to rush through the " *Menangcábaws* who surrounded it, but in vain: being repulsed in every " direction, he threw down his arms, and solicited them to spare his life. " This they would not listen to, and he was in a moment slain.

" The prince having thus revenged himself on *Rája* Mu'da, proceed- " ed towards *Tringáno*, hearing that the *Rája* of *Johór* had fled thither. " On the prince's arrival at *Tringáno*, he demanded of the *Rája*, that " the *Rája* of *Johór* should be given up to him, and the *Rája* of *Tringáno* " complied with his request. On the *Rája* of *Johór* being delivered up, " he was immediately put to death by the enraged *Menangcábaws*.

" The prince then recovered his wife from the *Rája* of *Tringáno*, " with whom she had been left by her father; and having remained a " few days at *Tringáno*, he returned with his followers to *Johór*. At

" *Johór*, he remained till such time as the *Práhus* could be repaired and " victualled for the voyage, and then embarked, with all the *Menang-* " *cábaws*, for the kingdom of his father.

" SEVERAL, however, of the *Menangcábaws* remained in the country of " *Johór*, in consequence of their being united in marriage to the *Johór* " women. The country of *Johór*, which was previously well cultivated, " was soon overgrown with wood; but the enclosed village in which the " men of *Menangcábaw* resided, still bears the name of *Campung Menang-* " *cábaw*, and many people are still to be found scattered over the coun- " try, who call themselves *Menangcábaws*, as it was for many years that " the prince resided in this country, and his followers and those con- " nected with him, had become very numerous."

THE ancient connection that subsisted between *Maláca* and *Johór* is particularly noticed in *Maláyu* history, according to which the first *Rája* of *Maláca*, *Sultan* ISKA'NDER SHAH, (afterwards, on his embracing the *Muhammedan* faith called MUHAMMED SHAH,) is supposed to have been a *Rája* of *Sin'hapura*, the ancient *Malay* state, near the site of *Johór*, who had taken refuge there, on his kingdom being invaded and destroyed by an armament from the island of *Java*. The subsequent flight of the *Maláca Rája* to the southern port of the peninsula, on the establishment of the *Portuguese*, is related in several *Malay* MSS. in my possession, from one of which the following narrative is a translation. If *Maláca* be considered as the principal state on the peninsula, the fate of its native government cannot be uninteresting, though the record must be of modern date. *Sultan* MUHAMMED SHAH, the present *Rája* of *Linga* and *Rio*, whither the seat of government has long been transferred from *Johór*, still traces his descent from the ancient *Rájas* of *Maláca*.

Translation of a Maláyu manuscript, entitled, "A history of former times, "containing an account of the first arrival of the "Portuguese at Maláca."

"IT is related that ten *Portuguese* vessels from *Manila* arrived at "*Maláca*, for the purpose of trade, during the reign of *Sultan* AH'MED "SHAH; at a time when that country possessed an extensive commerce, "and every thing in abundance, when the affairs of government were "well administered, and the officers properly appointed.

"AT the time that these ships arrived, the fort was composed of "*Níbungs*. Alas! with how many other captains did the commander of "the *Portuguese* enter the fort, and with what presents of gold, of "dollars, of cloths, of *Manila* chains, did they present themselves before "the *Rája*, and how pleased to excess was *Sultan* AH'MED SHAH with "the *Portuguese!* Whatever the commander required, *Sultan* AH'MED "SHAH was ready to grant; but how many *Bendaharas* and *Tamungungs* "with due obedience urged the *Rája* to be on his guard against the "*Portuguese*; for said they, "even the most experienced among us does "not recollect a misfortune so great as the arrival of the *Portuguese*." "To this the *Rája* would reply, 'Alas! my revered *Bendahara*, and "you respected *Tamungungs*, you know nothing when you state that "these white men will do what is wrong in our country.'

"THE *Bendahara* and the *Tamungungs* still remained of the same "opinion respecting the *Portuguese*, and were not well inclined towards "them; but finding that their representations were not attended to, nor "well received by the *Rája*, they ceased to make them. To how many "of the rich and great men did the commander of the *Portuguese* pre-"sent *Manila* chains, and how pleased was every one with the *Portu-"guese!* The *Bendahara* and the *Tamungungs* were alone dissatisfied.

" For forty days, the *Portuguese* ships traded at *Maláca;* but still the " *Portuguese* commanders remained on shore, presenting dollars by the " chest, and gold; and how many beautiful cloths did they present to the " illustrious *Sultan* Ah'med Shah, so that the *Sultan* was most happy!

" After this *Sultan* Ah'med Shah said to the commanders of the " *Portuguese*, ' What more do you require from us, that you tender us " such rich presents?' To this the commander replied, ' We only request " one thing of our friend, should he be still well inclined towards the " white men.' Whereupon *Sultan* Ah'med Shah said, ' State what it is " that I may hear it, and if it is in my power I will comply with the re- " quest of my friend.' The *Portuguese* answered, ' we wish to request a " small piece of ground, to the extent of what the skin of a beast may " cover.' Then said the *Rája*, ' let not my friends be unhappy, let " them take whatever spot of ground they like best, to the extent of what " they request.'

" The captains were highly rejoiced at this, and the *Portuguese* im- " mediately landed bringing with them spades, bricks, and mortar: the " commander then took the skin of the beast, and having rent it into " cords, measured out therewith four sides, within which the *Portuguese* " built a store house of very considerable dimensions, leaving large " apertures in the walls for guns; and when the people of *Maláca* en- " quired the reason of the apertures being left, the *Portuguese* returned " for answer, ' These are the apertures that the white men require for " windows.' The people of *Maláca* were satisfied and content.

" Alas! how often did the *Bendahara* and the *Tamungungs* approach " the *Rája* with a request that the white men might not be permitted to " build a large house: but the *Rája* would say, ' My eyes are upon them,

" and they are few in number, if they do any wrong, whatever it may be, " I shall see it, and will give orders for their being massacred (literally, " I will order men to *amok*, or as it is vulgarly termed, run a *muck* " among them.) Notwithstanding this the *Bendahara* and the *Tamung-* " *ungs* remained dissatisfied in their hearts, for they were wise men.

" After this, the *Portuguese*, during the night, conveyed cannon into " their store house, and they landed small arms, packed in chests, " saying the contents were cloths; and in this manner did the *Portuguese* " deceive and cheat the people of *Maláca!*

" What the *Portuguese* next did, the people of *Maláca* were ignorant " of, but it was long before the stone house was compleated: and when " all their arms were in order, then it was at mid-night, at a time " that the people of *Maláca* were asleep, that the *Portuguese* began to " fire off their guns from the fort of *Maláca!*

" They soon destroyed all the houses of the people of *Maláca*, and " their *Nibúng* fort; and it was during this night, when the *Portuguese* " first attacked the people of *Maláca*, that *Rája* Ah'med Shah, with his " people, fled in all directions, for no one could remain to oppose the " *Portuguese*.

" Thus did the *Portuguese* take possession of *Maláca*, whilst *Sultan* " Ah'med Shah fled to *Móar*, and from thence, in a short time, to *Johór*, " and afterwards to *Bentan*, to establish another country. Such is the " account of the *Portuguese* seizing the kingdom of *Maláca*, from the " hands of *Sultan* Ah'med Shah.

" It is related, that the *Portuguese* remained in quiet possession of the " country of *Maláca* for three years, after which they sent letters to their

" great country, which is called *Goa*, giving an account that the kingdom " of *Maláca* was conquered. As soon as this intelligence arrived, the " *Rája* of the *Portuguese* was exceedingly happy; and in about two " months after he answered the letters, and ordered the *Portuguese* to " build a fort at *Maláca* of iron stone, and the form of the fort to " be like that at *Goa*. Such was the occasion of the fort of *Maláca* " resembling that of *Goa*.

" As soon as the letters arrived at *Maláca* from the *Rája* of *Goa*, the " *Portuguese* who were in *Maláca*, ordered such of the people as had re- " mained there, to bring iron stones for the fort from *Quála Lingi*, *Pulau* " *Upi*, *Batu Bras*, *Pulau Jawa*, (a small island near *Maláca*,) from *Teloh* " *Mas*, from *Pisau Pringi*, from *Pulau Burung*, and from the country " in the interior of *Maláca*; and the price which the *Portuguese* paid for " them was at the rate of thirty dollars, for one hundred stones, if large, " and twenty dollars, for one hundred stones, if small. For eggs which " they used in their mortar, the *Portuguese* paid at the rate of a *Wang* " *Baru** (new coin) for each. For lime (*Capor*) they paid fifteen dollars " for a *Coyen*, and the labourers employed in digging away the hill, were " paid at the rate of half a dollar each, for one day's work.

" During thirty-six years three months and fourteen days, the *Por-* " *tuguese* were employed in the construction of the fort, and then it was " completed.

" From this time the *Portuguese* remained in quiet possession of *Ma-* " *láca* for about nine years and one month, when the country once more " began to flourish, and the trade became extensive on account of the

* Twenty-seven *Wang baru* are equal to a dollar, the *Madras* fanams.

" quantities of merchandize brought there from all quarters. Such is the " account of the country of *Maláca* under the *Portuguese*.

" It is related that after this period a *Dutch* vessel arrived at *Maláca* " for the purpose of trade; the vessel's name was *Afterlenden*, and that " of the captain Ibir. The captain perceived that *Maláca* was a very " fine place, and had a good fort; therefore, after the *Dutch* vessel had " traded for fifteen days, he set sail for *Europe*, and arriving after a con- " siderable time at the great country, he gave intelligence to the great " *Rája* of what he had seen, of the beauty of *Maláca*, the extent of its " commerce, and the excellence of its fort. On this the *Rája* of *Europe* " said, ' If such is the account of *Maláca*, it is proper that I should order " it to be attacked.' Twenty-five vessels were thereupon ordered by the " *Rája* of *Europe*, for the purpose of attacking *Maláca;* and troops being " embarked on each, they first set sail for the kingdom of *Bantam*, in the " country of *Java*, where the *Dutch* were on terms of friendship.

" At *Bantam* they found two *Dutch* ships and a ketch, and after " having taken on board buffaloes, and provisions for the use of the per- " sons on board, the vessels then sailed for *Maláca*.

" As soon as the fleet arrived at *Maláca*, the *Dutch* sent a letter to the " *Portuguese*, telling them to hold themselves in readiness, as it was the " intention of the *Dutch* to commence the attack on the morrow at mid- " day. To this the *Portuguese* replied, ' Come when you please, we are " ready.'

" On the next day the *Dutch* commenced the attack and the war con- " tinued for about two months, but the country of *Maláca* was not car- " ried and the *Dutch* returned to *Bentan*, where they remained quiet for

" some time in the intention of returning to *Europe;* all the great men " on board the vessels feeling ashamed of what had happened.

" The great men in each of the vessels, having afterwards held con- " sultations respecting another attack on *Maláca*, they proceeded against " it a second time, but it did not surrender. The *Dutch* now sent a let- " ter to *Johór*, in terms of friendship, to the *Sultan*, requesting his assis- " tance, in the attack of *Maláca*. With this the *Rája* of *Johór* was pleased, " and an agreement was entered into between the *Rája* of *Johór* and the " *Dutch*, which was sworn to; so that the *Dutch* and *Malays*, became " as one, as far as concerned the taking of *Maláca*. An agreement was " made, that the *Dutch* should attack from the sea and the people of *Johór* " from the land. If the country surrendered, the *Dutch* were to return " the country and the cannon; and every thing else that might be found " within *Maláca*, was to be equally divided between the *Dutch* and the " people of *Johór*.

" When these terms were agreed upon, the men of *Johór* and the *Dutch* " sailed for *Maláca*, and after attacking it for about fifteen days; from " the sea, many were slain, as well *Portuguese* as *Malays* and *Dutch*. The " *Malays* then held a consultation, and began to think that if they fought " against the white men, according to this fashion, *Maláca* would not " fall for ten years. It was therefore agreed upon by all the *Malays*, " that fifty men should enter the fort of *Maláca*, and run a *muck*, or " *Meng-amok*.

" The *Malays* then selected a lucky day, and on the twenty-first day " of the month at five o'clock in the morning, the fifty *Malays* entered " the fort and commenced *amok*, and every *Portuguese* was either put to

" death, or forced to fly into the interior of the country, without order " or regularity.

" On this, the *Malays* exerted themselves in plundering *Maláca*, and " the whole was divided between the men of *Johór* and the *Dutch*, ac- " cording to their agreement.

" The men of *Johór* then returned to the country of *Johór*, and the " *Dutch* remained in possession of *Maláca*, and from that time to the " present the *Dutch* and the men of *Johór*, have been on the strictest " terms of friendship.

" This is the account of former times, that was to be related."

To return to the subject of the *Undang Undang Maláyu*, it will appear from what I have previously stated, that the collection of *Malay* laws, as far as regards the *Maláyu* nation separately, is nearly completed; but it appears adviseable to adopt a more extensive plan, embracing the original institutions of the various nations among the eastern islands.

Of these, the institutions of *Java*, and of the *Bugis* and *Macasar* states, on the island of *Celebes*, are first in importance.

On the island of *Java*, there are several codes of *Undang Undang*, which are celebrated to the eastward; but as the whole island of *Java* was once under the dominion of the ancient emperor, or *Susuhónang Giri*, a power that is still acknowledged to a certain extent, these may no doubt be traced to one source and authority. The difficulty that has hitherto existed in communicating with *Java*, in consequence of the *Dutch* establishments, has prevented the acquisition of the most important of these institutions. The *Javanese* laws are arranged in native codes of

considerable antiquity, and were collected many years back by the *Dutch* government, for the guidance of their different officers. Of this collection I possess a copy, which will, at any rate, assist in the compilation of a more genuine code, from native authority, whenever circumstances may admit of a communication being opened with the *Javanese Rajas* and chiefs.

From the *Bugis* and *Macasar* nations of *Tana Gúa*, and *Tana Ugi*, on *Celebes*, I have received detached parts of the *Undang Undang;* but the copies that have yet reached me are so incomplete and inaccurate, and bear such evident traces of being but imperfect transcripts, from a better digested and more regular code, that they rather excite than satisfy enquiry. I have for some time adopted measures with the view of obtaining, if not the originals, at least more perfect transcripts; in which I have every reason to expect, I shall be successful. The two principal codes on this island, are those of *Macasar* and *Boni*. The laws as well as the history of the *Bugis* states, are of considerable antiquity, perhaps far exceeding those on the island of *Java*. These are preserved in books, the greater part of which are still extant, but only to be found in their purity and correctness towards the inland.

With respect to the *Sulu* islands, I have a short account of their laws and usages, though no regular code: several interesting particulars connected therewith, have been collected by Mr. Alex. Dalrymple, and printed in the *Oriental Repertory*.

Of the *Moluccas*, I have not yet been able to obtain further information, than what has tended to confirm in every respect the detailed and full account given by Valentyn; but as these islands have lately fallen into the hands of the *English*, whatever may be desiderated from that

quarter may easily be obtained. Though the interior of these islands still possess an original population, their government has long been *Malayan*.

As nothing beyond an imperfect description of a few original tribes, has yet been obtained, respecting the inland population of *Borneo*, it may be inferred, that as there appears to have been no original nation, of authority or extent adequate to reach the shores, or to be known by any of the states that have been established on the coast, their institutions, if they possess any, cannot be of importance, as they have not had any effect on the general population of the eastern *Archipelago*.

On *Sumatra*, Mr. Marsden has so well and diligently trodden the ground, that we cannot perhaps, contrary to his assertion, expect to find written laws and institutions, among any of the original nations. The compilation that has been made there by the *English* residents, will form a valuable standard for comparison with the laws and customs of the more eastern islands, but at the same time, a more extensive research into the interior, if unsuccessful in its principal object, cannot fail to be interesting in as far as it may lead to a more intimate acquaintance with the *Battas* and *Menangcábaws*, the former of which may be considered as the original population of the island; while the establishment of the *Menangcábaws* may be compared to that of the *Moguls*, on the continent of *India*. In the *Ketíka líma* or five times, of the *Battas*, adopted by the *Malays*, (of which I have a copy) the divisions of lucky and unlucky times, for undertaking any affair, are expressed by the terms *Mésewára*, *Bisnú*, *Brehma*, *Sri*, *Cála*, corresponding to the *Hindu* deities more correctly pronounced Maheswara, Vishnu, Brahma, Sri and Cala: the table for calculating these superstitious observances is extremely simple.

To the collection that has already been made of the various laws and usages of the *Malays*, *Sumatrans*, *Javanese*, *Bugis*, *Macasars* and *Sulus*, may be added the compendium of the *Muhammedan* law of inheritance, printed by the *Dutch* at *Batavia*, in 1760, in 102 articles, *Dutch* and *Maláyu*, of which I possess a copy.

As the collection of the *Undang Undang Maláyu* is so various and extended, the compilation must necessarily be deferred, until the best authorities procurable can be referred to, and if possible the leading native courts visited. In the mean time I request to present to the *Asiatick* society, a sketch of the maritime code of the *Malays*, as translated from the duplicate copies which I have brought with me to *Bengal*; and which, when collated with the more original and authentic copies, and elucidated by notes, corresponding with the general plan of the undertaking, I propose shall form one of six books of the *Malay* laws.

In tracing back the *Malay* laws, to those of the more ancient nations on the island of *Sumatra*, *Java* and the *Celebes*, and thence, perhaps, on one side, to the continent of *India*, and on the other, to the larger islands in the South seas, a wide field will be opened for research, as well into their origin, as into that of those extraordinary languages, which in proportion as they are correctly spoken or written, seem to contain a larger intermixture of *Sanscrit*.

The comparatively modern origin of the *Malays* is a fact, so generally admitted and universally confirmed by all their writings and translations, that it is difficult to account for the extraordinary opinion laid down by the author of the "Sketch of an intended essay, on the *Malay* language," that the *Arabians* and *Persians* have borrowed their present alphabeti-

cal character from the *Malays*;* an opinion that could only hope to attract attention, from the confident manner in which it is asserted. The proofs that seem to have occurred to the same author, on the "evident "antiquity" of the language, and its being from "the primæval stock of "JAVAN, one of the sons of JAPHETH, the third son of NOAH," and from the roots of which, *Persian*, *Sanscrit*, and *Arabic* derivatives and compounds have been formed, might as well be adduced in supporting a similar comparison between the *English* and *Latin*, whence we should be rather surprized to find the former, from the number of ancient words it has adopted, asserted to be the parent of the *Roman* tongue.

IT is easy and natural to account for the *Malays* having with their religion adopted the written character of the *Arabs*, and I have no hesitation in asserting that neither *Malay* writings nor inscriptions, in their present characters, can be traced back to an æra of greater antiquity than the invention of the modern *Arabic* alphabet, or beyond the period at which the great intercourse between the *Arabians* and eastern nations took place. Admitting, however, that more early writings did exist, there is no reason why they may not have been preserved on *Sumatra*, in the more ancient and original characters of the *Battas*, the *Rejángs* or the *Lampungs*: on *Java*, and the *Celebes*, in the characters of the *Javanese* and *Bugis* nations, and even on the *Malay* peninsula, in some modification of the *Siamese* character.

FOR the compound parts of the *Maláyu* language, as it at present

* "A Rough Sketch of part of an intended essay towards ascertaining, deducing, elucidat-"ing and correctly establishing the rudiments of the *Juhwee* or *Jahwee* language, vulgar-"ly called the *Malay* language by, J. S." and published at *Prince of Wales Island*, 1807. See pages 1, 2, & 3.

exists, and the sources from which we must trace the origin of the nation and of its language, I shall only at present refer to the enlightened Essay on the *Indo Chinese* nations, in a preceding volume of the *Asiatick Researches*; the enlarged views and determined positions in which, will, I am convinced, be the more confirmed and verified, in the proportion that they may be investigated.*

THE most obvious and natural theory on the origin of the *Malays*, is that they did not exist as a separate and distinct nation, until the arrival of the *Arabians* in the eastern seas. At the present day they seem to differ from the more original nations, from which they sprung in about the same degree, as the *Chuliàhs* of *Kilíng* differ from the *Tamul* and *Telinga* nations, on the *Coromandél* coast, or the *Mapíllas* of *Malabar* differ from the *Nairs*, both which people appear, in like manner with the *Malays*, to have been gradually formed as nations, and separated from their original stock by the admixture of *Arabian* blood, and the introduction of the *Arabic* language and *Moslem* religion.

THE word *Jahwí* so much insisted on by the author of the "Rough Sketch," is the *Malay* term for any thing mixed or crossed; as when the language of one country is written in the character of another, it is termed *B'hása Jahwí* or mixed language; or when a child is born of a *Kilíng* father and *Malay* mother, it is called *Anak Jahwí*, a child of mixed race. Thus the *Maláyu* language, being written in the *Arabic* character is termed *B'hasa Jahwí*; the *Malays*, as a nation, distinct from the fixed population of the eastern islands, not possessing any written character, but what they borrow from the *Arabs*.

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* LEYDEN on the languages and literature of the *Indo Chinese* nations. *Asiatick Researches*, Vol. X.

With respect to the Maritime Institutions which I have now the honor to lay before the *Asiatick* society, they have been selected on account of their singularity and characteristic peculiarities. The power of life and death vested in the *Nakhodah* may be considered as purely *Malay*, or at any rate to have had its origin in the Eastern Islands: the *Arabs*, from whom alone they could have borrowed a foreign sea-code, not possessing, as far as I have been able to ascertain, any treatise whatever on maritime law, or in any instance admitting the authority of the *Nakhodah* or captain of a vessel to inflict capital punishments. In this point of view, the paper, even in its present state, may not be uninteresting; and it may tend in some degree to account for some of the numerous peculiarities of a nation generally believed to act on most occasions, solely from individual will, and ferocious passion.

Maritime Institutions of the Malays.

CONTENTS.

The Maritime Institutions of the Malays, translated from the Maláyu Language.

IN the following sketch, which defines the laws and usages of the *Malays* at sea, the *Maláca* code has been selected for the text, as well on account of the admitted superiority of that once flourishing kingdom, among the *Malay* states in general, as from the circumstance of this code having, with but slight modifications, been adopted by several of the ancient and powerful states on the island of *Celebes*, and still continuing in force among many of the *Bugis* and *Macasar* traders from that island. The *Bugis* and *Macasar* states, which are nations radically distinct from the *Malays*, possess a Maritime Code of still greater antiquity, but in latter times they appear to have in many instances adopted the sea laws of *Maláca*, nearly in the same manner as the *Romans* adopted the celebrated *Rhodian* code.

THE *Maláca* code appears to have been compiled during the reign of *Sultan* MUHAMMED SHAH, the first sovereign of *Maláca*, recorded in the *Maláyu* annals to have embraced the *Muhammedan* faith. This circumstance is understood to have taken place about the year of the *Christian* æra, 1276. The origin of the *Malay* code may therefore be considered as nearly coeval with the first establishment of *Islamism* among the *Malays*. The authority of the code is thus stated in the preamble:

" THESE are the laws to be enforced in ships, *Junks*, and *Práhus*.

" FIRST of all, PATI HARUN and PATI 'ELIAS, assembled *Nakhodah* JENAL, and *Nakhodah* DEWA and *Nakhodah* IS-HAK, for the purpose of

consulting and advising relative to the usages at sea, and of compiling in conformity thereto a code of *Undang Undang* or Institutions.

" After they had consulted together and collected the laws, they presented them to Datu Bendahara Sri Maharaja, in the kingdom of *Maláca*, who laid them at the feet of the illustrious Muhammed Shah. Whereupon that prince said, ' I grant the request of the *Bendahara*, and establish these laws and institutions for your government and that of your posterity. When you administer these laws at sea, they shall not be afterwards interfered with on shore. Henceforth let the laws of the sea, be carried into effect at sea, in like manner as those of the land, are carried into effect on land, and let them not interfere with each other, for you (addressing himself to the *Nakhodahs,*) are as *Rájas* at sea, and I confer authority on you accordingly.

" The several *Nakhodahs* who had framed the code were then honoured with titles; *Nakhodah* Jenal, received the title of *Sang Yahi de Rája*,* *Nakhodah* Dewa, that of *Sang Utama de Rája*, and *Nakhodah* Is-hak, that of *Sang Setia de Rája*.†

" In such manner were the laws established and made known, during the times when the kingdom of *Maláca* was tranquil and prosperous, during the reign of *Sultan* Muhammed Shah, and when Sri Nara de Ra'ja, was *Bendahara* and governed that country.

" Therefore, as the laws of the sea are established, as well as the laws of the land, let them be observed, in order that whatever is undertaken may be properly regulated. Let these laws be followed towards all countries; in as much as the laws of the sea, which relate to the sea only, and the

* & † According to other copies, these titles are *Sang Boya de Rája* and *Setia Dupati*.

laws of the land, which relate to the land only, are defined: because those of the sea cannot interfere with those established on shore.

"ACCORDING to these institutions, let the law be administered at sea, that no disputes and quarrels may take place. Let them be known and descend to posterity, that men may not act according to their own will and inclination, but that order and regularity may prevail on board vessels, as well during prosperity as adversity. Let not what is established be done away, nor these laws be resisted or disobeyed!

"IF these laws are attended to, no one can question the authority of the *Nakhodah*, for as the *Rája* is on shore, so is the *Nakhodah* at sea. This authority has been conferred by the *Sultans* of the land, upon all *Nakhodahs*, in order that they may administer the laws on board their respective vessels. Whoever does not admit this authority offends against the law."

IT may be necessary to premise, that although the number and description of persons must materially depend on the size of the vessel and the nature and extent of the voyage, yet the following classes and denominations will be found to occur in almost every *Práhu*, a term under which the *Malays* include every description of vessel.

THE *Nakhodah*, or captain, who employs a *Jeru-tulis*, or writer, who corresponds in some degree to a purser.

THE *Kiwi* or *Kiwi Kiwi*, the principal of which is termed the *Mala Kiwi*—Supercargoes or persons who have an adventure in the voyage, and to whom part of the cargo belongs.

THE *Orang Tumpang* or *Menumpang*—Passengers from one port to another.

Officers and Crew.

Malim—The master. There are generally two, denominated the *Malim Besar* and *Malim Kichil*, the superor and inferior, the latter of whom is also termed *Malim Ang*, whose duty is principally to manage the sails according to the wind; the chief *Malim* attending to the course of the *Práhu*.

Jeru-mudi—Persons who steer the *Práhu*.

Jeru-batu—Persons who attend the anchor and fore part of the *Práhu*.

Tukang—Literally workmen, petty officers, having specific duties according to their denominations, as *Tukang Peták*, the officer of the hold, *Tukang Agung* the officers of the main-mast or chief petty officer, *Tukang Kiri* the officer of the larboard or left side, *Tukang Kánen* the officer of the right or starboard side, &c.

Awák Práhu or *Anák Práhu*—The crew or common men, who may consist either of freemen, debtors or slaves.

Of the Rank and Authority of the Nakhodah and Officers.

"Let every man obey the *Nakhodah*, agreeably to the authority conferred upon him by the *Sultans* of the land from time immemorial, for he is the *Rája* while at sea, and although he may be young, he shall be as an *Orang tuah*, or have the authority of age, and administer the law accordingly.

"First.—It is the law that in all *Práhus* of every description, the *Nakhodah* shall be as the *Rája*.

" That the *Jeru-mudi* or steersman shall be as the *Bendahara*, or prime minister, and the *Jeru-batus* as *Tamungungs* or chief peace officers, and it shall be the duty of these to superintend every one and to regulate right and wrong within the *Práhu*.

" That the *Tukang Kánen*, and the *Tukang Kiri*, shall possess a respectable influence, and perform duty with the *Tukang Agung*.

" That the *Jeru-batu Kiri*, the *Gung Tang* and *Sinawé*, as well as the *Tukangs*, shall be under the immediate orders of the *Nakhodah*; and all the *Awak Práhu* shall be under the orders of the *Tukangs* belonging to the *Práhu*.

" The *Malim* shall be as a ruler or judge* at sea, as it is his duty to direct the course of the vessel."

In the *Macasar* copy it is stated, " that the owner of the *Práhu* shall be as the *Rája*, the *Nakhodah* as the *Bendahára*, the *Tukangs* as the *Támungungs*, the *Tukang Haluén* (officers of the fore-castle,) as masters and the *Tukang Téngha* as *Sida Sidas*," but as the *Nakhodahs* are generally, and always in the smaller *Práhus*, owners, the distinction made at *Macasar*, which changes the comparison in the ranks of the different officers, in consequence of the introduction of a superior to the *Nakhodah*, is of no real importance, and does not essentially vary the rank or influence of the officers.

" If any of the crew disobey the orders of the *Tukang Agung*, that officer shall deliver the offender over to the *Jeru-batu*, in order that he may be punished with seven stripes. But it is the usage that such stripes shall

* *Hakim* or *Imam*.

not be inflicted with an uplifted or extended arm, nor without the knowledge of the *Tukang Agung*. If the person who has offended still resists the authority of the *Tukang Agung*, he shall be punished with four stripes more."

According to the *Macasar* copy, the *Awak Práhu* are stated to be under the immediate orders of the *Tukang Tengha*. If any one resists his authority he shall in the manner above described, be punished in the presence of the *Tamungung (Jeru-mudi)* with three times seven stripes. And if the offender still resists the authority of the *Tukang*, it shall be lawful for the *Tamungung* to hang him up (suspend him by the arms) and to punish him with three stripes more.

"If any of the crew disobey the *Guntang* and *Sínawé*, the offender shall be punished with three stripes."

Of the duties of the Officers and Crew, and the nature of their engagements.

There is no description of persons who receive wages on board a *Práhu*, with the exception of persons who may act as substitutes, for such as may be obliged to quit the *Práhu*, on account of illness or otherwise. Every person on board has some commercial speculation in view, however small, and his engagement is made for the voyage.

The *Nakhodah* or owner of the *Práhu*, gives to each according to established custom, what is termed *Tulungén*, which signifies assistance or advances; which advances are of two kinds, consisting either of shares of the cargo, or loans of money.

In short, the whole voyage is to be considered, as a commercial ad-

venture of the whole of the persons engaged in it, and bears no slight similarity to the outfit of a *Dutch* whaler.

Of the Malim.

"THE law respecting the *Malim* is, that he shall, if he requires it, be allowed one half of a division of the hold, and receive a further assistance from the *Nakhodah* to the extent of a *Tahil* and a half (twelve dollars,) this officer being on the same footing with the *Malim besar* or chief *Malim*.

IT is the duty of the *Malim* to remember the proper course to steer, and to know the seas and the lands, the winds and the waves, the currents, the depths and the shallows, the moon and the stars, the years and the seasons, the bays and the points of land, the islands and coasts, the rocks and shores, the mountains and hills, each and every one of them, and also to know where the *Práhu* may be at any time. With the whole of these should the *Malim* be well acquainted in order that every thing may go on prosperously, as well at sea as on land, and that the *Malim* may be free from fault.

"WHILE a *Práhu* is at sea, the *Malim Ang* shall have charge of all the cordage and rigging. He shall give orders respecting the same to the *Tukang Agung*, whose duty it is to see that the *Awak Práhu* do what is necessary respecting the same. The *Tukang Kiri* and *Tukang Kánen* shall also assist in superintending the *Awak Práhu*."

ACCORDING to the *Macasar* copy, any of the *Awak Práhu* who may neglect their duty, or the orders of the *Tukangs*, may be punished at the *Pataren Lawang*, or place where the cable and ropes are kept, with seven stripes.

"If every thing is not at sea as the *Málim* wishes it, and the sails are taken a back, let him, on his return to port, give alms to the poor, as an acknowledgment for his escape.

"If the *Malim* forgets the course he has to steer, and through his ignorance the *Práhu* is wrecked, he shall suffer death, for such is the law.

"If the *Malim* is desirous of quitting the *Práhu* at any port or place, he shall not be permitted to do so."

Of the Jeru-mudi or Steersman.

"It is the duty of the *Jeru-mudis* when relieved from their tour of duty at the helm, to superintend and take care of all the arms in the *Práhu*; and in the event of the *Práhu* falling in with pirates, let them combat with a strong hand and courageous heart, for such is their duty."

By the *Macasar* copy, it is established, that if the *Jeru-mudis* or *Jeru-bátus* are desirous of quitting the *Práhu* at any time, they may be permitted to do so, on paying, the former, the sum of half a *Tahil* or one *Pahar*, (four or two dollars) and the latter one *Pahar* or two *Mas*, (two or one dollar) each according to his ability, but not exceeding the sums stated.

Of the Petty Officers and Crew.

"If the *Práhu* is from three to four *Dépahs* (fathoms) wide, the *Awak Práhu* shall be allowed assistance, or a participation in the cargo, to

the extent of one *Coyen*, and all other persons, not slaves, two *Coyens*.*

" If the *Práhu* is two and a half *Depahs* wide, the *Awak Práhu* shall be allowed three hundred *Gantangs*, and the others, not slaves, six hundred *Gantangs*."

Independent of the descriptions of persons above alluded to as belonging to the *Práhu*, it may be necessary to advert to slaves, and debtors, particularly the latter, respecting whom the law is as follows:

" When any person wishes to bind himself in personal service for a debt, let an agreement be required at the time, that the debtor shall follow and perform service for his creditor for the term of three years, three months and three days, ' or according to the *Macasar* copy for the term of three years,' in order that if the party is not willing to conform thereto, he may not become a debtor, or if willing to do so, that he may follow and serve his creditor accordingly.

" If at any time before the expiration of the abovementioned period, the debtor wishes to discharge the obligation, he shall be required to pay an advance at the rate of one in ten on the amount of his debt, in addition to the principal; unless he does this, he need not be permitted to quit the *Práhu*. ' According to the *Macasar* copy,' if the debtors of the *Nakhodah* wish to quit the *Práhu* at any place by discharging their obligation, they shall, on paying the advance of one in ten on the amount of their debt, be

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* The *Malay* measures alluded to, are as follows:

4 *Chupális*,	equal	1 *Gantang*,	(about a gallon)
16 *Gantangs*,		1 *Nali*,	
10 *Nali*,	or 160 *Gantangs*	1 *Koncha*,	
5 *Koncha*,	or 800 *Gantangs*	1 *Coyen*,	which is generally calculated at something more than a ton, but various.

discharged, and not considered liable to the duty of the country, but if they have property in the *Práhu* beyond the amount of their debt, a further demand is authorized, according to their ability, to the extent of a *Pahar* (two dollars) each.

Of the Kiwis or Traders.

"THIS is the law relating to the *Kiwis*; they shall pay for the tonage they require, unless they have assisted the *Nakhodah*, in his trading concerns, to the extent of three or four *Tahils* (twenty-four or thirty-two dollars,) in which case the *Nakhodah* shall give them two or three *Coyens* of tonage, or one division of the hold, it being considered that the profit on the three or four *Tahils* is an adequate compensation.

"THE *Kiwis* may obtain seven or eight divisions of the hold, but they shall not pay for four divisions, as long as they are under agreement to pay a duty on their return to port, (on the goods they lade) at the rate of four out of every thirteen.

"THE *Mala Kiwi* shall be entitled to half of the division of the hold in which the rice or provisions are stowed, *(Petah Gandung)* because he is the *Pung'hulu* or head man of all the *Kiwis*.

"WITH respect to the duties of the country on the eight divisions of the hold, and also on the sails, it is the law, that the *Kiwis* shall present eight pieces of cloth and a bundle of rattans. The *Kiwis* who present these shall be freed from paying all other duties of the country, because this is adequate.

"IT is the usage, that in all affairs that may arise, good or bad, the *Nakhodah* shall advise with, and consult the *Mala Kiwi* and the *Kiwis*."

CHAPTER II.

" IT is the established law of the *Undang Undang (istéadat hukum Undang Undang)* that all *Nakhodahs*, and *Malims*, and *Tukangs*, and *Muda Mudas* and *Awak Práhu*, each and every one shall conform to what is the usage.

The Divisions of a Práhu.

THESE are the laws respecting the *Balai Lentang*. No person shall go there, except at a time when there is business of importance ; and then this is the place on which to assemble for the purpose of advising and consulting. If any of the crew go upon the *Balai Bujur*, and remain there, they shall be punished with five stripes.

" THE *Balai Bujur* is expressly appropriated for the recreation of the *Muda Mudas;* if any of the crew go there, they shall be punished with three stripes.

No person is allowed to remain in the *Putaren Lawang* or place where the cable and ropes are kept, except the *Nakhodah*, the *Muda Mudas*, and the *Tukang Agung;* if any of the crew go there, they shall be punished with six stripes.

THE *Allang Muka*, (the place before the *Nakhodah's* cabin) is appropriated for the *Tukang Teng'ha*, *Tukang Kanen* and *Tukang Kiri*, if any of the crew go there, they shall be punished with three stripes.

Regulations for the safety of the Práhu.

" When a *Práhu* proceeds to sea, every person on board shall be under charge of the *Nakhodah*.

" At the time a *Práhu* is about to sail on her voyage, the *Malim* shall inform the *Tukangs* thereof, who shall direct the persons who have the watch *(Orang berképong)* to take care that the rigging and sails are in order, and to prevent accident by fire, as fire is a dreadful calamity at sea.

" As it is the duty of the *Muda Mudas* to superintend the men on watch, let them be careful that they perform their duty. For if a vessel drifts, or runs on shore, on any coast or point of land, in consequence of the *Muda Mudas* neglecting to superintend the people on watch, it is the law, that the *Muda Mudas*, in such case, shall be punished, and fined according to their ability. With respect to the people on watch, they shall be punished with twenty stripes each.

" If the *Práhu* drifts from her anchorage, and approaches near shore, and the persons on watch are not aware of it, they shall be punished with eight stripes each.

" If the persons on watch allow *Práhus* to pass without hailing them," or according to the *Macasar* copy, " allow the people in the other *Práhu* to hail first, they shall be punished with seven stripes each." By that of *Macasar*: " The *Orang Muda Mudas* shall also, in such case, be liable to a similar punishment, as is directed in the event of slaves absconding from a *Práhu*, which " in the *Maláca* copy," is as follows:

" It is the duty of the persons on watch, to superintend and watch over all the slaves in the *Práhu*, in order to prevent their absconding. In this duty, as well as in all others, they shall be superintended by the

Muda Mudas. If, therefore, a slave at any time absconds from a *Práhu*, it shall be the duty of the *Muda Mudas* to find out the person who is to blame, and the person who is so found out shall be punished with sixty stripes." The *Macasar* copy states, "He shall be answerable for, and make good his value."

"It is the duty of the persons on watch to see that the vessel is properly baled out; if, therefore, too much water is at any time allowed to remain, the persons who are on the watch at the time, shall be punished with fifteen stripes each.

"If the persons on watch do not keep a good look-out, and any thing is stolen from the *Práhu*, they shall be punished with two stripes from every person in the *Práhu*.

"It is the usage that persons on watch shall each be allowed the conveniencies for smoking opium, in order that they may not fall asleep during the time that it is necessary for them to keep watch.

"When the term of the watch shall expire, the persons who are to be relieved, shall deliver over charge to the persons appointed to succeed them, and give notice thereof to every one, and to the *Muda Mudas*.

"It is the duty of those who dress victuals, *(Orang bertupi)* to guard against accident by fire, while a *Práhu* is at sea. After victuals are dressed, the fire shall be carefully extinguished, and if any person neglect to do so, and the cooking place take fire, the law is that after all the people in the *Práhu* shall have put out the fire, the person through whose neglect it was occasioned, shall be punished with two stripes from each person in the *Práhu*, and his master shall be warned to be more

careful in future, in order that the servant may not be guilty of such neglect again; for of all things fire is to be dreaded at sea.

"If the person who is the cause of the fire, is a slave, the master shall be fined four *Paku petis Jawa*. If the master refuses to pay the fine, the slave shall be punished with four stripes," according to the *Malacca*, and "forty stripes," according to the *Macasar* copy. "And such punishment shall be inflicted at the *Temba Ruang*, or place from which the *Práhu* is baled out."

The Laws respecting throwing Cargo overboard.

"When there is a violent storm, and it may be necessary to throw overboard a part of the cargo, for the safety of the *Práhu*, a general consultation shall be held with respect to the property in the *Práhu*, and those who have much and those who have little, must agree to throw overboard in proportion.

"If the *Nakhodah* omits to assemble all those who are interested, and the cargo is thrown overboard indiscriminately, the fault shall be on the *Nakhodah* of the *Práhu*, for such is not the custom.

Of Práhus running foul of each other.

"If a *Práhu* runs foul of a guard or armed vessel (in which case the crew are liable to forfeit their lives,) the offence may be compounded by each person on board the *Práhu*, paying such sum as a ransom for life, as may be agreed upon, each paying alike, whether slaves or not slaves, rich or poor, youths, men or women, and no one more than another.

" If during a heavy sea, or high winds, a *Práhu* strikes upon a rock or on a shore or shoal, or runs foul of another *Práhu*, by which one is lost, the law is, that the loss shall not be considered as accident, but as a fault, because when there is a heavy sea, the *Práhu* ought to be kept out of the way from such occurrences.

" The law therefore states, that whether the parties are rich or poor, the loss occasioned by the damage or wreck of the *Práhu*, shall be divided in three proportions, one of which shall be borne by the person to whom the damaged or lost *Práhu* belonged, and the remaining two thirds by the persons who were the occasion of it."

The *Macasar* copy differs in this respect, being as follows:

" During the time that there are one or more *Práhus* in company, and there happens to arise a storm, and the *Práhus* run foul, so that one is damaged, the fault shall be upon the persons in the *Práhu* that runs foul of the other, and the law is *(Papa Gurma)* according to what the loss or damage may be; the amount shall be divided into three parts and one part only shall be made good by the persons in fault, the other two parts being lost.

Of putting into Ports, and the mode of Trading.

" When the *Nakhodah* may be desirous of touching at any bay, coast, or island, he shall hold a general consultation, and if it is approved of and agreed upon, it is proper that the *Práhu* shall go where he wishes. But if the *Práhu* puts into any port or place without the *Nakhodah* having previously held a consultation, the *Nakhodah* is guilty of a fault.

" In like manner, if the *Nakhodah* is desirous of sailing to any other

place, or of crossing from one shore to another, he shall first hold a consultation, and then if it is agreed that it shall be so, the ropes shall be put in order; and when the rigging and sails are ready, a further consultation shall be held with the *Jeru-mudi* and *Jeru-batu*, and the *Tukang Agung*, in order that the *Práhu* may proceed accordingly.

" When a *Práhu* arrives at any port, the *Nakhodah* shall be first allowed to trade for four days, after which the *Kiwis* shall trade for two days, and then it shall be allowed to all on board the *Práhu* to trade.

On the *Nakhodah's* going on shore he shall be accompanied by the *Muda Mudas*, who shall afterwards return to their duty on board the *Práhu*.

After the regulated period for trading shall have expired, and the *Nakhodah* wishes to make a purchase, no person belonging to the *Práhu* shall offer a higher price, and if there are any persons who offer to purchase the goods of the *Mala Kiwi*, or others, it is the law that the *Nakhodah* should should first be made acquainted with the price.

" If any person on board a *Práhu* shall purchase a slave, or any merchandize, without informing the *Nakhodah* thereof, it is lawful for the *Nakhodah* to take them to himself, on paying the original cost."

" If any person on board a *Práhu* purchases a female slave, without the knowledge of the *Nakhodah*, it is the law, that the *Nakhodah* may take her to himself without reimbursement to the purchaser. Such is also the law with respect to run away slaves, who may be so purchased."

According to the *Macasar* copy, the following is the amount of duty, to be paid by *Práhus*, at different ports.

" When a *Práhu* arrives at *Java*, the amount of tribute or duty on account of each division of the hold is five hundred *Petis*, two sails, and one bundle of rattans.

At *Bima*, six hundred *Petis*, two sails, and one bundle of rattans.

At *Timor*, seven hundred *Petis*, two sails, and one bundle of rattans.

At *Mengcasar*, or *Macasar*, two *Gantangs* of gun-powder, three sails, and two bundles of rattans.

At *Tanjung Pura*, six hundred *Petis*, two sails, and one bundle of rattans.

" When slaves are purchased at *Java*, the duty shall be calculated on twelve men, for each division of the hold, and when at *Mengcasar* at ten men for each division of the hold.

" And whatever *Práhu* goes to any country for the purpose of trading, the duties of the country are calculated upon each *Práhu*, having eight divisions of the hold.

Of Detention.

" The law is that when the season is nearly over (*Musim Kassis*) and the *Nakhodah* of the *Práhu* omits to sail, the *Kiwi* shall wait, on his account, for seven days; after which, if the *Nakhodah* does not proceed, and the season is over, the price paid for the divisions of the hold shall be returned to the *Kiwis*.

" If the *Kiwis* are the cause of the delay, and the season is nearly over, the *Nakhodah* shall detain the *Práhu* seven days on their account, after which he is authorized to sail without them, (if they are not ready) and no more shall be paid or done relating thereto.

"If the season is not far encroached upon, and the *Nakhodah* shall be desirous of sailing with dispatch, let him give notice thereof to the *Kiwis*, and enter into an agreement with them to sail in seven or fifteen days, and if the *Kiwis* are not then ready, the *Nakhodah* is authorized to leave them behind, and to sail.

Of persons quitting a Práhu.

"If a *Kiwi* quits the *Práhu* (of his own accord) at any place during the voyage, he shall forfeit the price paid for his division of the hold, and have no further claim on the *Nakhodah*.

"If it is on account of any disagreement or quarrel, that he is desirous of quitting the *Práhu* (and in order to prevent mischief,) one half of the sum paid for his division of the hold shall be returned.

"But if a *Kiwi* is very quarrelsome and creates much trouble and dissention, it is proper for the *Nakhodah* to send him on shore, as soon as possible, and to return him the price he has paid for his division of the hold.

"The law with respect to passengers *(Orang Menumpang)* is, that if they quit the *Práhu* at any time before they arrive at their destination, even if the voyage is only half compleated, it shall be the same as if they had reached their destined port, and no part of what has been paid shall be returned.

"If one of the crew is sick, it is proper to wait for him five or seven days, and if he is not then recovered, and the rest of the crew shall say, "Why are we to bale out the vessel without his assistance," they shall be authorized to enquire for a man for hire, but it must not be one of the

crew that is so hired for wages, because no person can perform the duty of two. If the *Nakhodah* cannot find a substitute, the wages shall remain in his hands, and he shall divide the sick-man's share of the cargo, and property in the vessel, among the rest of the crew.

CHAPTER III.

Of persons who may be in distress, or who have been wrecked at Sea, (Orang Cáram.)

" THESE are the laws relating to persons who may be in distress, or suffer from hunger, in consequence of a scarcity of rice and paddy in their country.

" IF at a time when, in consequence of its having pleased the Almighty to visit the *Rájas* and nobles with dissentions, or owing to a state of war, there shall be great distress in any country from the want of food, the poor and wretched shall say to the rich, " take us as your slaves, but give us to eat," and if afterwards the persons who have relieved them, shall be desirous of selling them, when the country has recovered from its distress, it is the law that they shall give notice thereof to the *Orang Besar* or principal people, and the magistrate shall direct that the parties be not sold, because they were distressed at the time of the agreement. The magistrate shall, however, order that the person who provided the food, shall have a claim on the person who received it, to the extent of one half of the amount of his value.

" If a slave is not provided with food by his master, the magistrate shall direct him to perform service for the person who relieved him, for four seasons; after which he shall be returned to his master.

" If such slave dies, while performing service for the person who relieved him, and the circumstance is made known to the proper officers, he shall not be answerable for his value; but if the slave dies, and the person for whom he performs service does not report it, he shall be answerable to the proprietor of the slave, for half the amount of his value, for such is the loss sustained when a slave dies."

" In conformity to the above, are the laws respecting persons in distress at sea, or who have been wrecked; for

" If the persons who have been wrecked say, " take us and sell us rather than allow us to perish here," and the *Nakhodah* takes them accordingly, he shall only have a claim to their services until the *Práhu* reaches the port; when, if he is desirous of selling them, it shall be his duty to report the same to the *Shahbender*, in order that the magistrate may direct, that the *Nakhodah* be entitled to half the amount of their value. What the persons who were wrecked may have said, shall not be attended to, because they were in distress.

" If persons who have suffered from being wrecked, are met with at the time they are in the water, swimming, without a chance of their reaching the land in safety, and at their request are taken up by the *Nakhodah* of any *Práhu*, the *Nakhodah* shall be entitled to demand on his arrival at port, the sum of one *Pahar* (two dollars,) if the party is not a slave, and if a slave, the half of the amount of his value, but no more.

" If ship-wrecked persons are met under the lee of an island, where-

they have gone on account of high winds, and they shall be in distress, the demand on account of each, if not a slave, shall be five *Mas* (two dollars and a half,) and if a slave, seven *Mas* (three dollars and a half,) each."

Another copy of the *Maláca* code states that the *Nakhodah* shall be entitled to demand as follows, on account of the *Gantung Layer*, or hoisting of the sails.

"For all persons who may have been wrecked, met at sea, and taken up, the *Nakhodah* shall be entitled to demand on account of the *Gantung Layer*, at the rate of a *Tahil* (four dollars) each, and if such persons require to be supplied with victuals, he shall be entitled to make a further demand at the rate of a *Pahar* (two dollars) each.

"The *Nakhodah* is also authorized to make a similar demand for all persons who may have been passengers, in vessels that have been wrecked, if they have not reached their destined port, according to their agreement; and if they shall land previously, the law is that the demand shall (also) be at the rate of half a *Tahil* for each. If otherwise (or they shall have arrived at their destination) a *Pahar* (two dollars) each, which is in full of all that can be demanded."

Of Fishermen.

"It is the law with respect to fishermen *(Orang Penga'il,)* men who fish with lines and hooks, that if they have lost their *Práhu*, and are taken up by fishermen of their own class, the demand shall be at the rate of one *Pahar* (two dollars) for each. And if they still retain their *Práhu*, but have lost their sails and paddles, in such case the demand to be made by those who take them up, shall be two *Mas* (one dollar) each. For such is the law respecting fishermen of this description.

"THE laws respecting (*Orang Menúwás*) fishermen, who fish in fishing weers, are the same when they are wrecked and in distress, as the laws of the sea, but they shall be administered by the *Shahbender* of the port."

Of Troves.

"THESE are the laws respecting any thing that may be found, whatever it may be, whether gold, silver, run-away slaves, or otherwise.

"WHATEVER is found on the sea, whoever may discover it, is the property of the *Nakhodah* of the *Práhu*, who may give what he thinks proper to the persons who found it.

"WHATEVER may be found by persons sent on shore to procure wood or water, in like manner becomes the property of the *Nakhodah*, because such persons act under his authority and are performing the duty of the *Práhu*."

ACCORDING to the *Macasar* copy, "the trove is to be divided into four parts, one of which (only) shall belong to the *Nakhodah*, because there may be many of the finders."

"BUT whatever may be found on shore by persons belonging to the *Práhu*, at the time when they are not acting under the *Nakhodah's* orders, nor performing the duty of the *Práhu*, even if the parties are *Kiwis*, or *Túrún Menug'en*, the trove shall be divided into three parts, and one third shall appertain to the finder, and the remaining two parts become the property of the *Nakhodah*.

"IF a trove is found under such circumstances by the *Nakhodah's* debtors. In that case one half of the trove shall belong to the debtors

and the other to the *Nakhodah.*" By the *Macasar* copy, this is also the case with respect to what may be found by the *Túrún Menug'en.*

" If a *Kiwi* goes on shore in any bay, coast or island, not on account of, or performing the business of the *Nakhodah*, but exclusively for his own concerns, whatever trove he may find, it shall be divided into two parts, and one half shall appertain to the finder, the other to the *Nakhodah.*

" If any of the *Nakhodah's* family find any thing under such circumstances, the trove shall be divided into four parts, one share of which shall belong to the *Nakhodah*, the other three to the finder." The *Macasar* copy states, " that if a *Muda Muda*, related to the *Nakhodah*, meets with persons who have run away, whether it be in a bay, or on a coast, or elsewhere, the *Nakhodah* shall alone be entitled to benefit by it.

" If slaves, belonging to the *Nakhodah*, under any circumstances meet with a trove, it shall become the property of the *Nakhodah*, who may give to the finder what he thinks proper.

" Under whatever circumstances, slaves who have absconded from their masters, may be met and apprehended by the people belonging to a *Práhu*, they shall become the property of the *Nakhodah;* who is, however, bound to restore them to the original proprietor, wherever he may be met, and wherever the slaves may be brought from, on being paid one half of their value. Whatever valuables such slaves may have in their possession, at the time they are apprehended, shall belong to the *Nakhodah.*

" If a *Práhu* is driven from the land without the fishing weers, the persons who meet with it, and bring it to the shore, shall be entitled to demand half its value as a reward. But there are two cases in which such reward shall not be given.

"First—When the rope by which the *Práhu* is secured, is cut by any person, and the *Práhu* is carried out by the current, the proprietor shall not be obliged to give any reward.

"Secondly—When a *Práhu* is stolen by any one, and afterwards set adrift, and is carried to a distance by the current, it is not incumbent on the proprietor to pay any reward to the persons who meet with it, and bring it to the shore.

"The *Práhus* of the *Rája*, or of the *Orang besar besar*, and nobles, shall be exempted. No specific reward shall demanded for them; but the rich men, to whom they belong, shall give to those who find them what they think proper.

"With respect to *Sanpans*, or small boats, it is the law, that

"When a person meets with a *Sanpan* that has been drifted a considerable way, and has goods in it, and the proprietor demands it back, the value shall be divided into three parts, and the person who found the *Sanpan* shall be entitled to a quarter of one of those parts, (this appears to apply to rivers only.)

"If a person finds a *Sanpan* out at sea, with goods in it, the law is, that according to what may be in the *Sanpan*, the finder shall be entitled to one third part, and the owner receive back the remaining two thirds.

Of stealing slaves from another Country.

"If the slave of a *Rája* is stolen, it is the law that the *Nakhodah* shall be put to death. If the slave of an *Orang besar besar*, or of a *Bendahara* is stolen, the *Nakhodah* shall be fined ten *Tahils* one *Pahar* (eighty-two

dollars.) If the slave of a *(Tamen-Ráyet)* common person is stolen by the *Nakhodah*, he shall not only return the slave, but pay a fine in addition, equal to the value of the slave.

If the *Nakhodah* carries off the slave of the *Shahbender*, the law directs that his effects shall be seized, or that he be fined ten *Tahils* one *Pahar* (eighty-two dollars,) except the *Orang besar besar* think proper to pardon him.

If a *Nakhodah* carries off children or young people, or neglects to pay the duties, when he afterwards returns to the port, his effects shall be seized and he shall be fined, because he has no respect and attention for the country. But in this case the *Rája* may pardon him, if he think proper.

CHAPTER IV.

Of Crimes and Punishments, on board a Práhu.

"THERE are four cases, in which it is lawful to inflict capital punishment, on board a *Práhu*.

"First—When any person mutinies against the *Nakhodah*.

"Secondly—When any person conspires and combines with another for the purpose of killing the *Nakhodah*, the law is, that whoever he may be, whither *Kiwi*, or *Tukang*, or *Malim*, he shall suffer death.

"Thirdly—When a man, contrary to custom, wears his *Creese*, when

other persons in the *Práhu* do not, and with the view of effecting some purpose of his own, and of following his own inclination, it shall be lawful on sufficient evidence being adduced, that it is his intention to do mischief with his *Creesé*, to put such person to death without delay, in order to prevent harm."

Under this head, the *Macasar* copy adds, "That when a man is very bad indeed, beyond every other person in the *Práhu*, and evinces his intention of carrying his evil disposition into effect, it is lawful to put such person to death, and nothing more shall be said respecting it.

"Fourthly—In certain cases of adultery.

Of Disrespectful and Contumacious behaviour towards the Nakhodah.
(Orang Tajil dan Jedda, or according to the Macasar copy,
"Orang beadat, jíca, bonca.")

"Whoever is not respectful and obedient to the *Nakhodah*, whatever may be his rank or station, such person shall be adjudged and punished according to the nature of his offence, by the law of *Tajil dan Jedda*, and in the same manner as if such conduct had been shewn towards nobles and *Rájas* on shore. Or, the *Sanawé* may be directed to abuse or insult him, and if he retort, he may be subjected to the abuse and insult of every person on board the vessel. If he ask forgiveness, it may be granted, but let him be punished notwithstanding, in order that he may not do the like another time.

Of Adultery and criminal connection with a woman on board a Práhu.

"If any person on board a *Práhu* has criminal connection with the woman of the *Nakhodah*, it is the law that he be put to death.

" If the parties are not slaves, and the woman is married, it shall be lawful for the *Nakhodah* to order them both to be put to death by the crew.

" If the parties are not slaves and both unmarried, they shall be punished with one hundred stripes each, and afterwards obliged to marry. This punishment may be compounded on the parties paying a fine of one *Tahil* one *Pahar* (ten dollars,) but in either case they must marry, and if necessary, be forced to do so, after which the woman's fault shall be forgotten.

" If a man who is not a slave, has criminal connection with a female slave, who cohabits with her master, he shall pay to the master the value of such slave, provided she has never been pregnant, and has but lately cohabited with her master; but if she has been pregnant, and long cohabited with her master, the man shall be put to death. In either case, the woman shall suffer death.

" If a man who is not a slave, commits adultery with the wife of any of the crew, it shall be lawful for the husband to put him to death without further reference. The husband may also put the woman to death ; if he does not do so, she becomes the slave of the *Nakhodah* ; but if the *Nakhodah* does what is proper, he will order her to be put to death : if he does not, remarks may be made. Should the husband require another wife, the *Nakhodah* shall provide him with one, in order that he may be content and ready in the performance of his duty on board the *Práhu*.

" If a male slave has criminal connection with a female slave, they shall suffer the punishment of beating, which is to be inflicted by the whole crew, under the superintendance of the *Tukang Agung* ; for such is the law in this case with respect to slaves.

"If a man holds improper discourse with the female slave of another person, and it is in the presence of many, he shall be liable to pay her value."

Of quarrels, disputes and dissentions on board a Práhu.

"If any person quarrels with another on board a *Práhu*, and attempts to wound or strike him, and the blow, missing its object, falls on any part of the *Práhu*," or according to the *Macasar* copy, "If any one quarrel with another in a *Práhu*, and in the scuffle cuts or injures any part of the shrouds or cable," he shall be fined in the sum of four *Paker Petis Jawa*.

"If a man quarrels with another in the fore part of the *Práhu*, and draws his *Creese*, and afterwards comes aft, as far as the place where the sails are kept, towards the person he has quarrelled with, it is lawful that he may be put to death. But if he can be apprehended, he shall be fined instead, to the amount of one *Lacsa*, five *Paker Petis Jawa*.

"If a man quarrels with another and follows him quarrelling, to the door of the *Nakhodahs* cabin, though he may not have drawn his *Creese*, it is lawful to put him to death; but if he can be apprehended, he shall be fined instead, to the amount two *Lacsa Paker Petis Jawa*.

"If a *Kiwi* quarrels with the *Nakhodah*, and approaches towards him in the after part of the *Práhu*, he may be put to death; but if he asks forgiveness, it may be granted on his paying a fine of four *Paka Petis Jawa*, and providing a buffalo for the entertainment of the *Nakhodah*," or according to the *Macasar* copy, "five *Paka Petis Jawa*, and a present to the *Nakhodah* of a buffalo and a jar of *Tuak (Toddy.")*

Of Theft.

" If a man who is not a slave, commits a theft on board a *Práhu*, whether the thing stolen be gold, silver, or other valuables, he shall be punished according to the law established on the land.

" If a slave is guilty of a theft, he shall, in the first instance, be confronted with his master, and if it appears that the master knew of the theft, and did not inform the *Nakhodah* or *Tukang* thereof, but it reaches the *Nakhodah* through other information, the law is that the slave's hand shall be cut off, and the master fined as if he himself had been the thief, because the law is the same with respect to the thief and the person who receives the articles that have been stolen."

In concluding the above translation it may be necessary to observe that by " the laws of ports and harbours," which may be considered as part of the maritime law, it is established that if there is reason to believe the *Nakhodah* does not conform to the institutions herein laid down, his conduct may be investigated, on his return to port.

III.

On the early History of Algebra.

By EDWARD STRACHEY, Esq.

If it were as generally known as it is certainly true, that there is a fine field for oriental research in the mathematical sciences, and that it is easy of access, the subject would not be so much neglected as it is at present.

Four years ago I printed at *Calcutta*, some observations on the mathematical sciences of the *Hindùs*. In that tract I proved, that an extensive and accurate knowledge of the Algebra of the *Hindùs* might be had, by means of translations, extant in the *Persian* language, of certain *Sanscrit* books. As the *Persian* language is understood by most of the Company's civil servants in *Bengal*, I conceived that a consideration of the fact might induce persons who were competent to such studies, to direct their attention to them. Of the *Bíja Ganita*, or *Hindù* Algebra of Bha'scara Acha'rya, I have sent home a full account, which I suppose must have been published by this time. In that account (derived en-

tirely from a *Persian* translation) it is proved, that the *Hindùs* had made a wonderful progress in some parts of Algebra; that in the indeterminate analysis they were in possession of a degree of knowledge, which was in *Europe*, first communicated to the world by BACHET and FERMAT, in the seventeenth century, and by EULER and DE LA GRANGE, in the eighteenth. It would be very curious to push these inquiries into the *Hindù* indeterminate analysis, as far as possible. They might, perhaps, shew that the *Indians* had a knowledge of continued fractions, and possibly speculations in physics and the higher geometry, that we know nothing of: for the foundation of the indeterminate analysis of the *Hindùs* is directly explicable on the principle of continued fractions. And there are branches of natural philosophy and mathematics, where equations will arise, which can be solved only by the rules of the indeterminate analysis. In the introduction to the *Bíja Ganita*, where the first principles are given, a method is taught of solving problems of the form $Ax^2+b=\square$. This, simply considered, may be thought only a vain speculation on numbers; but, in the body of the *Bíja Ganita*, the rule is applied to the solution of equations. It is true, that these equations arise from questions purely numeral; yet it appears, nevertheless, that the application of the rule was understood. But whatever may be thought of this argument, it is, at all events, interesting, to ascertain the progress which has been made in the sciences, by different nations, in distant times.

A GOOD comparison of any of the mathematical sciences of the *Greeks*, the *Arabs*, and the *Indians*, would be exceedingly valuable; and every information, which will serve to illustrate the subject, is of importance to the early history of science.

WE know but very little of Algebra, in its infancy and first progress.

It was introduced into *Europe*, from *Arabia*, towards the beginning of the thirteenth century; and the work of DIOPHANTUS became known about three hundred years after. From the difference between his Algebra and that of the *European* writers, there was reason to believe that they were not of the same origin.

SOME learned persons thought that DIOPHANTUS was the inventor; but the more received opinion was, that his writings bore internal evidence of the contrary; and that Algebra must have been known long before his time.

IN 1579, BOMBELLI published a treatise of Algebra, in which he says, that he and a lecturer at *Rome*, whom he names, had translated part of DIOPHANTUS; adding; "that they had found that in the said work the "*Indian* authors are often cited; by which they learned that this science "was known among the *Indians* before the *Arabians* had it." (HUTTON'S *Dictionary*.)

DR. HUTTON has adopted the opinion, that the *Arabians* had their Algebra from the *Greeks*. In his dictionary (article Algebra) we find, "the "*Arabians* say, it was invented amongst them, by MAHOMET* BIN-"MU'S'A or son of MOSES, who it seems flourished about the eighth or "ninth century." It may be observed, by the way, that no *Arabian* writer has been cited in support of this. It does not appear on what foundation the assertion stands; I imagine it is taken from WALLIS. The learned *Muslemàns* in *India*, certainly consider the science as having originated among the *Indians;* and the arithmetic, which in their treatises always precedes Algebra, is undoubtedly *Indian*.

* MUH'AMMED-BIN-MU'S'A-UL-KHA'REZMI, according to D'HERBELOT, flourished under the *Khalifa* MAM'UN, and left a set of astronomical tables, which were highly esteemed, before NAS'RUDDIN TU'SI published his.

DR. HUTTON goes on: "It is more probable, however, that MAHOMET "was not the inventor, but only a person well skilled in the art; and it "is further probable, that the *Arabians* drew their knowledge of it from "DIOPHANTUS or other *Greek* writers; and, according to the testimony "of ABULPHARAGIUS, the arithmetic of DIOPHANTUS was translated into "*Arabic*, by MAHOMET-BIN-YAHYA-BAZIANA." This I suppose is taken from POCOCKE's translation,* but the word which he has explained by "interpretatus est" is فسّر meaning he commented on, rather than he translated. Surely, this is not sufficient to give rise to a probability, that the *Arabians* derived their Algebra from the *Greeks*. The Algebra of the *Arabians* bears no resemblance to that of DIOPHANTUS, the only *Greek* writer on the subject who has ever been heard of. Inquiries have been made, in different parts of *India* and *Persia*, for the supposed translation of DIOPHANTUS; but without success. In the five first propositions of the 13th book of EUCLID, and in the 10th and 11th propositions of ARCHIMEDES' book on spiral lines, and in the 9th proposition of the 2d book of his *Isorropics*, WALLIS thought he saw traces of Algebra; and it is to be presumed, that no farther evidence of its existence, among the ancient *Greeks*, is discoverable; for, except the above, I do not know that any authors have been directly quoted, in proof of the argument; although there has been much assertion, in general terms, that the works of certain writers do contain traces of Algebra. If there were any undoubted marks of it, in the writings of the ancients, they could not have escaped the notice of so learned and so indefatigable a scholar as WALLIS. What he says on this subject, appears to result from a prejudiced conviction of the antiquity of the science, and not from an unbiased search for truth.

* Diophantí librum de Algebra interpretatus est.

If the analysis of the five first propositions of the 13th book of EUCLID were (as is believed) by THEON, they could not well be adduced in proof of the ancient *Greeks* having a knowledge of Algebra; because THEON is supposed to have been nearly contemporary with DIOPHANTUS. He could not have been long before him, if it is true, that his daughter HYPATIA commented on a work of DIOPHANTUS. But, be this as it may, the analysis of the propositions in question is not at all Algebraical. It is the common analysis of the ancient geometers, which is quite different from Algebra; the former being geometrical and the latter arithmetical. WALLIS's reasoning, on the three propositions of ARCHIMEDES, to which he refers, amounts to no more than this. The demonstrations, as they now stand, are difficult; they might have been done by Algebra with ease; therefore, it is probable they were done by Algebra. We know of no *Greek* writer on Algebra, but DIOPHANTUS; neither he, nor any known author, of any age, or of any country, has spoken, directly or indirectly, of any other *Greek* writer on Algebra, in any branch whatever; the *Greek* language has not even a term to designate the science. The instance of DIOPHANTUS's treatise, with some indirect and disputable arguments, drawn, by inference, from works on other subjects than Algebra, is not sufficient. It is unlikely that the ravages of time and the depredations of barbarians should have destoyed all the direct and indisputable proofs. Such causes might account for the deficiency of our information on certain particulars, but will not authorise forced constructions, to argue the existence of a complete science, from its supposed demolition. The general extent of the literature of the *Greeks*, especially in mathematics, is well known; and that they had Algebra, can be established only by clear and positive evidence. For the different arguments which have been used, and the authorities which have been quoted on this question, see

on one side Wallis's Algebra, Chap. 1, 2, 75, &c. with the authors he refers to; and, on the other side, the *French Encyclopedie* Art. *Algebre*, *Application*, *Diophante* by D'Alembert, and *Analyse* by De Castillon. See also Montucla. Though Bhascara Acharya, who is comparatively a modern writer, could not have been one of the authors whom Diophantus is said to have quoted, it is by no means improbable that some *Alexandrian* merchant, trading to *India*, might have learned a little Algebra from the *Bramins*, and instructed some of his countrymen; or Diophantus might have learned from *Indians* at *Alexandria*. If there is doubt of the *Diophantine* Algebra being of *Greek* origin, it is worthy of remark that its author had opportunity of communicating with persons from whom he might have drawn materials for his work, and whom there is evidence of his having actually cited. It is objected that Bombelli is the only person who has taken notice of Diophantus' reference to *Indian* authors, and that no such reference is now to be found in his work. But the authority of Bombelli, on this point, cannot be overset, till it is ascertained that the manuscript of the *Vatican*, which he particularizes, does not contain the citations. One would think that Bombelli's assertion must have had some foundation, that it is not a mere fabrication. Though it does not appear that any *Sanscrit* works on this science, of greater antiquity than the *Bija Ganita*, have yet been discovered, we are not to conclude, therefore, that there are none; for the author of the *Bija Ganita* expressly says, his work is extracted from three copious treatises. These books have not been found; we know nothing of their contents nor their dates. The following was the result of a general comparison of the *Bija Ganita* with Diophantus.* "The

* From "observations," &c. above referred to.

" *Bíja Ganita* will be found to differ much from DIOPHANTUS' work. " It contains a great deal of knowledge which the *Greeks* had not; such " as the use of an indefinite number of unknown quantities, and the use " of arbitrary marks to express them; a good arithmetic of surds; a " perfect theory of indeterminate problems of the first degree; a very " extensive and general knowledge of those of the second degree; a " knowledge of quadratic equations, &c. The arrangement and man- " ner of the two works will be found as essentially different as their " substance. The one constitutes a body of science, which the other " does not. The *Bíja Ganita* is well digested and well connected, and " is full of general rules which suppose great learning: the rules are " illustrated by examples, and the solutions are performed with skill. " DIOPHANTUS, though not entirely without method, gives very few ge- " neral propositions, and is chiefly remarkable for the ability with which " he makes assumptions in view to the solution of his questions. The " former teaches Algebra as a science, by treating it systematically; the " latter sharpens the wit by solving a variety of abstruse and complicated " problems, in an ingenious manner. The author of the *Bíja Ganita* " goes deeper into his subject, and treats it more methodically, though " not more acutely, than DIOPHANTUS. The former has every charac- " teristic of an assiduous and learned compiler; the latter of a man of " genius in the infancy of science."

THE *Greek* Algebra may be seen in DIOPHANTUS, who is the only *Greek* writer on the subject who has ever been heard of.

THE *Indian* Algebra may be seen in the *Bíja Ganita*, and the *Lílavati* (by the author of the *Bíja Ganita*,) and as the *Persian* translations of these works contain a degree of knowledge, which did not exist in any of

the ordinary sources of science, extant in the time of the translators, they may be safely taken as *Indian*, and of ancient origin. To give some idea of the Algebra of the *Arabians*, whereby we may be enabled to judge, whether, on the one hand, it could have been derived from DIOPHANTUS; or, on the other, that of the *Hindùs* could have been taken from them, the work entitled *Khulásat-ul-Hisàb*, may be taken as a specimen; especially because, as will be more particularly stated in another place, there is a part of this book which marks the limits of Algebraical knowledge, in the time of the writer.

WE have seen, that the first *European* Algebraists learnt of the *Arabians*, but no account has been given of the nature, the extent, and the origin of *Arabian* Algebra. No distinct abstract or translation of any *Arabic* book, on the subject, has appeared in print; nor has it been established beyond controversy, who taught the *Arabians*. The *Khulásat-ul-Hisàb* is of considerable repute in *India*; it is thought to be the best treatise on Algebra, and it is almost the only book on the subject, read here. I selected it, because I understood, that as well as the shortest, it was the best treatise that could be procured. Besides general report, I was guided by the authority of MAULAVI ROSHEN ALÌ, an acknowledged good judge of such matters, who assured me that among the learned *Muslemàns* it was considered as a most complete work; and that he knew of no *Arabian* Algebra beyond what it contained. In the *Suláfat-ul-Ásr*, a book of biography, by NIZ'AM-UL-DÍN-AH'MED, there is this account of BAH'A-UL-DÍN, the author of the *Khulásat-ul-Hisàb*. "He was "born at *Bâlbec*, in the month *D'hi'lhaj*, 953 *Hijrì*, and died at *Isfahàn* "in *Shawàl*, 1031." Mention is made of many writings of BAHA-UL-DÍN on religion, law, grammar, &c. a treatise on astronomy, and one on the

astrolabe. In this list of his works, no notice is taken of his great treatise on Algebra, the *Behr-ul-Hisàb*, which is alluded to in the *Khulásat-ul-Hisàb*. Maulavi Roshen Alì tells me the commentators say, it is not extant. There is no reason to believe that the *Arabians* ever knew more than appears in Baha-ul-dìn's book, for their learning was at its height long before his time.

From what has been stated it will appear, that from the *Khulásat-ul-Hisàb*, an adequate conception may be formed of the nature and extent of the Algebraical knowledge of the *Arabians;* and hence I am induced to hope that a short analysis of its contents will not be unacceptable to the society. I deem it necessary here to state, that possessing nothing more than the knowledge of a few words in *Arabic*, I made the translation, from which the following summary is abstracted, from the *vivâ voce* interpretation into *Persian* of Maulavi Roshen Alì, who perfectly understood the subject and both languages, and afterwards collated it with a *Persian* translation, which was made about sixty years after Bah'a-ul-dìn's death, and which Roshen Alì allowed to be perfectly correct.

The work, as stated by the author in his preface, consists of an introduction, ten books and a conclusion.

The introduction contains definitions of arithmetic, of number, which is its object and of various classes of numbers. The author distinctly ascribes to the *Indian* sages the invention of the nine figures, to express the numbers from one to nine.

Book 1, comprises the arithmetic of integers. The rules enumerated under this head are *Addition*, *Duplation*, *Subtraction*, *Halving*, *Multiplication*, *Division*, and the *Extraction of the Square Root*. The method of

proving the operation by throwing out the nines is described under each of these rules. The author gives the following remarkable definitions of multiplication and division, viz. "Multiplication is finding a number "such that the ratio which one of the factors bears to it shall be the "same as that which unity bears to the other factor," and "division is "finding a number which has the same ratio to unity as the dividend has "to the divisor."

For the multiplication of even tens, hundreds, &c. into one another, the author delivers the following rule, which is remarkable in this respect, that it exhibits an application of something resembling the indexes of logarithms.

"Take the numbers as if they were units, and multiply them together "and write down the product. Then add the numbers of the ranks to-"gether, (the place of units being one, that of tens, two, &c.) substract "one from the sum and call the remainder the number of the rank of "the product. For example, in multiplying 30 into 40, reckon 12 of the "rank of hundreds; for the sum of the numbers of their ranks is 4, and "three is the number of the rank of hundreds, multiplying 40 into 500, "reckon 20 of the rank of thousands, for the sum of the numbers of the "ranks is 5."

The following contrivances have sufficient singularity to merit particular mention.

I. To multiply numbers between 5 and 10. Call one of the factors tens, and from the result, subtract the product of that factor by the difference of the other factor from ten. For example, to multiply 8 into 9. Subtract from 90 the product of 9 by 2, there remains 72. Or add the

factors together, and call the excess above 10, tens. Multiply together the two differences of the factors from 10, and add the product to the former number. For example, to multiply 8 by 7, add to 50 the product of 2 into 3.

II. To multiply units into numbers between units and 20; add the two factors together, call the difference of the sum from 10, tens. From this result, subtract the product of the difference of the simple number from 10 and of the compound number from 10. For example, to multiply 8 by 14. Subtract from 120, the product of 2 into 4.

III. To multiply together numbers between 10 and 20; add the units of one factor to the other factor and call the sum tens: add to this the product of the units into the units. For example to multiply 12 into 13, add 6 to 150.

IV. To multiply numbers between 10 and 20 into compound numbers between 20 and 100; multiply the units of the smaller by the tens of the greater, add the product to the greater number and call the sum tens. Add to it the product of the units in both numbers. For example, to multiply 12 into 26, add 4 to 26 and call 30, tens. Finish the operation, it is 312.

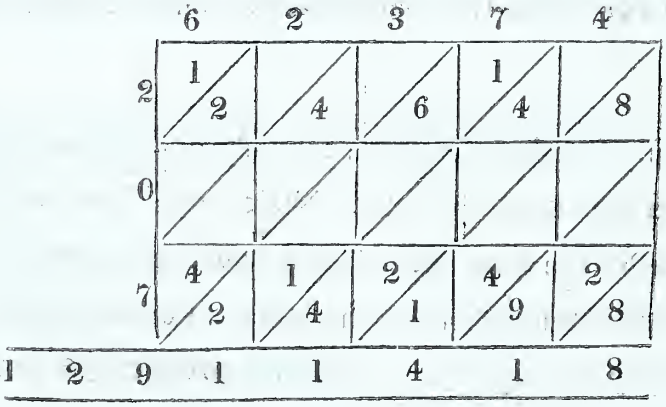
V. To multiply numbers between 20 and 100, where the digits in the place of tens are the same; add the units of one factor to the other and multiply the sum by the tens, call the product tens, and add to it the product of the units multiplied by the units. For example, to multiply 23 by 25, multiply 28 by two. Call the product 56 tens, finish the operation; 575 is obtained.

VI. To multiply numbers between 10 and 100, when the digits in the place of tens are different. Multiply the tens of the smaller number into the larger number; add to the result, the product of the units of the smaller number into the tens of the greater; call the sum tens; add to this the product of the units into the units. For example, to multiply 23 into 34, add 9 to 68, add 12 to 770.

VII. To multiply two unequal numbers, half the sum of which is simple *(Mufrid,)* take the sum of the two and multiply half of it into itself. From this product, subtract the square of half the difference of the two numbers. For example, to multiply 24 by 36. From 900 subtract the square of half the difference of the numbers, that is 36. There remains 864.

For multiplying numbers consisting each of several places of figures, the method described by this author, under the name of *Shabacah* or net work, and illustrated by the following example, may have suggested the idea of Napier's bones.

Multiply 62374 *by* 207.



On the other rules, nothing is delivered differing so much from those contained in our common books of arithmetic, as to require specific mention.

Book second, contains the arithmetic of fractions; and book third, the rule of three, or to find an unknown number by four proportionals. Book fourth, delivers the rule of position, or to find an unknown number by assuming one once or twice, and comparing the errors. Book fifth, gives the method of finding an unknown number, by reversing all the steps of the process described in the question.

The sixth book, treats of mensuration. The introduction contains geometrical definitions. Chapter I. treats of the mensuration of rectilinear surfaces. Under this head the two following articles are deserving of notice. I. To find the point in the base of a triangle where it will be cut by a perpendicular, let fall from the opposite angle. Call the greatest side the base; multiply the sum of the two lesser sides by their difference; divide the product by the base, and subtract the quotient from the base; one half the remainder will shew the place on the base, where the perpendicular falls towards the least side.*

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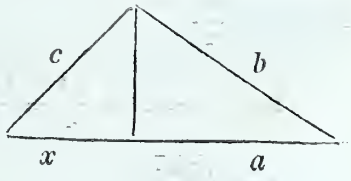
* Let a be the base, or longest side, b the middle, c the smallest, and x the distance of the perpendicular from the least side. Then



$$b^2 = a^2 + c^2 - 2ax \text{ (Eucl. 13. 2.)}$$

$$2ax = a^2 + c^2 - b^2$$

$$x = \frac{a}{2} - \frac{b^2 - c^2}{2a}$$

But $b^2 - c^2 = \overline{b + c} \times \overline{b - c}$

2. To find the area of an equilateral triangle. Multiply the square of a quarter of the square of one of the sides by three: the square root of the product is the area required.*

CHAPTER second, treats of the mensuration of curvilinear surfaces. For the circle the rule delivered in many common books of mensuration is given: viz. multiply the square of the diameter by 11, and divide the product by 14.†

CHAPTER third, on the mensuration of solids, contains nothing of singularity sufficient to merit particular notice. This chapter concludes with the following sentence. "The demonstrations of all these rules are "contained in my greater work, entitled *Bahr-ul-Hisàb* (the ocean of "calculation,) may GOD grant me grace to finish it."

BOOK seventh, treats of practical geometry. Chapter first on levelling,

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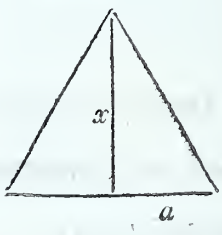
Therefore $x = \frac{a}{2} - \frac{\overline{b+c} \times \overline{b-c}}{2a}$

See the geometrical demonstration in the elements of plane trigonometry, annexed to SIMSON's *Euclid*, prop. 7.

* Let a side of the triangle be a and the perpendicular x.



The area is $\frac{ax}{2}$

But $x^2 = a^2 - \frac{a^2}{4} = \frac{3a^2}{4}$

$x = \sqrt{\frac{3a^2}{4}}$

$\frac{ax}{2} = \frac{a}{2}\sqrt{\frac{3a^2}{4}} = \sqrt{\frac{3a^4}{16}}$

† This is founded on the rough proportion of the diameter, to the circumference as 7 : 22. BHA'SCARA, in the *Lilavati*, assigns 1250 : 3927, which is 1 : 3.1416 and differs only 0.000007 from the most accurate computation hitherto made.

for the purpose of making canals. In this are described the plummet level, and the water level on the same principle with our spirit level.

Chapter second, on the mensuration of heights, accessible and inaccessible. Under the former of these heads are delivered the common methods, by bringing the top of a pole whose height is known, in a line between the eye and the top of the height required; by viewing the image of the top in a horizontal mirror; by taking the proportion between a stick of known length, set up perpendicular to the horizon and its shadow; and by taking the length of the shadow of the height when the sun's altitude is 45 degrees. The last method is this, "Place the index of the astro-"labe at the mark of 45 degrees, and stand at a place from whence the "height of the object is visible through the sights, and measure from the "place where you stand to the place where a stone would fall from the "top; add your own height, and the sum is the quantity required."

For the mensuration of inaccessible heights the following rule is delivered, "Observe the top of the object through the sights, and mark on "what shadow line (division) the lower end of the index falls. Then "move the index a step forward or backward, and advance or recede "till you see the top of the object again. Measure the distance between "your stations, and multiply by 7 if the index is moved a *Dhil-Kadam*, "and by 12 if it is moved a *Dhil-As'bâ*,* according to the shadow lines "on the Astrolabe. This is the quantity required.

* This part of the astrolabe consists of two squares put together laterally; the index of the instrument being at the point of the adjacent angles above. One square has seven, and the other, twelve divisions: the former called *Dhil-i-Kadam*, the latter *Dhil-i-As'bâ*. The squares are graduated on the outer sides from the top, and at the bottom from the point of the adjacent angles. The divisions on the upright sides are those lines which Chaucer, in his treatise on the astrolabe, calls *Umbra-recta*; those on the horizontal he calls *Umbra-versa*.

Chapter third. On measuring the breadth of rivers and the depth of wells. 1st. Stand on the bank of the river, and through the two sights look at the opposite bank ; then turn round and look at any thing on the land side, keeping the astrolabe even. The distance from the observer to the object is the same as the breadth of the river. 2d. Place something

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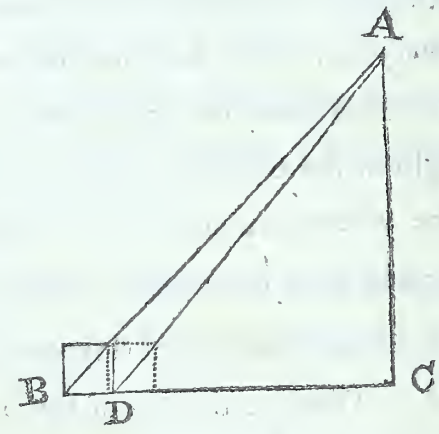
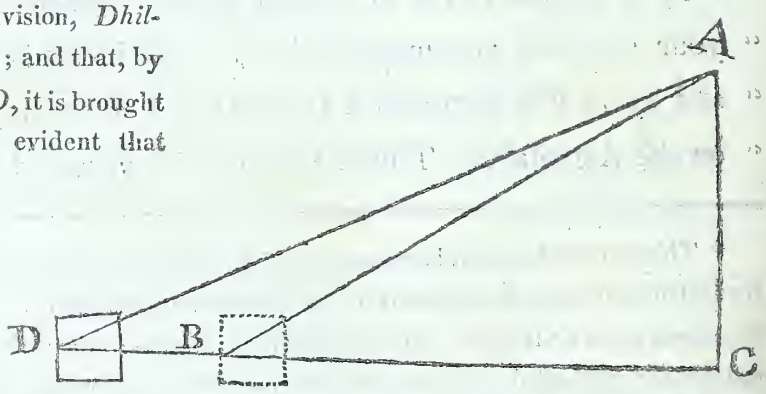
Chaucer's astrolabe had only one square, *Dhil-i-Asbá*, being divided into twelve parts. The *Umbra-recta* is called *Dhil-Mustawi*, and the *versa*, *Dhil-Mácùs*.

The rule in the text is very inaccurately delivered; for the only case in which it will apply is when at the first station the index coincides with the diagonal of the square, and being afterwards moved one division on the horizontal side, the observer advances towards the object, till the top is again seen through the sights. For let $A\,C$ be the height required, B the first station, D the second. As the angles at A and B are equal, $A\,C = B\,C$. But at the second position $A\,C : D\,C :: 7 : 6$. Therefore $A\,C = 7\,B\,D$.



But suppose at the first station B, the index falls on the fourth division, *Dhil-Kadam*, on the vertical side; and that, by retiring from the object to D, it is brought on the third; then it is evident that $B\,C : A\,C :: 7 : 4$, and $D\,C : A\,C :: 7 : 3$. Therefore $D\,C = \frac{4\,B\,C}{3} = 4\,B\,D$. Consequently $7 : 3 :: 4\,B\,D : A\,C = \frac{12\,B\,D}{7}$.



over the well which shall serve for its diameter ; from the center of this diameter drop something heavy and shining till it reach the bottom, and make a mark at the center ; then look at the heavy body through the two sights of the astrolabe, so that the line of vision may cut the diameter. Multiply the distance from the mark on the diameter to the place where the line of vision cuts it, by your own height, and divide the product by the distance from the place where the line is cut to the place where you stand. The quotient is the depth of the well.*

Book eighth. "On finding unknown quantities by Algebra. In this book are two chapters.

"Chapter first. Introductory. Call the unknown quantity *Shai* (thing,) its product into itself *Mál* (possession,) the product of *Mál* into *Shai*, *Cáb* (a die or cube,) of *Shai* into *Cáb*, *Mal-Mál* ; of *Shai* into *Mal-i-Mal*, *Mal-Cáb* ; *Shai* into *Mál-i-Cáb*, *Cáb-i-Cáb* ; and so on, without end. For one *Cáb* write two *Mál*, and from these two *Máls* one becomes *Cáb* ; afterwards both *Máls* become *Cáb*. Thus the seventh power is

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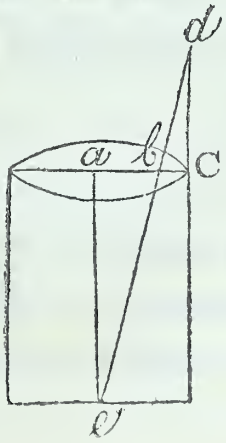
* The impossibility of attaining accuracy in either of these operations is abundantly obvious. The first depends on the principle, that on a level plain, two places, which with a given height of the observer's eye have the same dip below the horizon must be at equal distances. The second is thus : let the body drop from a to e ; and let the observer at $c\,d$ observe it in the line $d\,e$ which cuts $a\,c$ in b. Then $b\,c : c\,d :: a\,b : a\,c = \frac{a\,b \times c\,d}{b\,c}$



Mál-i-Mál-i-Câb, and the eighth *Mál-i-Câb-i-Câb*, in the ninth *Câb-i-Câb-Câb*, and so on. All these powers are in proportion, either ascending or descending. Thus the ratio of *Mál-i-Mál* to *Câb* is like the ratio of *Câb* to *Mál*, *Mál* to *Shai*, and *Shai* to one, and one to one divided by *Shai;* and one divided by *Shai* to one divided by *Mál;* and one divided by *Mál* to one divided by *Câb;* and one divided by *Câb* to one divided by *Mál-i-Mál.* To multiply one of these powers by another, if they are both on the same side, (viz. of unity) add the exponents of their powers together; the product will have the same denomination as this sum. For example, to multiply *Mál-i-Câb* by *Mál-i-Mál-i-Câb*, the first is the 5th power and the 2d the 7th. The result then is *Câb-i-Câb-i-Câb-i-Câb* or four *Câbs*, which is the 12th power. If the factors are on different sides, the product will be the excess on the side of the greater. The product of one divided by *Mál-i-Mál* into *Mál-i-Câb* is *Shai;* and the product of one divided by *Câb-i-Câb-Câb* into *Câb-i-Mál-i-Mál*, is one divided by *Mál:* and if the factors are at the same distance (from one,) the product is one. The particulars of the methods of division, and extraction of roots and other rules, I have given in my greater book. The rules of Algebra which have been discovered by learned men are six, and they relate to number and *Shai* and *Mál.* The following table will shew the products and quotients of these, which are here given for the sake of brevity.

		Multiplier.						
		$\frac{1}{a^2}$	$\frac{1}{a}$	1	a	a^2		
Dividend.	a^2	1	a	a^2	a^3	a^4	a^2	Multiplicand.
	a	$\frac{1}{a}$	1	a	a^2	a^3	a	
	1	$\frac{1}{a^2}$	$\frac{1}{a}$	1	a	a^2	1	
	$\frac{1}{a}$	$\frac{1}{a^3}$	$\frac{1}{a^2}$	$\frac{1}{a}$	1	a	$\frac{1}{a}$	
	$\frac{1}{a^2}$	$\frac{1}{a^4}$	$\frac{1}{a^3}$	$\frac{1}{a^2}$	$\frac{1}{a}$	1	$\frac{1}{a^2}$	
		a^2	a	1	$\frac{1}{a}$	$\frac{1}{a^2}$		
		Divisor.						

"The use of the table is this: multiply the co-efficient of one of the two quantities by that of the other; the result is the co-efficient of the product, which is of the denomination contained in the square where the lines from the two factors meet. If on either side there be a substractive (negative) quantity, call the minuend *plus* or affirmative, and the subtrahend *minus* negative. The product of *plus* into *plus* and *minus* into *minus* are both *plus*, and the product of different kinds are *minus*. Multiply the quantities together, and subtract the negative from the affirmative. For example, the product of 10 and one *Shai* into 10 all but one *Shai*, is 100 all but *Mál*. The product of 5 all but *Shai*, by 7 all but *Shai* is 35 and one *Mál* all but 12 *Shai*. Another example. The product of 4 *Mál* and 6 all but 2 *Shai*, into 3 *Shai* all but 5, is 12 *Câb*, and 28 *Shai* all but 26 *Mál* and 30. In division, find a number which multiplied by the divisor will produce the dividend. Divide the co-efficient of the dividend by that of the divisor, the quotient is the co-efficient of the quantity which is opposite to the dividend and divisor.

"CHAPTER second. On the six rules of Algebra. To find unknown quantities by Algebra depends on acuteness and sagacity; an attentive consideration of the terms of the question, and a successful application of the invention to such things as may serve to bring out what is required. Call the unknown quantity *Shai*, and proceed with it according to the terms of the question, as has been said, till the operation ends with an equation. Let that side where there are negative quantities be made perfect, and let the negative quantity be added to the other side: this is called restoration *(Jebr.)* Let those things which are of the same kind, and equal on both sides, be thrown away: this is opposition *(Mukábalah.)* Equality is either of one species to another, which is of three kinds, called *(Mufridát)* simple; or of one species to two species, which of three kinds, called *(Muktarinát)* compound.

"CASE the first. *Mufridát.* Number is equal to things. Divide the number by the co-efficient of the things, and the unknown quantity will be found. For example; a person admitted that he owed ZAID 1000 and one half of what he owed AMER; and that he owed AMER 1000 all but one half of what he owed to ZAID. Call ZAID's debt *Shai*. Then AMER's debt is 1000, all but half of *Shai*. Then ZAID's is 1500 all but a fourth of *Shai*. This is equal to *Shai*. After *Jebr*, 1500 is equal to one *Shai* and a quarter of *Shai*. So for ZAID is 1200 and for AMER 400."

"CASE the second. Multiples of *Shai* equal to multiples of *Mál*. Divide the co-efficient of the things by that of the *Mál;* the quotient is the unknown quantity. Example. Some sons plundered their father's inheritance, which consisted of *Dínars*. One took 1, another 2, the third 3, and so on increasing by one. The ruling power took back what they had plundered, and divided it among them in equal shares. Then each

received 7. How many sons were there, and how many *Dínàrs?* Suppose the number of sons *Shai*, and take the sum of the extremes, that is to say, 1 and *Shai*. Multiply them by half of *Shai*. This is the number of *Dinàrs*. For the product of the sum of any series of numbers in arithmetical progression, is equal to the product of the sum of the two extremes, into half the number of terms. Divide the number of the *Dinàrs* by *Shai*, which is the number of the sons; the quotient, according to the terms of the question, will be seven. Multiply 7 by *Shai*, which is the divisor; 7 *Shai* is the product, which is equal to $\frac{1}{2}$ *Mál* and $\frac{1}{2}$ *Shai*. After *Jebr* and *Mukabálah*, one *Mál* is equal to 13 *Shai*. *Shai* then is 13; and this is the number of the sons. Multiply this by 7. The number of *Dinàrs* will be found 91.

"Questions of this sort may be solved by position. Thus, suppose the number of sons to be 5; the first error is 4 in defect. Then suppose it to be 9, the second error is 2 in defect. The first *Mahfùdh* is 10 and the second is 36; their difference is 26; the difference of the errors is 2. Another method, which is easy and short, is this. Double the quotient, (the number 7 in the question) subtract one, and the result is the number of sons.

"Case the third. Number equal to *Mál*. Divide the number by the co-efficient of the *Mál*; the root of the quotient is the unknown quantity. For example. A person admitted that he owed Zaid the greater of two sums of money, the sum of which was 20 and the product 96. Suppose one of them to be 10 and *Shai*, and the other 10 all but *Shai*. The product, which is 100 all but *Mál*, is equal to 96; and after *Jebr* and *Mukábaláh*, one *Mál* is equal to 4, and *Shai* equal to 2. One of the sums then is 8 and the other 12, and 12 is the debt of Zaid.

"First case of *Muktarinàt*. Number equal to *Mál* and *Shai*. Complete the *Mál* to unity if it is deficient, and reduce it to the same if it exceeds, and reduce the numbers and *Shai* in the same ratio, by dividing all by the co-efficient of the *Mál*. Then square one half the co-efficient of the *Shai*, and add this square to the numbers. Subtract from the root of the sum half the co-efficient of the *Shai*, and the unknown will remain. Example. A person admitted that he owed Zaid a sum less than 10, so much that if the square of it was added to its product by $\frac{1}{2}$ what it wants of 10, the sum would be 12. Suppose the number *Shai*, its square is *Mál*; half the remainder from 10 is 5 all but half of *Shai*. The product of *Shai* by this is 5 *Shai* all but $\frac{1}{2}$ of *Mál*. Therefore $\frac{1}{2}$ of *Mál* and 5 *Shai* are equal to 12. One *Mál* and 10 *Shai* are equal to 24. Subtract half the co-efficient of the *Shai* from the root of the sum of the square of $\frac{1}{2}$ the co-efficient of the *Shai* and the numbers. There remains 2, which is the number required.

Second case. *Shai* equal to numbers and *Mál*. After completing or rejecting, subtract the numbers from the square of half the co-efficient of the *Shai*, and add the root of the remainder to half the co-efficient of the *Shai*; or subtract the former from the latter; the result is the unknown quantity. Example. What number is that which being multiplied by half of itself and the product increased by 12, the result is five times the original number. Multiply *Shai* by half itself, then half of *Mál* added to 12 is equal to 5 *Shai*. One *Mál* and 24 is equal to 10 *Shai*. Subtract 24 from the square of 5, there remains one, and the root of one is one. The sum or difference of 1 and 5 is the number required.

Third Case. *Mál* equal to number and *Shai*. After completion or rejection, add the square of half the co-efficient of the *Shai* to the numbers,

and add the root of the sum to half the co-efficient of the *Shai*. This is the unknown quantity. For example. What number is that which being subtracted from its square, and the remainder added to the square, is 10? Subtract *Shai* from *Mál* and go on with the operation, 2 *Mál* all but *Shai* is equal to 10; and after *Jebr* and *Radd*, *Mál* is equal to 5 and $\frac{1}{2}$ of *Shai*. The square of half the coefficient of the *Shai* and 5, is 5 and half an eighth, and its root is $2\frac{1}{4}$. To this add $\frac{1}{4}$, the result is $2\frac{1}{2}$, which is the number required.

Book ninth, contains twelve rules regarding the properties of numbers, viz.

1st. To find the sum of the products of a number multiplied into itself and into all numbers below it: add one to the number, and multiply the sum by the square of the number; half the product is the number required.

2d. To add the odd numbers in their regular order: add one to the last number and take the square of half the sum.

3d. To add even numbers from two upwards: multiply half the last even number by a number greater by one than that half.

4th. To add the squares of the numbers in order: add one to twice the last number, and multiply a third of the sum by the sum of the numbers.

5th. To find the sum of the cubes in succession: take the square of the sum of the numbers.

6th. To find the product of the roots of two numbers: multiply one by the other, and the root of the product is the answer.

7th. To divide the root of one number by that of another: divide one by the other, the root of the quotient is the answer.

8th. To find a perfect number: that is a number which is equal to the sum of its aliquot parts, (EUCLID, book 7, def. 22.) The rule is that delivered by EUCLID, book 9, prop. 36.

9th. To find a square in a given ratio to its root: divide the first number of the ratio by the second; the square of the quotient is the square required.

10th. IF any number is multiplied and divided by another, the product multiplied by the quotient is the square of the first number.

11th. THE difference of two squares is equal to the product of the sum and difference of the roots.

12th. IF two numbers are divided by each other, and the quotients multiplied together, the result is always one.

BOOK tenth, contains nine examples, all of which are capable of solution by simple equations, position, or retracing the steps of the operation, and some of them by simple proportion; so that it is needless to specify them.

THE conclusion, which marks the limits of algebraical knowledge in the age of the writer, I shall give entire, in the author's words. "Conclusion. There are many questions in this science which learned men have to this time in vain attempted to solve; and they have stated some of these questions in their writings, to prove that this science contains difficulties, to silence those who pretend they find nothing in it above their ability, to warn arithmeticians against undertaking to answer every ques-

tion that may be proposed, and to excite men of genius to attempt their solution. Of these I have selected seven. 1st. To divide 10 into 2 parts, such, that when each part is added to its square root and the sums are multiplied together, the product is equal to a supposed number. 2d. What square number is that which being increased or diminished by 10, the sum and remainder are both square numbers? 3d. A person said he owed ZAID 10 all but the square root of what he owed ÂMER, and that he owed ÂMER 5 all but the square root of what he owed ZAID. 4th. To divide a cube number into two cube numbers. 5th. To divide 10 into two parts, such, that if each is divided by the other, and the two quotients are added together, the sum is equal to one of the parts. 6th. There are three square numbers in continued geometrical proportion, such, that the sum of the three is a square number. 7th. There is a square, such, that when it is increased and diminished by its root and 2, the sum and the difference are squares. Know, reader, that in this treatise I have collected in a small space the most beautiful and best rules of this science, more than were ever collected before in one book. Do not underrate the value of this bride; hide her from the view of those who are unworthy of her, and let her go to the house of him only who aspires to wed her."

IT is seen above that these questions are distinctly said to be beyond the skill of algebraists. They either involve equations of the higher order, or the indeterminate analysis, or are impossible.

IT does not appear that the *Arabians* used algebraic notation or abbreviating symbols; that they had any knowledge of the Diophantine Algebra, or of any but the easiest and elementary parts of the science. We have seen that BAHA'-UL-DÌN ascribes the invention of the numeral figures in the decimal scale to the *Indians*. As the proof commonly given

of the *Indains* being the inventors of these figures is only an extract from the preface of a book of *Arabic* poems, it may be as well to mention that all the *Arabic* and *Persian* books of arithmetic ascribe the invention to the *Indians*. The following is an extract from a *Persian* treatise of arithmetic in my possession.

" The *Indain* sages, wishing to express numbers conveniently, invent-
" ed these nine figures ۱ ۲ ۳ ۴ ۵ ۶ ۷ ۸ ۹. The first figure on the right hand
" they made stand for units, the second for tens, the third for hundreds,
" the fourth for thousands. Thus, after the third rank, the next follow-
" ing is units of thousands, the second tens of thousands, the third hun-
" dreds of thousands, and so on. Every figure therefore in the first rank
" is the number of units it expresses ; every figure in the second the num-
" ber of tens which the figure expresses, in the third the number of hun-
" dreds, and so on. When in any rank a figure is wanting, write a cipher
" like a small circle o to preserve the rank. Thus ten is written 10, a
" hundred 100 ; five thousand and twenty-five 5025."

Of the *Indian* Algebra in its full extent the *Arabians* seem to have been ignorant ; but it is likely they had their Algebra from the same source as their Arithmetic. The *Arabian* and *Persian* treatises on Algebra, like the old *European* ones, begin with the Arithmetic, called in those treatises the Arithmetic of the *Indians*, and have a second part on Algebra ; but no notice is taken of the origin of the latter. Most likely their Algebra, being numeral, was considered by the authors as part of Arithmetic.

Though part only of the *Khulásat-ul-Hísàb* is about Algebra, the rest, relating to arithmetic and mensuration, must be thought not wholly unconnected with the subject. It is to be hoped that ere long we shall

have either translations from the *Sanscrit* of the *Bíja Ganita* and *Lílawati*, or perfect accounts from the originals; and that other ancient *Hindú* books of Algebra will be found, and made known to the world. But as there is no immediate prospect of these desiderata being realized, the translations into *Persian* will be found well deserving of attention. Only let them be examined without prejudice.

THERE are principles which will safely lead to a distinction of what is interpolated from what is original; and it is the neglect of these principles, and not any fair examination of the translations, that may lead to error.

IV.

An account of the funeral ceremonies of a Burman Priest.

Communicated
By Wm. CAREY, D. D.

THE manner in which different nations dispose of their dead is one of those circumstances, which have been thought worthy of peculiar notice, by all who have studied the history of man, as it is in most instances connected with the idea which they entertain respecting a future state.

Those nations who believe in the doctrine of the resurrection, practise inhumation. The *Hindoos* and other nations who believe the doctrine of the metempschycosis, and consider fire as the element which purifies all things, usually burn their dead, with a variety of ceremonies suited to those religious notions which are peculiar to the different sects. The inhabitants of *Thibet*, differing from most other nations, either totally

neglect the bodies of their dead, or treat them in a manner which to us appears highly barbarous.

The *Burmans* burn their dead like the *Hindoos*, though with a great difference in the method and the attendant ceremonies. With them, the wood of the coffin (which is made larger and stronger than with us) is nearly all the fuel used to consume the bodies of the common people. The priests, or *Poongees*, are like them burnt by the wood of their own coffins, but the fire is communicated by means of rockets. As this is a very singular practice, and has not been noticed by any writer which I have met with, I take the liberty to communicate to the *Asiatick* society, the following account of the funeral ceremonies of a *Poongee* or *Burman* priest, as communicated by my son, Mr. Felix Carey, who resides at *Rangoon*, and was an eye-witness thereto.

"The man whose funeral ceremonies I am going to describe, died about two years ago. After the death of a *Poongee*, the body is embalmed in the following manner. First, the intestines are taken out, after which the body is filled with spices of different kinds, and the opening sewed up. A layer of wax is then laid all over the body, so as to prevent the admission of air; upon that is put a layer composed of *lac* and some other ingredients, and the whole covered over with leaf-gold. The body of this person was stretched out at full length, with the arms laid over the breast. When one of these people dies, the body is thus prepared at the house where he died. After about a twelve months, the corpse is removed to a house built for that purpose, where it is kept a year or two longer, till the *Poongees* order it to be burnt. At one of these places I saw the body of this man, about a month before it was taken out for the purpose of being destroyed. It was then placed upon a stage, which

was in a house made like one of their *Kuims*,* rising in a conical form, and about thirty feet in height. The stage was made of bamboos and wood, and the house which contained it was covered with paper, and over-laid with leaf-gold. By the side of this stage lay the coffin in which the body was to be carried out; this, also, was over-laid with gold, and ornamented with several figures, designed to represent death in a variety of forms. In the court yard two large four-wheeled carriages were preparing, one to carry the coffin, and the other the stage with its apparatus. The carriage in which the corpse was to be drawn, had another stage built upon it, similar to the one in the house, only it was larger, and fixed upon an elephant, made in a kneeling posture.

When the time for the ceremony approached, the principal people of every street were commanded, each to prepare a rocket, and an image, (the shape of some animal,) to which the rocket was to be fixed. Besides these large rockets, a great number of smaller ones was also prepared, as well as other fire-works. The *Burman* new year began either on the 13th or 14th of April, I do not exactly remember which, when the festival celebrated by sprinkling of water commenced, which would have continued six or seven days, had not the viceroy put a stop to it to admit of the burning of this *Telapoy*. On the 17th, the figures to which the rockets were to be fastened, were drawn in procession round the town; and from this day to the end of the ceremony, all the people of the town and its vicinity, both male and female, were compelled to assist. The

* This is the name of the buildings occupied by the *Burman* priests, who live in societies subject to the chief of the *Kuim*, who is distinguished by his age, or learning. The *Kuims* are a sort of colleges, where instruction is given to any one who wishes for it; but the members are subject to a discipline not very different from that of a monastery.

figures were drawn in procession, one after another, in the following order; first, six or eight flags were carried, these were followed by a number of dancing boys and girls, then the carriages with the figures, some drawn by boys, and others by bullocks, followed; and after them went a number of young women, dancing and singing, with an older woman between each row, to keep them in order. Women were never known to attend such processions before, but this was done in consequence of a particular order from the viceroy. On this occasion even the wives and daughters of the principal officers of government were obliged to dance, some with umbrellas held over them, and others under an awning large enough to shade forty or fifty persons, and supported by six or eight men; last of all followed the men in like manner, singing, clapping their hands, and dancing, with two men between each row to keep them in order.

The people of each street attended their own carriages, and in this manner proceeded round the town, one company after another. The figures were very large, much larger than the animals they were intended to represent. Some of them were representations of buffaloes, others of bulls, lions, bears, elephants, horses, or men. There were not less than thirty, of a very large size, about thirty feet in height, and a great number of smaller ones.

The next day was spent in drawing the body of the *Poongee* in his carriage, backwards and forwards, or rather in pulling against each other. All the people, being divided into two parties, drew the corpse, from the place where it formerly was, to an extensive valley, near the hill where it was to be burnt. In the front of the valley the viceroy had a temporary house erected, from which he could view the whole shew. Four cables

were fastened to the axle-tree of the carriage, two each way; these were held by the people, who every now and then uttered a loud shout and pulled both ways at the same time. That day neither party gained any advantage over the other, till near evening, when one of the cables broke and the opposite party gained the victory.

The following day they discharged the large rockets. Early in the morning they carried all the figures and their rockets from the town, and each of these figures was fixed upon a carriage of four wheels, and the rockets were secured, by rattan loops, to strong ropes, which passed between the feet of the animal, so that when discharged, they, sliding on the ropes, ran along the ground. Some of these rockets were from seven to eight feet in length, and from three to four in circumference, made of strong timber, and secured by iron hoops, and rattan lashings. The last of them, when discharged, ran over a boy of ten or twelve years old, who died in a few minutes; three or four grown up persons were also much hurt. Towards evening a great number of fire-works were discharged, which made a very fine appearance.

The next day was the time appointed for blowing up the corpse. On this occasion, a quarrel arose between the two parties who had pulled the former day, the party which had been unsuccessful insisting that the cables had been cut, and not broken, by the opposite party; they therefore presented a petition to the viceroy, requesting that they might have another trial at pulling. This was granted, upon which, having procured four new *Europe* cables, from the ships in the harbour, they re-commenced their trial of strength; however, the party which had been victorious before won again, and broke the cables of the other. The unsuccessful party was not yet satisfied, but insisted on another trial of strength, the

following day. That day neither party obtained the victory, upon which the viceroy issued an order to stop the contest, and to burn the *Telapoy* the next day, which was accordingly done.

That day the corpse was burnt in a temporary house, erected for that purpose, in the shape of a *Kuim*, with a stage in it upon which the coffin was set to be burnt. This was performed with small rockets, fixed upon ropes with rings of rattan, so as to slide along them, from the top of a hill, to the coffin, which was placed on the top of another hill. The rockets being discharged, slided along the ropes, over the intermediate valley, to the coffin, which was set on fire by them, and, with its contents, quickly consumed.

V.

An account of observations taken at the Observatory near Fort St. George, in the East Indies, for determining the Obliquity of the Ecliptic in the months of December, 1809, June and December, 1810.

By Capt. JOHN WARREN,

Of H. M. 33d Regiment of Foot.

1. ALTHOUGH the diminution of the obliquity of the ecliptic be a question of a general nature, and in that respect not immediately within the scope of the researches of the *Asiatick* society; yet if we advert to the opinion of a celebrated mathematician,* "that it is only within the tor- "rid zone, and near to the equator that the obliquity of the ecliptic can "be observed with great precision," the subject may be deemed to fall within their province, and to be deserving of their attention.

* Vide Bougaen's figure de la terre, pag. 230.

2. No observation of this kind has been, I believe, made in *India*, (or at least given to the public) since Mr. LE GENTIL visited *Pondicherry*, in the years 1768–9. Nor do I think that any instrument of sufficient power for that purpose had reached this country, until the government of *Fort St. George* were pleased to purchase and intrust to my hands a circular instrument made by CARY, in the year 1807; which, being used with proper attention, and some degree of skill, proved perfectly adequate to the purpose. This will appear from the consistency and regularity of the observations and results which form the subject of this paper.

3. THIS instrument being intended for astronomical and geographical observations, in all cases where angular distances may be the object, is on that account somewhat complex. But I shall confine my description to its means and powers for taking altitudes.

4. THE vertical circle is 18 inches in diameter, and is divided in a masterly manner on the limb to fifteen minutes. In order to read the intermediate parts there are two microscopes, fixed horizontally on *Brachiæ*, consisting of an horizontal, and an oblique ladder bar, meeting at an angle somewhat acute, to where the microscope is suspended, the other ends being screwed against the conic pillar which supports the axis of the circle on that side.

5. THIS mode of suspending the microscope (though perhaps sufficient for northern countries) is rather defective for tropical climates; for after using this instrument upwards of ten months, I perceived the absolute impossibility of trusting to the level alone for very fine observations, and saw the necessity of a constant reference to an horizontal mark placed at a convenient distance, for accurate results. This irregularity compelled me to reject the solstitial observations which I had taken in

December, 1808, and June, 1809, and is to be accounted for from the great expansion to which the intense heat of these climates, subjects every kind of metal. It is true that this cannot be supposed to affect the adjustment within the limits of an observation, but I never observed twice at the distance of an hour without having occasion to alter by some seconds the mircrometers, when set to the horizontal mark.

6. The microscopes which read on opposite points of the circle are of the usual construction, and contain micrometers the heads of which are divided to 2″ of a degree, and by estimation read to one. The wires inside act as in all such instruments, one as a fixed, the other as a moveable wire.

7. There is but one level which answers for all adjustments. It is suspended on two short arms, projecting from the horizontal axis of the circle, and is exquisitely sensible; the tube hangs freely so that the air bubble remains upwards, whatever be the position of the circle. This level is supplied with the proper adjusting screws and perfectly competent for its purpose, subject to the checks to which I had recourse.

8. The error of centring is very trifling, and is variable. I never observed it at its maximum to exceed 3″. The error of collimation has frequently varied from accidents, or other causes; but since I refered to an horizontal mark this became of no sort of importance, because previous to every observation, the moveable wires were always set at *zero* against the mark. The thickness of the wire in the focus of the telescope, (which subtends nearly 6″) is considered in the altitudes,* by observations of opposite limbs.

* In place of wires, a large spider's web, found in numbers in the *Coorg* country, is made use of. It is exquisitely delicate: it is perhaps extraordinary that it should have been found on a great number of observations to subtend so considerable a quantity.

9. THE successive observations were taken as is usual, with the limb of the circle facing alternately east and west, and latterly care was taken, that previous to letting the light in, it should be equally heated, which was done by inverting it from the position it was in during the morning, a short time before the sun's passage over the meridian.

10. IMMEDIATELY before observing I set the micrometers at *zero*, the horizontal wire being on the mark, and immediately after taking the altitude I renewed the operation. Between these two readings there seldom was a difference above 2″. The mean was always registered.

11. THE instrument is placed on the center granite pillar in the observatory, and is in every respect perfectly fixt and steady. The temperature was always noticed at the time of observation, with a view to the refraction, which was computed (without reference to the tables) from BRADLEY'S *Formula*, and with the constant quantities given in my paper on the declination of stars, published in the XI. vol. of the *Asiatick* researches. The sun's declination used for the reductions, and also for the latitudes, was invariably interpolated for the exact moment from the tables given in the Ephemerides. The parallax was taken for the month, and day, from BRADLEY'S tables, given in CALLET'S *Logarithms*.

12. THE *Brahmin* assistant, SANEVASA-CHAIRY, always observed the transit of the sun, whilst I was taking its meridional altitude, which formed also a powerful check, against any irregularity which might have crept in, from the instrument being disturbed from the meridian, when I elevated the telescope. How far these precautions have succeeded will best be shewn by what follows.

PARTICULARS OF OBSERVATIONS.

13. I STATED above, that from want of sufficient knowledge of my instrument, I had been under the necessity of rejecting the solsticial observations, which I had taken in December, 1808, and June, 1809; these receding rather too wide, for deducing from them the obliquity of the ecliptic. It was only in December following that I obtained sufficient checks over the irregularities I have noticed, for relying on the powers of my instrument. But then the weather proved generally unfavorable, and I obtained but a few unobjectionable observations, two of which only, were sufficiently near the solstice, for the present purpose, and on which alone I would not have trusted the fate of the present paper, though the mean result agrees within 2″ of all subsequent setts.

14. OBSERVATIONS of the sun's altitude in December, 1809.

	20th.	23d.
Obs'd Altitude of ☉'s Lower Limb, ..	53 13 14.88	53 12 38.30
Refraction, ...	— 35.30	— 35.50
	53 12 39.58	53 12 2.80
Parallax, ...	+ 5.12	+ 5.12
	53 12 44.70	53 12 7.92
☉'s Semidiameter, ...	+ 16 17.40	+ 16 17.60
Cor'd. Altitude ☉'s Center,.....	53 29 2.10	53 28 25.52
	90	90
Zenith Distance, ...	36 30 57.90	36 31 34.48

THE sun entered ♈ on the 21st of December, at $^{H.}16\ ^{M.}38$, to which instant the above zenith distances are to be reduced, by interpolating for the maximum of the declinations, given in the ephemerides for the 19th, 20th, 21st and 22d, and comparing this quantity* with the declination

* Maximum of Declination on 21st,....	23° 27′ 43.136	23 27 43.136
Declination on 20th, ...	23 26 50.600	23 27 26.640
Differences,.....	52.536	16.496

due to the 20th and 23d at noon, *Madras* time, or 19th and 22d, 18$^{H.}$ 38$'$ 46$''$ *Greenwich* time.

15. OBSERVATIONS of the sun's altitude in June, 1810.

	17th.	22d.	26th.
Obs'd Altitude of ☉'s Lower Limb,	79 25 41.25	79 20 44.09	79 24 15.99
Refraction,	— 8.55	— 8.70	— 8.58
	79 25 32.70	79 20 35.39	79 24 7.41
Parallax,	+ 1.42	+ 1.55	+ 1.54
	79 25 34.12	79 20 36.94	79 24 8.95
☉'s Semidiameter,	+ 15 46.10	+ 15 45.90	+ 15 45.60
Cor'd Altitude ☉'s Center,	79 41 20.22	79 36 22.84	79 39 54.55
	90	90	90
Zenith Distance,	10 18 39.78	10 23 37.16	10 20 5.45

THE ☉ entered ♋ on the 21st of June, at 15$^{H.}$ 54$^{M.}$, *Greenwich* time, therefore proceeding as above we have*

Zenith Distances,	10 18 39.78	10 23 37.16	10 20 5.45
Reduction,	4 55.92	0.16	3 30.07
Observations reduced to 21st,	10 23 35.70	10 23 37.32	10 23 35.22
			10 23 37.32
			10 23 35.70
Mean zenith distance reduced to the 21st,			10 23 36.186

* Maximum of Declination,	23 27 42.44	23 27 42.44	23 27 42.44
Declinations,	23 22 46.52	23 27 42.28	23 24 12.37
Differences,	4 55.92	0.16	3 30.07

16. OBSERVATIONS of the sun's altitude in December, 1810.

	20th.	21st.	22d.	
Obs'd Altitude ⊙'s Upper Limb,	53 46 7.30	53 45 19.56	53 12 26.39	*LL.*
Refraction,	— 34.67	— 34.48	— 35.29	
	53 45 32.63	53 44 45.08	53 11 51.10	
Parallax,	+ 4.90	+ 4.90	+ 5.02	
	53 45 37.53	53 44 49.98	53 11 56.12	
⊙'s Semidiameter,	— 16 17.45	— 16 17.50	+ 16 17.55	
Cor'd. Altitude ⊙'s Center,	53 29 20.08	53 28 32.48	53 28 13.67	
	90	90	90	
Zenith Distance,	36 30 39.92	36 31 27.52	36 31 46.33	

THE ⊙ entered ♑ on the 21st of December, at H. 22 M. 31, *Greenwich* time; therefore, repeating the preceding process we have*

	20th.	21st.	22d.
Zenith Distance,	36 30 39.92	36 31 27.52	36 31 46.33
Reduction,	1 6.05	0 19.10	0.48
	36 31 45.97	31 31 46.62	36 31 46.81
			36 31 46.62
			36 31 45.97
Mean zenith distance reduced to the 21st,			36 31 46.466

* Maximum of Declination,	23 27 41.92	23 27 41.92	23 27 41.92
Declinations,	23 26 35.87	23 27 22.82	23 27 41.44
Differences,	1 6.05	19.10	0.48

17. We now proceed to deduce the apparent obliquity of the ecliptic from what precedes.

Zenith Distance, 21st of December, 1809,			36° 31′ 50.″52
——— 21st of June, 1810,			10 23 36.11
Distance of Tropics,			46 55 26.53
Half sum or apparent Obliquity,			23 27 43.26
Solar Nutation,*			+ 51
Obliquity for the middle of 1810,			23 27 44.17
Zenith Distance, 21st of June,	1810,		10 23 36.11
——— 21st of December,	1810,		36 31 46.28
Distance of Tropics,			46 55 22.39
Half sum or apparent Obliquity,			23 27 41.19
Solar Nutation,			+ 51
Obliquity for the beginning of 1811,			23 27 41.70
Obliquity for July 1st, 1810, N. A.			23 27 42.12
——— by Observation,			23 27 44.17
Difference,			+ 2.05
Obliquity for January 1st, 1811, N. A.			23 27 41.48
——— by Observation,			23 27 42.10
Difference,			+ 0.28

* For the solar nutation we have the following formula. Let the sun's longitude = L. The solar precession = P. The obliquity of ecliptic = Obl. N = the nutation. Then,

$$N = \text{Sin.}^2 L \times \frac{\text{Sin. Obl.}}{90} \times \frac{P}{4} = \text{Sin.}^2 L \times \frac{0.4311}{1.570} \times 3''.628 = \text{Sin.}^2 L \times 1'', \text{ nearly,}$$

and when L = 90°, then Sin.^{2} = 1, and N = 1″ nearly. Doctor Vince makes it 1″ in the winter, and 0″.7 in the summer solstice, the mean of which is 51″.

18. As the mean obliquity of the ecliptic, and the quantities of its diminution, can only be deduced with accuracy from a great number of observations of the apparent obliquity taken at different times and places, and at considerable intervals; I shall not detain the reader with this last reduction, but present this paper to astronomers in *Europe*, as an ingredient which may be combined with others, for the resolution of this important problem; being at the same time in hopes, that the advantage which I have had of observing between the tropics, may balance the inaccuracies which (notwithstanding the utmost care in taking the altitudes) may have crept into my observations.

Of the Latitude of the Madras Observatory, deduced from 100 *observations of the Sun's Meridional Altitude.*

19. These observations are given in the tables at the end, with the respective elements which have served for obtaining the latitude. The mean limit of the results is $6''$. The power of the instrument may therefore be taken at $3''$ on each side of the mean, and any observation diverging by more than double that quantity on either side, ($6''$) may justly be rejected as affected by some error, independant of the instrument. This I have done in the course of the present series.

20. It will appear remarkable, that the mean latitude derived from 100 unobjectionable observations, (48 of which were taken when the sun was either on or near the zenith) should give the latitude of the observatory by $7''\ 43'''$ less than the stars. This difference is further confirmed by 76 observations of the sun, taken with the zenith sector at different times at the observatory. What follows will shew the comparison.

With Major Lambton's Zenith Sector.	56 Observations within 8° of the Zenith, in 1803,	13 4 5.25
	20 Observations of do. very near the Zenith, in 1807,	13 4 4.20
With Cary's Circle.	100 Observations, the details of which are given in tables, I, II, III, and IV.	13 4 6.41
	Mean, by 176 observations,	13 4 5.30
With the Z. Sector.	Latitude by 500 observations of 52 Stars, within 8° of the Zenith,	13 4 13.17
	Difference,	7.46

21. Mr. Le Gentil, who observed the obliquity of the ecliptic at *Pondicherry*, in the year 1769, remarks, that his observations of the pole star, gave the latitude by 5″ 43 less than the sun, which he considers as a proof of the correctness of the elements he has used in the reduction of his observations. With due deference to the ingenuity of so eminent an astronomer, I beg to observe that the pole star, which is so little elevated under the parallel of *Pondicherry*, was not a fit object of comparison, on account of the great refraction due to it at 10° and 13° altitude.* I shall propose Regulus in preference, which is on the sun's path, and being only 9′ 14″ north of the zenith of the observatory, is not subject to any sensible error of refraction.

22. Now it will appear by table 1, of my paper above quoted, that Regulus gave 13° 4′ 13.484 for the latitude of the observatory, and by

* I have taken 14 altitudes at the superior transit of the pole star, with Cary's circle, the limits of which are 8″.6; that is the extremes 4″.3 from the mean. The mean superior altitude was observed 14° 51′ 36″.826, which, by using Bradley's refraction (3′ 32″.274) gives the latitude 13° 4′ 7″.33. This result is perfectly consistent with the present observations. But as I had no observation of the inferior altitude, and as I did not refer at that period to an horizontal mark, I omit for the present giving the particulars relating to it, though I believe the results cannot be far removed from the truth.

the present, that 48 observations of the sun, when near the zenith, brought out 13° 4′ 6″.484. Hence the difference is 6″.95; not far different from Mr. LE GENTIL's quantity, but with a contrary sign, so that we differ in this respect by 12; but in the far more important object of the obliquity, it will appear that we agree as near as could be expected.

23. ON the probable cause why the sun should so constantly give a lower latitude than the stars, I can only repeat what I have said formerly in the paper above referred to, namely, that from allowing too much for the effects of refraction, astronomers in *Europe*, assign probably too great a zenith distance to the sun, by which excess they place their zenith too far from the ecliptic, a circumstance which tends necessarily to depress the results of observations of the sun, taken in low latitudes.

JOHN WARREN.

Honorable Company's Observatory,
1st of February, 1811.

Errata in the paper on the declination of Stars, published in the XIth Volume of the Asiatick Researches. Table Vth, 3d column, corresponding Latitudes.

⊙ N. for 13° 4′ 2″.207 read 13° 4′ 2″.879
⊙ S. for 13 4 4.499 read 13 4 5.403
Column 4th. for 13 4 3.323 read 13 4 4.181

THESE differences arise from the latitudes having been reduced, without interpolating the sun's declination for the respective days; which has been done in the present correction. This alteration however, affects nothing of what I have said in the 26th article of the paper, because I only considered the observed zenith distances and not the latitudes.

TABLE I.

Containing the Observed Altitudes of the Sun, when near the Zenith of the Madras Observatory, in the years 1809 *and* 1810.

Twelve observations of the Sun, in April and May, 1809.

Article I.

Day of the Month.	Face.	Obs'd Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination.	Latitude.
			INCHES.	°	" −	" +	" +	° ′ ″ + −	° ′ ″
April 14	E.	S. 85 40 23.07	29.870	87.7	3.309	0.60	15 57.7	9 16 45.500	13 20 27.439
19	E.	87 26 39.52	29.844	88.8	1.860	0.342	15 56.3	11 2 57.810	13 20 23.508
							−	−	
May 1	E.	N. 88 6 33.40	29.758	92.0	1.743	0.315	15 53.3	14 57 56.450	13 20 21.722
5	E.	87 27 24.27	29.760	88.0	2.291	0.419	15 52.44	16 8 50.957	13 20 20.915
14	E.	84 32 17.13	29.854	94.0	4.628	0.842	15 48.9	18 32 23.786	13 20 26.030
16	E.	84 3 39.935	29.836	86.0	5.107	1.880	15 50.2	19 1 0.040	13 20 26.038
									13 20 24.275
									12 47 48.409
N. B. These observations and the following were taken without reference to an Horizontal Mark.								Mean;	13 4 6.342
April 20	W.	S. 88 20 1.97	29.824	88.0	1.579	0.292	15 56.05	11 23 41.160	12 47 44.427
25	W.	89 59 21.68	29.894	88.0	0.229	0.000	15 54.80	13 4 19.828	12 47 49.479
							−	−	
May 2	W.	N. 87 15 53.35	29.820	92.0	1.990	0.365	15 53.90	15 16 3.648	12 47 48.273
3	W.	86 58 2.70	29.852	87.0	2.259	0.405	15 52.87	15 33 54.850	12 47 48.566
4	W.	86 40 27.64	29.797	85.0	2.506	0.448	15 52.65	15 51 31.348	12 47 49.580
							+		
6	W.	86 6 3.77	29.746	92.0	2.953	0.539	15 52.22	16 25 56.557	12 50 48.133
Error of collimation, 18″ 42.067. Affected of the error of centring.								Mean,	12 47 48.409

Twelve observations of the Sun, in August, 1809.

Article II.

Day of the Month.	Face.	Obs'd. Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination.	Latitude.
			INCHES.		−	+	+	−	
Aug. 12	E.	N. 87° 57′ 36.34″	29.896	88.0	1.891	0.298	15′ 49.2″	15° 7′ 7.29″	13° 20′ 31.237″
14	E.	88 33 48.73	29.892	89.0	1.394	0.211	15 49.5	14 30 51.99	13 20 29.037
17	E.	89 30 10.295	29.772	91.0	0.621	0.075	15 50.0	13 34 32.93	13 20 32.679
								+	
19	E.	S. 89 51 13.63	29.794	86.0	0.343	0.025	15 50.5	12 55 53.99	13 20 31.178
22	E.	88 19 58.75	29.830	87.0	1.779	0.624	15 50.1	11 56 27.35	13 20 40.255
24	E.	87 39 22.15	29.798	88.0	2.081	0.341	15 51.5	11 15 51.48	13 20 39.570
									13 20 33.992
									12 47 39.337
								Mean,	13 4 6.6645
11	W.	N. 87 6 46.70	29.884	88.0	2.135	0.425	15 49.0	15 25 7.67	12 47 41.660
13	W.	87 42 43.92	29.914	88.0	2.161	0.373	15 49.4	14 49 11.17	12 47 42.702
18	W.	89 16 26.69	29.798	85.0	0.371	0.107	15 50.3	13 15 20.23	12 47 37.026
21	W.	S. 89 12 0.60	29.834	86.0	0.232	0.114	15 50.9	12 16 27.99	12 47 36.608
23	W.	88 52 47.53	29.794	88.0	0.983	0.213	15 51.1	11 36 15.12	12 47 37.260
26	W.	87 30 26.35	29.770	87.0	1.810	0.360	15 51.96	10 33 57.63	12 47 40.770
Error of collimation, 18′ 32.662″. Affected of the error of centring.								Mean,	12 47 39.337

Twelve observations of the Sun, in April and May, 1810.

Article III.

April 18	E.	S. 87 16 49.80	29.736	86.5	2.219	0.40	15 56.7	10 36 49.80	13 4 5.119
20	E.	87 58 27.35	29.714	87.5	1.647	0.31	15 56.2	11 18 31.00	13 4 8.787
22	E.	88 39 26.85	29.706	86.5	1.093	0.21	15 55.6	11 59 26.71	13 4 5.143
24	E.	N. 89 19 35.70	29.668	87.0	0.547	0.11	15 55.2	12 39 36.42	13 4 5.057
								−	
May 2	E.	87 36 38.85	29.646	87.8	1.937	0.36	15 53.2	15 11 35.53	13 4 6.003
4	E.	87 1 0.92	29.690	89.0	2.416	0.45	15 52.7	15 47 12.666	14 4 4.320
									13 4 5.738
									13 4 7.754
N. B. These observations and the following were taken with reference to an Horizontal mark.								Mean,	13 4 6.746

Article III. *Continued.*

Day of the Month.	Face.	Obs'd Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination.	Latitude.
			INCHES.						
April 19	W.	S. 87° 37′ 49.80″	29.736	86.5	1.933 −	0.34 +	15′ 56.4″	10° 57′ 49.80″ +	13° 4′ 5.193″
21	W.	88 18 58.25	29.702	86.8	1.371	0.26	15 55.8	11 39 4.32	13 4 11.381
23	W.	88 59 35.35	29.684	86.5	0.820	0.16	15 55.4	12 19 37.52	13 4 7.430
27	W.	N. 89 41 47.32	29.672	88.0	0.245	0.06	15 54.4	13 38 17.73 −	13 4 11.475
29	W.	88 31 52.54	29.708	87.2	1.194	0.23	15 53.9	14 16 19.52	13 4 4.996
May 1	W.	87 54 41.39	29.646	87.0	1.696	0.32	15 53.4	14 53 32.64	13 4 6.054
Error of collimation, 1.008″.								Mean,	13 4 7.754

Twelve observations of the Sun, in August and September, 1810.

Article IV.

Aug. 2	E.	N. 84 50 45.47	29.562	92.0	4.140	0.60	15′ 47.63″	17° 57′ 34.970″	13° 4′ 4.930″
12	E.	87 36 43.89	29.656	90.2	1.930	0.35	15 49.13	15 11 35.560	13 4 7.000
15	E.	88 31 23.24	29.616	88.0	1.190	0.22	15 49.70	14 16 52.310	13 4 4.310
17	E.	89 9 2.03	29.622	87.0	0.680	0.13	15 50.1	13 39 12.600 +	13 4 4.180
21	E.	S. 89 1 23.150	29.568	87.0	0.700	0.15	15 50.9	12 21 21.320	13 4 7.820
23	E.	88 21 14.170	29.546	88.7	1.330	0.24	15 51.3	11 41 13.520	13 4 9.120
									13 4 6.226
									13 4 6.145
Mean of the four latitudes, 13° 4′ 6.4843″.								Mean,	13 4 6.185
Aug. 1	W.	N. 84 35 43.23	29.542	91.8	4.340	0.76	15′ 47.5″	18° 12′ 37.380″ −	13° 4′ 4.53″
11	W.	87 18 53.61	29.646	88.8	2.170	0.37	15 48.96	15 29 22.760	13 4 3.53
14	W.	88 12 52.80	29.636	86.2	1.250	0.27	15 49.5	14 35 21.250	13 4 2.32
20	W.	S. 89 21 9.67	29.634	86.8	0.540	0.10	15 50.7	12 41 8.730 +	13 4 8.80
24	W.	88 0 52.73	29.544	87.7	1.600	0.29	15 51.5	11 20 52.900	13 4 9.98
Sept. 1	W.	85 15 0.89	29.464	88.8	3.760	1.05	15 53.2	8 31 59.09	13 4 7.71
Error of collimation, 0.045″.								Mean,	13 4 6.145

TABLE II.

Containing Observations of the Sun's Altitude, when near the Solstices.

Ten observations of the Sun, in June, 1810.

Article I.

Day of the Month.	Face.	Obs'd Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination.	Latitude.
			INCHES.						
June 13	E.	N. 79° 37′ 0.70	29.560	92.0	8.40	1.51	+ 15′ 46.3	− 23° 11′ 25.50	13° 4′ 5.61
15	E.	79 30 32.11	29.472	91.8	8.48	1.53	15 46.2	23 17 55.43	13 4 6.89
17	E.	79 25 41.25	29.472	91.0	8.55	1.54	15 46.1	23 22 46.52	13 4 6.86
22	E.	79 20 44.09	29.546	88.0	8.70	1.55	15 45.9	23 27 42.28	13 4 5.12
26	E.	79 24 15.99	29.504	91.0	8.58	1.54	15 45.6	23 24 12.37	13 4 6.92
28	E.	79 28 27.81	29.482	82.9	8.67	1.54	15 45.6	23 19 59.22	13 4 5.50
								Mean,	13 4 6.15
June 14	W.	N. 79 33 37.26	29.520	92.4	8.41	1.52	15 46.3	23 14 52.25	13 4 8.89
25	W.	79 22 46.46	29.528	88.8	8.66	1.55	15 45.7	23 25 41.71	13 4 6.76
27	W.	79 26 12.36	29.526	91.0	8.56	1.54	15 45.6	23 22 17.95	13 4 8.89
29	W.	79 31 8.98	29.465	87.5	8.51	1.54	15 45.6	23 17 15.88	13 4 3.46
									13 4 7.00
									13 4 6.15
Error of collimation, 0.42.								Mean,	13 4 6.575

Ten observations of the Sun, in December, 1810, and January, 1811.

Article II.

Dec. 13	E.	S. 54 4 42.16	29.672	81.5	34.150	4.86	− 16′ 16.9	− 23° 7′ 58.22	13° 4′ 6.11
21	E.	53 45 23.22	29.714	83.1	34.480	4.90	16 17.5	23 27 22.82	13 4 4.79
26	E.	53 48 29.44	29.654	80.2	34.490	4.89	16 17.7	23 24 12.97	13 4 4.89
1811. 28	E.	53 20 44.50	29.670	78.0	35.180	5.01	+ 16 17.75	23 19 39.47	13 4 8.45
Jan. 3	E.	53 45 12.25	29.668	81.8	34.280	4.90	16 17.77	22 54 46.71	13 4 7.63
6	E.	54 36 36.00	29.814	78.0	33.930	4.74	16 17.72	22 36 8.72	13 4 2.19
									13 4 5.676

Article II. *Continued.*

Day of the Month.	Face.	Obs'd Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination.	Latitude.
			INCHES.		—	+	+	—	
Dec. 10	W.	S. 53° 47′ 1.94	29.680	81.1	34.57	4.92	16′ 16.6	22° 53′ 2.92	13° 4′ 8.12
1811 22	W.	53 12 26.39	29.682	81.2	35.29	5.02	16 17.55	23 27 41.44	13 4 4.89
Jan. 4	W.	54 23 36.56	29.772	79.0	34.06	4.80	16 17.75	22 49 0.96	13 4 9.49
7	W.	54 10 49.10	29.786	78.0	34.43	4.84	16 17.70	22 29 8.94	13 4 10.68
									13 4 8.295
									13 4 5.676
		Mean latitude, in December, 1810, and January, 1811,							13 4 6.985
		Mean latitude, in June, 1810, ...							13 4 6.575
Error of collimation, 1.″307.								Mean,	13 4 6.780

TABLE III.

Containing the Observed Altitudes of the Sun, when on or near the Equator, in the Year 1810.

								N. +	
Sept. 3	E.	84 28 23.44	29.428	86.0	4.489	0.21	15 53.70	7 48 16.82	13 4 4.379
7	E.	83 0 26.82	29.542	91.2	5.634	1.03	15 54.70	6 20 24.68	13 4 7.764
9	E.	82 14 31.50	29.496	91.0	6.248	1.14	15 54.20	5 34 19.86	13 3 59.268
12	E.	81 6 4.81	29.564	90.5	7.179	1.31	15 55.95	4 26 2.43	13 4 7.539
15	E.	79 57 3.52	29.551	91.0	8.160	1.50	15 56.75	3 17 3.94	13 4 10.270
17	E.	79 10 48.18	29.554	90.0	8.714	1.60	15 57.27	2 30 45.81	13 4 7.474
							Mean latitude by face E.		13 4 6.1156
Sept. 4	W.	84 6 11.20	29.476	88.0	4.766	0.74	15 53.95	7 66 18.83	13 4 11.706
10	W.	81 51 46.58	29.526	91.8	6.555	1.19	15 55.45	5 11 39.29	13 4 1.625
14	W.	80 20 12.23	29.564	90.5	7.793	1.42	15 56.47	3 40 7.34	13 4 5.013
							Mean latitude by face W.		13 4 6.1143
								E.	13 4 6.1156
								Mean latitude,	13 4 6.1199

TABLE IV.

Containing the Observed Altitudes of the Sun, at various places between the Tropics, in the Year 1809–10.

Day of the Month.	Face.	Obs'd Altitude.	Barometer.	Thermometer.	Refraction.	Parallax.	⊙'s Semidiameter.	⊙'s Declination. N.	Latitude.
1809			INCHES.						
Dec. 20	E.	53° 13′ 14″.88	29.686	80.0	35.30	5.12	16′ 17″.4	23° 26′ 50″.60	13° 4′ 7″.30
30	E.	53 27 44.94	29.744	79.8	35.13	5.09	16 17.7	23 12 19.52	13 4 7.88
1810								+	
March 31	E.	80 35 30.70	29.716	86.2	7.74	1.14	16 1.2	3 55 34.63	13 4 9.030
April 6	E.	82 53 33.50	29.710	87.9	5.801	1.06	15 59.9	6 13 36.76	13 4 8.101
8	E.	83 38 48.70	29.728	86.5	5.200	0.95	15 59.4	6 58 50.28	13 4 6.430
10	E.	84 23 25.50	29.654	87.0	4.570	0.84	15 58.8	7 43 30.25	13 4 9.680
								−	
May 4	E.	87 1 0.92	29.690	89.0	2.416	0.45	15 52.7	15 47 12.666	13 4 4.320
8	E.	85 53 4.64	29.586	88.0	3.325	0.61	15 51.8	16 55 13.067	13 4 6.792
10	E.	85 20 46.28	29.628	89.2	3.762	0.69	15 51.3	17 27 37.467	13 4 11.975
17	E.	83 36 54.30	29.584	85.6	5.211	0.94	15 50.0	19 11 24.696	13 4 4.725
22	E.	82 32 24.96	29.502	85.3	6.085	1.10	15 49.0	20 15 55.176	13 4 4.151
								Mean by face E.	13 4 7.307
								Mean by face W.	13 4 7.858
								Mean latitude,	13 4 7.582
1809									
Dec. 23	W.	53 13 14.88	29.780	80.0	35.50	5.12	16 17.60	23 27 26.64	13 4 7.340
31	W.	53 31 48.03	29.780	80.9	35.26	5.11	16 17.70	23 8 17.37	13 4 7.050
1810								+	
April 5	W.	82 30 43.60	29.648	87.5	6.094	1.11	16 0.20	5 50 50.56	13 4 11.744
11	W.	84 45 43.90	29.694	87.4	4.271	0.78	15 58.60	8 5 45.19	13 4 6.181
13	W.	85 29 40.90	29.648	86.5	3.670	0.67	15 58.00	8 49 40.98	13 4 5.080
15	W.	86 12 55.58	29.708	86.7	3.085	0.57	15 57.50	9 32 57.30	13 4 6.815
17	W.	86 55 42.95	29.672	86.5	2.501	0.43	15 57.0	10 15 48.60	13 4 10.721
								−	
May 3	W.	87 18 48.28	29.678	88.0	2.179	0.41	15 53.00	15 29 31.259	13 4 10.770
5	W.	86 43 40.10	29.638	86.9	2.661	0.49	15 42.50	16 4 37.065	13 4 7.494
7	W.	86 9 33.71	29.598	88.0	3.166	0.58	15 52.00	16 38 39.267	13 4 2.391
9	W.	85 36 44.3	29.620	88.9	3.551	0.65	15 51.6	17 11 34.557	13 4 7.556
21	W.	82 41 44.46	29.533	83.0	5.940	1.70	15 49.3	20 3 41.318	13 4 10.658
								Mean by face W.	13 4 7.858

VI.

On the notions of the Hindu *Aſtronomers, concerning the preceſſion of the Equinoxes and motions of the Planets.*

BY THE PRESIDENT.

IN an eſſay on the *Indian* and *Arabian* diviſions of the Zodiack, inſerted in the Ninth Volume of the *Aſiatick* Reſearches, I adverted to a paſſage of BHÁSCARA, on the preceſſion of the equinoxes, and intimated an intention of further noticing this ſubject in a ſeparate eſſay. * The paſſage, which I had then in view, occurs in BHÁSCARA's deſcription of the armillary ſphere. † It appears to me deſerv-

* As. Res. Vol. 9. P. 353.

† *Gólád'hyáya*, C. 6. V. 17 and 18.

ing of diſtinct examination for the information which it contains, the difficulties which it preſents, and the variety of topicks which it ſuggeſts. I ſhall here quote the original and add a verbal tranſlation.

विषुवक्रान्तिवलययोस्सम्पातःक्रान्तिपातःस्यात् ॥ तद्भगणाःसौरेका व्यस्ताश्चयु
तत्रयङ्कल्पे ॥ १७ ॥ अयनचलनंयदुक्तंमुन्जालाद्यैस्सूरयवायं ॥ तत्पक्षेतद्भगणा
कल्पेगोंगर्तुनन्दगोचन्द्राः ॥ १८ ॥

"THE interſection of the ecliptic and equinoctial circles is the *Crán-*
"*tipáta* or interſecting point of the ſun's path. Its revolutions, as
"declared on the authority of SÚRYA *(Sauróctah)*, are retrograde three
"myriads in a *Calpa*. This is the ſame with the motion of the ſolſtice,
"as affirmed by MUNJÁLA, and others. But, according to their
"doctrine, its revolutions are 199,669 in a *Calpa*."

THIS is the very paſſage, to which the commentator on the *Súrya-ſidd'hánta*, cited by Mr. DAVIS,* alludes, where he ſays "the mean-
"ing of BHÁSCARA ÁCHÁRYA, was not that SÚRYA, [in the *Súrya*
"*ſidd'hánta*,] gave 30,000 as the revolutions of the places of the colures,
"in a *Calpa*; the name he uſed being *Saura* not *Súrya*, and applied
"to ſome other book."

IT is certainly true, as here obſerved by this commentator, that BHÁSCARA's quotation does not agree with the text of the *Súrya ſidd'hánta*, which expreſſes, "The circle of the aſteriſms moves eaſtward

* As. Res. Vol. 2, P. 267.

" thirty ſcores in a *yuga*. Multiplying the number of elapſed days by " that, and dividing by the terreſtrial days, [which compoſe the " cycle], the quantity obtained is an arc, which, multiplied by three, " and divided by ten,* gives degrees *(ans'a)* termed *ayana*, [or the " place of the colure.]"

त्रिंशत्कृत्योयुगेभानांचक्रंप्राक्परिलंबते ॥ तद्घ्नाभ्दिनैर्भक्तांशुगणाद्भदवाप्यते ॥ तद्घ्नेस्त्रिघ्नादशाप्तांशविज्ञेया त्रयनाभिधा ॥

HERE the number of revolutions is 600 in a *yuga*, anſwering to 600,000 in a *Calpa;* and not as ſtated by BHÁSCARA, 30,000. But the commentator's mode of reconciling the contradiction by ſuppoſing a different book from the *Súrya ſidd'hánta*, to have been intended, is incompatible with BHÁSCARA's own explanation of his text, in the *Váſanábhāſhya*, containing annotations by himſelf on his own treatiſe. He there ſays in expreſs words, " the revolutions of the interſecting " point of the ſun's path are ſtated in the *Súrya ſidd'hánta*, as amounting " to 30,000 in a *Calpa*."†

अतोऽस्यकान्तिपातस्यभगणाः कल्पेऽयुतत्रयंतावत्सूर्यसिद्धान्तोक्ताः ॥

HIS commentator, MUNÍŚWARA, has therefore recourſe to other expedients for reconciling the contradiction between BHÁS-

* Ratio of 27° to 90°.

† BHÁSCARA's *Váſaná Bhāſhya* on the aſtronomy and ſphericks of his *Sidd'hánta ſirómani*. This volume of annotations is commented, with the *Sirómani*, by NRĬSINHA in the *Váſaná Vártica*, as proceeding from the ſame writer; and is expreſsly acknowledged to be a work of the author of the text (as it actually purports) by the Scholiaſt MUNÍŚWARA, in this very place, where he is endeavouring to ſupport his own interpretation of the text, againſt the apparent and natural ſenſe of a paſſage in the author's notes.

CARA's quotation and the text of the *Súrya ſidd'hánta*. Some, he obſerves, have propoſed to read *niyuta* "a hundred thouſand" for *ayuta* "a myriad."* Others have ſuppoſed the *calpa* to be a twentieth part only of the period uſually ſo denominated. The commentator further ſuggeſts the reſolution of the term *vyaſtáh*, tranſlated "retrograde," into *vi* for *vinſáti* "twenty" and *aſtáh*, which he makes to ſignify "multiplied," and expounds the phraſe "thirty thouſand multiplied by twenty." But diſſatisfied with this and with another expoſition, by which *trayam* "three" is conſtrued into "ſixty," he gives the preference to an equally ſtrained interpretation, which divides the ſentence into two members: "its revolutions are declared by "SÚRYA, and [according to a different authority] are retrograde three "myriads in a *calpa*."

HOWEVER unſatisfactory theſe explanations of the text may be, they prove the concurrence of the commentators of both works in the received interpretation of the very obſcure paſſage of the *Súrya-ſidd'hánta* which is the ſubject of their diſcuſſion. That interpretation is ſupported by correſponding paſſages of the *Sóma ſidd'hánta*, *Laghu Vaſiſht'ha*, and *Sácalya-ſanhitá*, in which the number of ſix hundred revolutions is explicitly ſtated:† as well as by other quotations, which

* HE alludes either to the *Váſaná vártica*, in which that emendation of the text is actually ſuggeſted by the annotator NRĬSINHA, or to ſome earlier commentary in which the ſame conjectural emendation may have been originally propoſed.

† युगेषट्शतसङ्ख्याह्यभचक्रंप्रविलंबते ॥ तत्कुणोभूद्दिनैर्भक्रोद्युगुणोऽयनखेचरः । *Sómaſidd'hánta* तत्यश्चाञ्चलितंचक्रम् इत्येतदेकंषट्चलनंयुगेतानिचषट्शतं ॥ *Sácalyaſanhitá*. 1. 286—291. अङ्काःखखर्तुभिर्भाज्यास्तद्दोस्त्रिघ्नाद्दशाहृता ॥ *Laghuvaſiſht'ha Sidd'hánta* cited by DÁDÁBHÁÏ and NRĬSINHA, on the *Súrya ſidd'hánta*.

clearly demonſtrate, that a libration of the equinoxes, at the rate of ſix hundred in a *yuga*, was there meant. For, in all the paſſages quoted, the revolution, as it is termed, of the equinoctial points, conſiſts in a libration of them within the limits of twenty-ſeven degrees eaſt, and as many weſt, of the beginnings of Aries and Libra: and that ſuch is the meaning conveyed in the text of the *Súrya ſidd'hánta*, is diſtinctly ſhown by the commentator cited by Mr. DAVIS,* as well as by the other commentators on that work.

THE ſame doctrine is taught in the *Párášara-ſidd'hánta*, as quoted by MUNÍŚWARA; and, if we may rely on the authority of a quotation by this author from the works of A'RYABHAT'T'A, it was alſo maintained by that ancient aſtronomer: but, according to the firſt mentioned treatiſe, the number of librations amounts to 581,709, and, according to the latter, 578,159 in a *Calpa*, inſtead of 600,000: and A'RYABHAT'T'A has ſtated the limits of the libration at 24° inſtead of 27° †.

BHÁSCARA himſelf, adopting the doctrine for which he quotes the authority of MUNJÁLA, in the paſſage above cited, mentions a complete revolution of the places of the colures through the twelve ſigns of the Zodiack at the rate of II III IIII V VI 59 54 2 31 12 per annum, or 199,669 complete revolutions in a *Calpa*. Having computed upon the ſame

* As Res. 2. p. 267. The commentator is *Nrŕſinha*.

† चतुर्विंशत्यंशैश्चक्रमुभयतोगच्छेत्॥

A'RYABHAT'T'A, in the *Áryáſhtaſ'ata*; quoted by MUNÍŚWARA. It is eſpecially neceſſary to diſtinguiſh the particular work of this author to which reference is made: for BRAHMEGUPTA reproaches him for his inconſiſtency in affirming revolutions of the nodes in the *A'ryáſhtaſ'ata*, which he denied in the *Daſ'agítaca*. It is therefore probable, that the libration of the equinoxes (conſidered as nodes) for which the firſt mentioned work is quoted, may not be ſtated in the other.

principle, the quantity of the preceſſion in his own time at rev. s ° ′ ″ ‴ ⁗ ⁵ ⁶ 91,189 0 10 54 35 23 55 40 48, he thence, for the ſake of facility in calculation, aſſumes in his practical treatiſe, named *Carańa Cutúhala*, the actual preceſſion in whole numbers at eleven degrees, and allows the annual motion to be taken at one minute.* The time, for which this computation was made, is the ſame with the epocha of the *Carańa Cutúhala*;† which is the year 1105 *Śaca*,‡ thirty-three years after the *Śirómańi* was completed ‖

Bhásкara's authority, ſupporting that of Munjála, and countenanced by Vishnú Chandra's,§ has not availed with Indian aſtronomers. Even his commentator Muníswara, rejects the notion of a complete revolution; and, in his own treatiſe entitled *Sidd'hánta Sárvabhauma*, aſſerts the doctrine of libration, and attempts to refute the other opinion, not indeed by argument, but in deference to the *Súrya-ſidd'hánta* and other authorities to which it is oppoſed. Upon the ſame ground, Camalácara in the *Sidd'hánta tatwavivéca* ſays, "The "degrees of the colures, as ſtated by Munjála, and taught in the

* Muníswara, in his commentary on the *Śirómańi*.

† The *Grahalág'hava*, written in 1412 *Śaca*, deducts 444 from the expired years of the *Śaca*, and divides by 60; reckoning the preceſſion at a minute a year. This agrees nearly with the *Carańa Cutúhala*: for, if the ſame number (444) be deducted from the years expired, (1105 *Śaca*;) the remainder gives but one minute above 11°, the quantity there aſſumed by Bhásкara.

Rámachandra, who in the *Cálanirńaya* ſtates the quantity of preceſſion as amounting to 12°, and reckons the preceſſion at a minute of a degree, a year, ſeems alſo to have followed the ſame authority. He may therefore have written about ſixty years ſubſequent to the date of the *Carańa Cutúhala*; or *Śaca* 1165. This aſcertainment of the age of Rámachandra Áchárya is a ſtep towards inveſtigating the age of writers in other branches of ſcience, who have quoted this author or who are cited by him. They are numerous.

‡ Faizí; in his tranſlation of *Bháſcara's Líláwatí*.

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"*Siromani*, contrary to what is declared by ARCA (SÚRYA) and others, "from not rightly underſtanding what was by them declared, muſt "be rejected by the wiſe." He certainly here expreſſes the prevalent opinion of the *Hindu* aſtronomers, which is decidedly in favor of a libration of the places of the colures.

BESIDES MUNJÁLA mentioned by BHÁSCARA, the only other ancient author, whoſe name I find quoted for a complete revolution of the equinoctial and ſolſtitial points, is VISHN'U CHANDRA,* from whoſe works a paſſage is cited by PRI'T'HU'DACASWA'MI, declaratory of a ſolſtitial *yuga*, or period of the *ayana*. The text is corrupt in reſpect of the loweſt digits of the number; and, having found no other quotation of it, I ſhall not attempt to ſtate the period from a conjectural emendation of this paſſage.

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BRAHMEGUPTA and the reſt did not nevertheleſs ſtate it on the ſtrength of authority, ſince it had been declared in the *Saura ſidd'hánta*; in like manner as the numbers of revolutions, the periphery of epicycles, &c ?"* He replies "In mathematical ſcience holy tradition is authority, ſo far only as it agrees with demonſtration." He goes on to ſay "Such motion, as reſults from the aſſigned revolutions, by which, places being calculated agree with thoſe which are obſerved, muſt be admitted whether taught by a holy ſage or by a temporal teacher. If then the ſame places are deducible from other revolutions, which of the aſſigned motions is the true one? The anſwer is, whichever agrees with preſent obſervation muſt be admitted. But, if in proceſs of time the difference become great, then men of genius, like BRAHMEGUPTA, will ariſe, who will acknowledge ſuch motions as agree with preſent obſervation and compoſe books (*S'áſtras*) conformable thereto. Accordingly this mathematical ſcience has no end in eternal time."

BUT BRAHMEGUPTA'S commentator, expounding a paſſage of this author,† which he conſiders to be levelled againſt thoſe who affirmed a periodical revolution of the ſolſtitial points, and which does deny ſuch a revolution, and declares the ſolſtice to be invariable, becauſe the longeſt day and ſhorteſt night occur conſtantly at the end of *Mit'huna* or GEMINI, adverts in the courſe of his expoſition of the text to paſſa-

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"Why has it not been ſtated by BRAHMEGUPTA and other ſkilful aſtronomers? It was not perceived by them, becauſe it was then inconſiderable. But it is perceived by the moderns, becauſe it is now conſiderable. Accordingly it is concluded, that there is motion, [of the ſolſtice."] BHĀSCARA in the *Váſaná-bháſhya*.

* यद्येवमनुपलभ्योपि सैरसिद्धान्तोक्तत्वादागमप्रामाण्येनभगणपरिध्यादिवत्कथं तैर्नोक्तः ॥

† Ch. II.

ges which place the ſouthern and northern ſolſtice reſpectively in the middle of *Aśléſhá*, and beginning of *Dhaniſht'há;* and proceeds to remark 'this only proves a ſhifting of the ſolſtice, not numerous revo-'lutions of it through the ecliptic.' His notion appears then to have been, that his author was aware of the fact of a change in the poſitions of the ſolſtitial and equinoctial points, but did not admit the inference that the motion muſt be periodical.

FROM all that has been ſaid, it appears, that ſome of the moſt celebrated aſtronomers, as BRAHMEGUPTA, have been ſilent on the ſubject of a change in the places of the colures, or have denied their regular periodical motion. That others, as MUNJA'LA and BHA'SCARA (we may add VISHN'U CHANDRA) have aſſerted a periodical revolution of the places of the colures. But that the greater number of celebrated writers, and all the modern *Hindu* aſtronomers, have affirmed a libration of the equinoctial points.

THE earlieſt known author, who is cited for the ſupport of this doctrine, as far as preſent reſearch has gone, is A'RYABHAT'T'A, who is undoubtedly more ancient than BRAHMEGUPTA, for he is repeatedly quoted in the *Brahme Sphú'ta-ſiddhánta* which is aſcribed to BRAHMEGUPTA; and which there is every reaſon to conſider genuine, ſince the text of the book accords with the quotations from that celebrated aſtronomer to be found in treatiſes of various dates.

I PURPOSELY omit in this place the *Súrya-ſiddhánta, Sóma, Sácalya, Váſiſht'ha* and *Párá ſara*, becauſe their authenticity and age are ſubjects of queſtion or of controverſy.

I HAVE dwelt the longer upon the hiſtory of this opinion, becauſe it appears to me deſerving of attention on more than one account. ALBÁTANÍ is the earlieſt of the Arabian aſtronomers who improved upon PTOLEMY. (For ALFARGÁNI, who was a century earlier, is not cited as correcting the Greek aſtronomer on this point.) It was he then, who firſt, among the aſtronomers of the Weſt of Aſia, computed the motion of the ſtars at a degree in 66 years; which is almoſt the ſame with the rate of the motion of trepidation according to the *Súrya-ſidd'hánta*, and the herd of *Hindu* aſtronomers, who reckon a degree and a half in a century.* He is the firſt alſo, as far as can be diſcovered, in whoſe works mention is made of a motion of trepidation, and we may be permitted to conjecture, that the earlier aſtronomers alluded to by him were *Indian;* ſince we find ÁRYABHAT'TA, an author ſeemingly of an earlier age, quoted for a libration of the equinoctial points within the limits of twenty four degrees, at the rate of one in 78 years; and ſince we know that an Arabian aſtronomer, anterior by nearly a century to ALBÁTANÍ, had compiled tables in conformity to rules of aſtronomy apparently *Indian*.†

WE may then ſafely conclude, that, on the ſubject of the preceſſion of the equinoxes, the *Hindus* had a theory, which, though erroneous, was their own; and which, at a ſubſequent time, found advocates among the aſtronomers of the weſt. That they had a knowledge of

* This is the rate reſulting from the quantity of the motion in trepidation ſtated in the *Súrya ſid'hánta*: and the ſame reſults from the rules of calculation given in the *Bhásvatí-carana* of SATANANDA and in the *Játacárnava* improperly aſcribed to VARÁHA-MIHIRA. They both direct the number 421 to be deducted from the expired years of *Sáca;* and the one deducts a tenth and reduces the remainder into degrees; the other adds half and divides by a hundred. Another rule, producing the ſame reſult, is mentioned in BAILLY's Aſt. Ind. p. 76.

† "Ad Regulos Send Hend." *(Sid'hánt?)* Abulfarag. Hiſt. Dynaſt. p. 114, and 161. COSTARD's Aſtronomy, p. 157, and Montucla Hiſt. des math. p. 344.

the true doctrine of an uniform motion in antecedentia, at leaſt ſeven-hundred years ago,* when the aſtronomers of Europe alſo were divided on the queſtion. That they had approximated to the true rate of that motion much nearer than PTOLEMY, before the Arabian aſtronomers, and as near the truth as theſe have ever done ſince. From this we may perhaps be led to a further concluſion, that the aſtronomy of the *Hindus* merits a more particular examination than it has yet obtained, not indeed with any expectation of advancing the ſcience of aſtronomy, which needs not ſuch aid, and can derive none from the labors of aſtronomers who have recorded no obſervations; but for the hiſtory of the ſcience, and aſcertainment of the progreſs which was here made: and that, with this view, the works of *Hindu* aſtronomers, whoſe age is preciſely known, and in particular thoſe of BHÁSCARA, which contain a complete courſe of aſtronomy and of ſciences connected with it, ſhould be carefully peruſed; as well as thoſe of BRAHMEGUPTA, which are full of quotations from earlier aſtronomers, as A'RYABHAT'T'A,† VA'RÁHAMIHIRA,‡ S'RI'SHÉNA,‖ VISHN'UCHANDRA,§ and ſome others, who are cited by him for the purpoſe of expoſing and correcting their errors.

IN regard to VA'RA'HAMIHIRA and the *Súrya-ſidd'hánta*, both ſeparately quoted in the *Brahme-ſphuṭa-ſidd'hánta* of BRAHMEGUPTA, I may here remark, that a book entitled *Súrya-ſidd'hánta* is mentioned by VÁRÁHAMIHIRA himſelf, in his moſt undoubted work, the treatiſe on aſtrology entitled *Váráhi-ſanhitá*, where, deſcribing

* BHÁSCARA, who quotes MUNJÁLA, completed the *S'iromaṇi* in 1072, *Saca*, or A. D. 1150.
† Author of the *Das'agítiká* and *Áryáſhṭa ſata*.
‡ Named with cenſure by BRAHMEGUPTA.
‖ Author of the *Rómaca-ſidd'hánta*.
§ Mentioned as the author of the *Vaſiſht'ha ſidd'hánta*.

the qualifications requiſite to form an accompliſhed aſtrologer, he ſays "the aſtrologer ſhould be converſant with diviſions of "time and geometrical figures as taught in the five *Sidd'hántas*, or "ſyſtems of aſtronomy, called *Pauliſa*, *Rómaca*, *Vaſiſhi'ha*, *Saura*, and "*Paitámaha*." * VA'RA'HAMIHIRA, as appears from the quotations of his own commentator BHAT'T'ÓTPALA and many other aſtronomical writers, is likewiſe author of a treatiſe entitled *Pancha-ſidd'hántica*, in which the five ſyſtems abovementioned are compared; and, as far as can be gathered from quotations, their agreements and diſagreements noticed. A paſſage of this treatiſe, as cited by BHAT'T'ÓTPALA, is ſufficiently remarkable to be here inſerted, ſince it bears relation to the ſubject of this paper. It correſponds in import to a paſſage quoted by Mr. DAVIS, and Sir W. JONES, † from the 3d Chapter of the *Várahíſanhitá*, but refers the actual poſition of the colures to the aſteriſms inſtead of the ſigns of the zodiack.

श्लेषार्द्धादासीद्यदानिवृत्तिःकिलोत्तरायणस्य॥ युक्तमयनंतदासीन्नांपुनर्वसुतः॥ अयनंपुनर्वसुतः॥

"WHEN the return of the ſun took place from the middle of *Aſ'léſhá*, "the tropick was then right. It now takes place from *Punarvaſu*."

THE ſame five ſyſtems of aſtronomy, from which VA'RA'HAMIHIRA is underſtood to have compiled the aſtronomical treatiſe juſt now quoted, and which are named by him in the paſſage of his aſtro-

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* तत्रग्रहगणितेपौलिसरोमकवासिष्ठसौरपैतामहेषुपंचस्वेतेषुसिद्धान्तेषुयुगवर्षायनर्तुमासपक्षाहोरात्रयामम् हूर्त्तनाडीविनाडीप्राणत्रुटित्रुटयवयवस्यकालस्यक्षेत्रस्यचवेत्ता॥

† As. Res. 2d, vol. p. 391.

logy before cited, are mentioned by BRAHMEGUPTA alſo as ſtandard authorities, and enumerated by him in the ſame order: and his names, which are preciſely the ſame with thoſe in VÁRÁHAMIHIRA's enumeration*, are explained by BHAT'T'ÓTPALA, as intending the *Puliśa-ſidd'hánta*, *Rómaca-ſidd'hánta*, *Vaſiſht'ha-ſidd'hánta*, *Súrya-ſidd'hánta*, and *Brahme ſidd'hánta*.

ALL theſe books are frequently cited in aſtronomical compilations: and are occaſionally referred to their real or ſuppoſed authors. The firſt is every where aſſigned to PULIŚA, whoſe name it bears. The *Rómaca-ſidd'hánta* is aſcribed by the ſcholiaſt of BRAHMEGUPTA, and by a commentator of the *Súrya-ſidd'hánta*, to S'RÍŚÉN A or S'RÍS'HE'N'A (for the name is variouſly written.) The *Váſiſht'ha-ſidd'hánta* is by the ſame authority given to VISHN'UCHANDRA. Both theſe authors are repeatedly mentioned with cenſure by BRAHMEGUPTA; and it is acknowledged, that they are entitled to no particular deference.

THE *Brahme-ſidd'hánta*, which is the baſis of BRAHMEGUPTA's work, is not any where attributed to a known author; but referred in all quotations of it, which have fallen under obſervation, either to the *Viſhnu-d'hermóttara Puráńa*, of which it is conſidered as forming a part, or to BRAHME (alſo called PITA'MAHA), who is introduced into it

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* पौलिशरोमकवासिष्ठसौरपैतामहेषु यत्रोक्तं तत्रश्चानयनंनार्यभटोक्तं तदुक्तिरतः ॥

This paſſage, in which the *Paulińa*, *Rómaca*, *Váſiſht'ha*, *Saura* and *Paitámaha* are ſpecified, is introductory to a diviſion of the lunar aſteriſms (for aſtrological purpoſes, it ſhould ſeem,) in unequal portions, by allotting to fifteen of them a quantity equivalent to the mean diurnal motion of the moon in minutes of a degree (790′ 35″); and half as much more to ſix of thoſe aſteriſms (1185′ 52′) and ſo much leſs to the like number of *nacſhatras* (395′ 17″) and aſſigning the complement of the circle (254′ 18″) to the ſupplementary *nacſhatra* called *Abhiji't*.

(☞ The numbers here ſet down are copied from the ſcholiaſt BHAT'T'O'TPALA, and from BHÁSCARA's commentators; being ſtated by them at the neareſt ſecond: for the moon's mean daily motion according to BRAHMEGUPTA and BHÁSCARA is a little leſs than 790′ 35″.

as the ſpeaker in a dialogue with BHRĬGU; or it is acknowledged to be the work of ſome unknown perſon.* The true author it may be now impracticable to diſcover and would be vain to conjecture.

THE *Súrya-ſidd'hánta* if the ſame which we now poſſeſs) is in like manner aſcribed to no certain author, unleſs in the paſſage cited by our colleague Mr. BENTLEY,† who ſays, that "in the commentary on the *Bháſwatí*, it is declared, that VARA'HA was the author of the *Súrya-ſidd'hánta*;" and who adds, that "SATÁNANDA, the author of the *Bháſwatí*, was a pupil of VARÁHA under whoſe directions he himſelf acknowledges he wrote that work."

THE concluding remark alludes to the following verſe of the *Bháſwatí-carana*.

अथप्रवक्ष्येमिहिरोपदेशात् तात्कूर्य्यसिद्धान्तसमंसमासात्॥

"NEXT I will propound ſuccinctly, from MIHIRA's inſtruction, "[this ſyſtem] equal to the *Súrya-ſidd'hánta*."

IT is preceded by an introductory couplet, which will be found quoted at the foot of the page, ‡ or is omitted in ſome copies: but the correct reading, as appears from collation of text and ſcholia, retains both.

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* DA'DA'BHA'I, in his commentary on the *Súrya-ſidd'hánta*, ſays ſo.

यैतामह्ममिकेनचिन्निबद्धं तस्योपरिब्रह्मगुप्तेनयैतामह्नोभट्यंनिबद्धं तदपिपौरुष॥

† As. Res. vol. 6. p. 572.

‡ नत्वामुरस्यस्यारविन्दंश्रीमान्सतानन्द इतिप्रसिद्धः तांभास्वतीं शिष्यहितायमाह शाकेविधीनेशशि पक्षवेदे॥

"Having bowed to the foot of the ſoe of MURA, the fortunate SATÁNANDA propounds, for the benefit of ſtudents, the *Bháſwatí*, in the *Sáca* year 1021."

The author SATÁNANDA, as he himſelf informs us in the cloſe of the book, was an inhabitant of *Puruſhot-*

ADMITTING then its authenticity, and ſuppoſing, with moſt of the commentators, that VA'RA'HAMIHIRA is here intended, by the ſingle word *Mihira*, which however is a name of the ſun, and may here allude to the fabled dialogue of SU'RYA with MEYA, as is obſerved by the ſcholiaſt BALABHADRA;* ſtill the paſſage is not unambiguous. It does not neceſſarily imply oral tuition, and may refer to inſtruction derived from the works of VA'RA'HA; eſpecially from the *Pancha-ſidd'hántica* of that author, in which the *Súrya-ſidd'hánta* was explained concurrently with four other treatiſes termed *Sidd'hánta*.

To return from this digreſſion. It appears from what had been before ſaid, that a work bearing the title of *Súrya-ſidd'hánta* is named as authority by VA'RA'HAMIHIRA, in whoſe time, according to his aſſertion, the place of the ſummer ſolſtice was at the beginning of the ſign *Carcata* and in the aſteriſm *Punarvaſu*. A treatiſe under the ſame title is ſimilarly mentioned by BRAHMEGUPTA, who has likewiſe noticed VA'RA'HAMIHIRA himſelf, and who is ſuppoſed by BHA'SCARA to have lived when the colures had not ſenſibly deviated from that poſition.

IT may be queſtioned whether this teſtimony be not overthrown by proofs of a more modern date (between ſeven and eight hundred years ago) drawn from internal evidence, as ſet forth by Mr. BENTLEY, in his ingenious eſſays inſerted in the 6th and 8th Volumes of our Reſearches.†

tama, (the ſite of the temple of *Jagannát'ha*): and dates his work there in 4200 of the *Caliyúga*. In the body of the work he directs the difference of longitude to be reckoned from the meridian of *Puruſhóttama-cſhétra*.

* His commentary is dated in 1465 of VICRAMÁDITYA; more than 400 years ago.

† Vol. 6. p. 572, and Vol. 8 p. 206.

WITHOUT entering at present into any disqu'sition on this subject, or discu'ng the accuracy of the premis's; but acced'g generally to the position, that the date of a set of astronomical tables, or of a system for the computation of the places of planets, is deducible from the ascertainment of a time when that system or set of tables gave results nearest to the truth; and granting that the date abovementioned approximates within certain limits to such an ascertainment; I shall merely observe, that supposing the dates otherwise irreconcilable, still the book, which we now have under the name of *Súrya*, or *Saura*, *Sidd'hánta*, may have been, and probably was, modernised from a more ancient treatise of the same name, the later work borrowing its title from an earlier performance of a different author. We have an instance of this practice in the kindred case of the *Brahme-sidd'hánta*; for we are acquainted with no less than three astronomical treatises bearing this title; one extracted from the *Vishn'u-dhermóttara*, another termed the *Sác'ya*, and the third the *Sphut'a-sidd'hánta* of BRAHMEGUPTA; and an equal number of tracts entitled *Vasishi'ha sidd'hánta* may be traced in the quotations of authors; one by VISHN'UCHANDRA; another termed *Laghu-vasisi'ha*, which from its name should be an abridgment: and the third, apparently an ample treatise, distinguished as the *Vridd'ha-vasisht'ha*. This solution of the objection also is entirely compatible with the tenor of the references to the *Saura*, which have been yet remarked in the works of BRAHMEGUPTA and VA'RA'HAMIHIRA; none of them being relative to points that furnish arguments for concluding the age of the book from internal evidence.

AT all events, whatever may be thought of the *Súrya-sidd'hánta*, we have the authority of a quotation from ÂRYABHAT'T'A, to show, that the *Hindus* had ascertained the quantity of the precession more correctly than PTOLEMY; and had accounted for it by a motion in libra-

tion or trepidation, before this notion was adopted by any other aſtronomer whoſe labours are known to us.

It appears alſo from a paſſage of BRAHMEGUPTA's refutation of the ſuppoſed errors of that author, and from his commentator's quotation of A'RYABHAT'T'A's text, that this ancient aſtronomer maintained the doctrine of the earth's diurnal revolution round its axis. "The ſphere of the ſtars," he affirms, "is ſtationary; and the earth, making a revolution, produces the daily riſing and ſetting of ſtars and planets."* BRAHMEGUPTA anſwers "If the earth move a minute in a *prán'a*, then whence and what route does it proceed? If it revolve, why do not lofty objects fall?" † But his commentator PRI'T'HÚDACA-SWÁMI', replies, "A'RYABHAT'T'A's opinion appears nevertheleſs ſatisfactory, ſince planets cannot have two motions at once; and the objection, that lofty things would fall, is contradicted; for, every way, the under part of the earth is alſo the upper; ſince, wherever the ſpectator ſtands on the earth's ſurface, even that ſpot is the uppermoſt point."

We here find both an ancient aſtronomer and a later commentator ‡ maintaining, againſt the ſenſe of their countrymen, the rational doctrine which HERACLIDES of *Pontus*, the Pythagorean ECPHANTUS, and a few others among the Greeks, had affirmed of old, but which was abandoned by the aſtronomers both of the eaſt and of

* भपञ्जरः स्थिरोभूरेवावृत्यावृत्य प्रतिदैवसिकौ चोदयास्तमयौ संपादयतिनक्षत्रग्रहाणाम्॥
A'RYABHAT'T'A cited by PRI'T'HU'DACA.

† प्राणेनैतिकलामूर्ध्वंदितत्कुतोव्रजेत्क्रमध्यानम्। आवर्तनमथवाक्षेत्रपतन्तिसमुच्छ्रायात्कस्मात्॥
Brahme-ſphuta-ſidd'hánta.

‡ The commentator wrote at leaſt ſeven centuries ago; for he is quoted by BHA'SCARA in the text and notes of the *S'iróman'i*.

the weſt, until revived and demonſtrated in comparatively modern times.*

BRAHMEGUPTA is more fortunate in his reaſoning where he refutes another theory of the alternation of day and night imagined by the *Jainas*, who account for the diurnal change by the paſſage of two ſuns, and as many moons, and a double ſet of ſtars and minor planets, round a pyramidical mountain, at the foot of which is this habitable earth. His confutation of that abſurdity is copied by BHA'SCARA, who has added to it from PRI'T'HU'DACA's gloſs on a different paſſage of BRAHMEGUPTA, a refutation of another notion aſcribed by him to the ſame ſect, reſpecting the tranſlation of the earth in ſpace.

THIS idea has no other origin than the notion, that the earth, being heavy and without ſupport, muſt perpetually deſcend: and has therefore no relation whatever to the modern opinion of a proper motion of the ſun and ſtars.

PART of the paſſage of BHA'SCARA has been quoted in a former eſſay.† What regards the further ſubject now noticed, is here ſubjoined.

'THE earth ſtands firm, by its own power, without other ſupport, in ſpace.'

'If there be a material ſupport to the earth, and another upholder of that, and again another of this, and ſo on, there is no limit. If

* For an outline of A'RYABHAT'T'A's ſyſtem of aſtronomy, ſee a note at the cloſe of this eſſay.

† As Reſ. Vol. 9. p. 322.

finally ſelf ſupport muſt be aſſumed, why not aſſume it in the firſt inſtance? why not recogniſe it in this multiform earth?

'As heat is in the ſun and fire, coldneſs in the moon, fluidity in water, hardneſs in iron; ſo mobility is in air, and immobility in the earth, by nature. How wonderful are the implanted faculties!

'THE earth poſſeſſing an attractive force;* draws towards itſelf any heavy ſubſtance ſituated in the ſurrounding atmoſphere, and that ſubſtance appears as if it fell. But whether can the earth fall in etherial ſpace which is equal and alike on every ſide?

'OBSERVING the revolution of the ſtars, the *Bauddhas*† acknowledge, that the earth has no ſupport, but as nothing heavy is ſeen to remain in the atmoſphere, they thence conclude, that it falls in etherial ſpace.

'WHENCE doſt thou deduce, *O'Baudd'ha*, this idle notion, that, becauſe any heavy ſubſtance thrown into the air falls to the earth, therefore the earth itſelf deſcends.‡'

HE adds this further explanation in his notes: 'For, if the earth were ſailling, an arrow ſhot into the air would not return to it when the projectile force was expended, ſince both would deſcend.—Nor can it be ſaid, that it moves ſlower, and is overtaken by the arrow; for heavieſt bodies fall quickeſt, and the earth is heavieſt.'

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* Like the attraction of the loadſtone for iron. *Mallic* on BHÁSCARA.

† Meaning the *Jainas*; as appears from the author's own annotation on this paſſage.

‡ *Sirománi Góla'dhyaya*, c. 1. v. 2. 4. 7. and 9.

It has been obſerved in a former part of this eſſay, that BRAHMEGUPTA's treatiſe of aſtronomy is founded on an anterior one entitled *Bráhma-ſidd'hánta*: and the authenticity of the book extant under BRAHMEGUPTA's name has been relied upon, and paſſages have been freely cited from it, as the genuine performance of that ancient aſtronomer. Theſe matters appear to be of ſufficient importance to deſerve a more particular explanation of their grounds.

THE ſource, from which BRAHMEGUPTA drew, is indicated by the author himſelf, in his introductory couplet, cited by LACSHMÍDÁSA in the commentary on BHÁSCARÁ;*

ब्रह्मोक्तग्रहगणितंमहताकालेनयत्स्फुटीभूतम्। अभिधीयतेस्फुटंतत् जिष्णुसुतब्रह्मगुप्तेन॥

which, in a literal verſion, will ſtand thus; "The computation of "planets, as declared by BRÁHMA and become perfect by great length "of time, is perſpicuouſly. *(Sphuṭa)* explained by BRAHMEGUPTA "ſon of JISHNU."

THE ambiguity imputable to this paſſage is obviated by the more explicit terms of the initial ſtanza of his 11th Chapter, where BRAMEGUPTA announces a refutation of opinions oppoſed to the *Bráhma-ſidd'hánta*.

येज्ञानपटलारुद्धदृशोन्यत्राह्याहदर्शनसिद्धान्तात्। तेषांमतादिभेदाद्ये दोषास्तान्प्रवक्ष्यामि॥

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* The *Gánita tatwa Chintámani*, dated in 1423 Saca, or 1501 A. D.

"I will refute the errors (reſpecting the yugas and other matters) of thoſe who miſled by ignorance maintain things contrary to the *Bráhma ſidd'hánta*."

WHAT the work is, to which BRAHMEGUPTA refers under the title ſpecified by him, and correſponding to a ſubſequent mention by him of the *Paitámaha-ſidd'hánta* (both titles being of the ſame import) is explained by the ſcholiaſts of BHÁSCARA and of the *Súrya-ſidd'hánta*. NRÍSINHA, a commentator on both texts,* affirms that BRAHMEGUPTA's rules are formed from the *Viſhńud'hermóttara-puráńa* in which the *Brahme-ſidd'hánta* is contained;† BHÁSCARA's commentator, MUNÍSWARA‡ remarks, that BRAHMEGUPTA, having verified by obſervation the revolutions ſtated in the *Bráhma-ſidd'hánta* of the *Viſhnu-d'harmóttara*, and having found them ſuitable to his own time, adopted theſe numbers, rejecting the revolutions taught by SÚRYA and the reſt. In other places the commentator cites parallel paſſages from BRAHMEGUPTA and the *Bráhma* (alſo termed by him *Paitámaha*) *ſidd'hánta* of the *Viſhńu-d'hermóttara*;‖

* He is author of a commentary on the *Súrya-ſidd'hánta*, and of the *Vásaná Vartica* on BHÁSCARA's text and notes. It is dated in 1543 *Saca*, or 1621 A. D.

† As. Res. vol. 2. p. 242.

‡ Author of the *Márichi* on BHA'SCARA's *S'iromani*, and of a diſtinct treatiſe of aſtronomy, the *Sidd'hánta Sárvabhauma*. The earlieſt copy of the *Márichi* is dated 1560 *S'aca* (A. D. 1638), which is not much later than the date of the work itſelf; for the Emperor NÚRUDDIN JEHANGIR is mentioned at the cloſe of the book, as he alſo is in the preface of a commentary on the *Súrya-ſidd'hánta* by the author's father RANGANÁT'HA.

‖ Take the following as examples:

1ſt. The number of Sidereal days in a *Calpa*, (viz. 1582236450000) which the *Paitámaha-ſidd'hánta*, of the *Viſhńud'hermóttara* cited in *Marichi* ch. 1.) expreſſes by theſe words.—चत्वारिशून्यानिषंचवेदरसाश्वियमभक्षाः शरेन्दवः कल्पेनप्रति नक्षत्रेोदयाः ॥

and BRAHMEGUPTA renders by the equivalent terms, परिवर्तनाख्यचमुष्टयशराब्धिरसगुणयमद्विवसुतिथयः ॥

2d. The commencement of the *Calpa*, on Sunday, 1ſt Chaitra, at the moment of ſunriſe on the meridian of *Lancá* which the *Bráhma-ſidd'hánta* of the *Viſhńu d'hermottara-purána* (Marichi, Ch. 2.) thus ex-

and these with numerous quotations from BRAHMEGUPTA in the *Chintámani* and in other commentaries on BHÁSCARA, as well as in the author's notes on his own text, are exactly conformable with the *Brahme-sphuta-sidd'hánta* now in my possession, and which is accompanied by the gloss of BRAHMEGUPTA's celebrated commentator CHATURVÍDA PRĬT-HÚDACA SWÁMÍ.

IT appears then from a collation of the passages so cited, that BRAHMEGUPTA's work is, at least in part, a paraphrase of the BRÁHMA or PAITÁMAHA; containing however, additional matter: and it is accordingly termed by one of the scholiasts of the *Súrya sidd'hánta*,* a commentary, on the *Paitámaha*; and CHATURVÍDA's gloss is denominated by the same scholiast, an interpretation of the *Paitámahi-bháshya*.

IN support of what has been here said, I shall adduce a few instances of quotation on subjects possessing some degree of interest.

THE first is one in which BHÁSCARA vindicates a passage of BRAHMEGUPTA from the objections of his commentator, quoting the passage itself in his notes, and there naming the scholiast, CHATURVÍDA: From which, be it remarked, the commentary is ascertained to be anterior

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professes लंकायामर्कोदये चैत्र शुक्लप्रतिपदारंभेर्कदिनादावश्विन्यादौ किंस्तुघ्नादौ रौद्रादौ कालप्रवृत्तिः ॥

and BRAHMEGUPTA by the following couplet

चैत्रसितादेरुदयाद्भानोर्दिनमासवर्षयुगकल्पाः । सृष्ट्यादौ लंकायां समं प्रवृत्ता दिनेऽर्कस्य ॥

* DÁDÁBHAJ, see p. 29.

to BHÁSCARA's work: I have a further reaſon, however, for citing the paſſage, as it furniſhes occaſion for ſome obſervations on the *Indian* theory of Aſtronomy.

THE *Hindus*, as is well known, place the earth in the centre of the world, and make the Sun, and Moon and minor planets revolve round it, apparently in concentrick orbits, with unequal or irregular motion. For a phyſical explanation of the phœnomena, they imagine the planets driven by currents of air along their reſpective orbits (beſides one great vortex carrying ſtars and planets with prodigious velocity, round the earth, in the compaſs of a day.) The winds or currents, impelling the ſeveral planets, communicate to them velocities, by which their motion ſhould be equable and in the plane of the ecliptick; but the planets are drawn from this courſe by certain controlling powers, ſituated at the apogees, conjunctions and nodes.

THESE powers are clothed by *Hindu* imaginations with celeſtial bodies inviſible to human ſight, and furniſhed with hands and reins, by which they draw the planets from their direct path and uniform progreſs. The being at the apogee, for inſtance, conſtantly attracts the planet towards itſelf, alternately however with the right and left hands. The deity of the node diverts the planet, firſt to one ſide, then to the other, from the ecliptick. And laſtly, the deity at the conjunction cauſes the planet to be one while ſtationary, another while retrograde, and to move at different times with velocity accelerated or retarded. Theſe fancied beings are conſidered as inviſible planets; the nodes and apogees having a motion of their own in the ecliptick.

THIS whimſical ſyſtem, more worthy of the mythologiſt than of the aſtronomer, is gravely ſet forth in the *Súrya-ſidd'hánta*: and even BHÁSCARA gives into it, though not without indications of reluctant acquieſcence; for he has not noticed it in his text, and only briefly in his notes.

To explain on mathematical principles the irregularity of the planetary motions, the *Hindu* aſtronomers remove the earth from the centre of the planet's orbit, and aſſume the motion in that excentrick to be really equable, though it appear irregular as viewed from the earth. Another hypotheſis is alſo taught by them; according to which the planet revolves with an equal but contrary motion in an epicycle, of which the centre is carried with like but direct motion on a concentrick orbit.

BHÁSCARA remarks, that both theories are equivalent, giving the ſame reſults in computation: but he maintains, that the planet's motion in an excentrick orbit *(pratimandala)* is conſonant to the truth; and the other hypotheſis of an epicycle *(nichóchcha-vrítta)* is merely a device for the facility of computation.

BOTH theories, with certain modifications, which will be ſubſequently noticed, ſuffice for the anomaly of the Sun and Moon. To account for the ſtill greater apparent irregularities of the five minor planets, the *Hindu* aſtronomers make them revolve with direct motion on an epicycle borne on an excentrick deferent. (In the caſe of the two inferior planets, the revolution in the excentrick is performed in the ſame time with the Sun: conſequently the planet's motion in its epicycle is in fact its proper revolution in its orbit. In the inſtance of the ſuperior planets on the contrary, the epicycle correſ-

ponds in time to a revolution of the Sun; and the excentrick deferent anſwers to the true revolution of the planet in its orbit.)

So far the *Indian* ſyſtem, as already remarked by Mr. DAVIS in his treatiſe on the aſtronomical computations of the *Hindus*,* agrees with the *Ptolemaick*. At the firſt glance it will remind the reader of the hypotheſis of an excentrick orbit deviſed by HIPPARCHUS; and of that of an epicycle on a deferent, ſaid to have been invented by APOLLONIUS but applied by HIPPARCHUS. At the ſame time the omiſſion of an equant (having double the excentricity of the deferent) imagined by PTOLEMY for the five minor planets, as well as the epicycle with a deferent of the centre of the excentrick, contrived by him to account for the evection of the Moon; and the circle of anomaly of excentricity, adapted to the inequality of MERCURY's motions, cannot fail to attract notice.

THE *Hindus*, who have not any of PTOLEMY's additions to the theory of HIPPARCHUS, have introduced a different modification of the hypotheſis, for they give an oval form to the excentrick or equivalent epicycle, as well as to the planet's proper epicycle. That is, they aſſume the axis of the epicycle greater at the end of the *(ſama)* even quadrants of anomaly (or, in the line of the apſides and conjunctions,) and leaſt at the end of the *(viſhama)* or odd quadrants (1ſt and 3d), and intermediately in proportion†. This contrivance of an oval epi-

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* As. Res. vol. 2. p. 250.

† Rad: Sine of Anomaly :: Diff. between circles deſcribed on greateſt and leaſt axis: diff. between circles deſcribed on greateſt axis and on the diameter of the epicycle for the propoſed anomaly. Whence the circle deſcribed on that diameter is determined; and is uſed for the epicycle in computations for that anomaly. Since circles are to each other as their Radii, the proportion above ſtated anſwers to the following;

cycle is applied by certain aſtronomers to all the planets; and by others, is reſtricted to few; and by ſome, is altogether rejected. ARYABHÁT'T'A, for example, and the *Súrya-ſidd'hánta*, make both epicycles of all the planets oval, placing however the ſhort axis of the proper epicycles of Jupiter and Saturn in the line of mean conjunction termed by *Hindu* aſtronomers their quick apogee *(Síghróchcha)*. BRAHMEGUPTA and BHÁSCARA, on the contrary, acknowledge only the epicycles of Mars and Venus to be oval; and inſiſt, that the reſt are circular. The author of the *Sidd'hánta Sárvabhauma* goes a ſtep further, maintaining that all are circular, and taking the mean between the numbers given in the *Súrya-ſidd'hánta*.

DIMENSIONS OF THE EPICYCLES IN DEGREES OF THE DEFERENT.

		☉	☾	♂	☿	♃	♀	♄
Epicycle of Anomaly.	*Brahmegupta.*	13 40′	31° 36′	70°±6 40′	†	38°	33°	11° & 9° ‖ 30°
	Bháscara,	—	—	—	—	—	—	—— 50
Circle described on the great axis of the oval epicycle.	*Súrya Sidd'hánta,*	14	32	75		30	33	12 49
Circle described on the leſs axis.		13 40	31	40 72		28	32	11 43
Proper epicycle.	*Brahmegupta,*			243	40±6	40†	132	68 258 &263 ‖ 40
Circle on the great axis of the oval epicycle.	*(Súrya Sidd'hánta)*			235			133	72 262 40
Circle on the leſs axis.				232			132	70 260 32

ſemitranſverſe axis: diff. between tranſverſe and conjugate ſemiaxis :: ordinate of the circle: a fourth proportional; which is preciſely the difference between that ordinate and an ordinate of the ellipſe for the ſame abſciſs. Hindu aſtronomers take it for the difference between the Radius of the circumſcribed circle and the ſemidiameter of the ellipſe at an angle with the axis equal to the propoſed anomaly; and, in an ellipſis very little excentrick, the error is ſmall.

† The epicycles of Mars, according to BRAHMEGUPTA and BHÁSCARA, are increaſed in ſix ſigns and diminiſhed in ſix other ſigns of anomaly, by a quantity found by this proportion; ſine of 45°: ſine or co-ſine of anomaly (whichever be the leaſt) :: 6° 40′: correction additive in ſix firſt ſigns, and ſubtractive in ſix laſt.

‖ The epicycles of Venus are oval, and the circles deſcribed on the tranſverſe and conjugate axis (circles circumſcribed and inſcribed) are here ſtated.

A FURTHER difference of theory, though not of practice, occurs among the *Hindu* aſtronomers, in regard to the curvature of the excentrick deferents, and the conſequent method of computing on the equivalent hypotheſis of epicycles.

A REFERENCE to Mr. DAVIS's eſſay* and to the diagrams which accompany it, will render intelligible what has been already ſaid and what now remains to be explained. It is there obſerved, that it is only in computing the retrogradations and other particulars reſpecting the minor planets, that the *Hindus* find the length of the *Carńa* ∈ ⊕ † (or line drawn from the centre of the earth to the planet's place in the epicycle). In other caſes, as for the Anomaliſtick Equation of the Sun and Moon, they are ſatisfied to take *hc* as equal to the Sine *lm* ‡ (that is, the Sine of mean anomaly, reduced to its dimenſions in the epicycle in parts of the radius of the concentrick, equal to the Sine of the Anomaliſtick Equation). The reaſon is ſubjoined: "The difference, as the commentator on the *Súrya-ſidd'hánta* obſerves, being inconſiderable."

MOST of the commentators on the *Súrya-ſidd'hánta* do aſſign that reaſon; but ſome of them adopt BRAHMEGUPTA's explanation. This aſtronomer maintains, that the operation of finding the *Carńa* is rightly omitted in reſpect of the excentricks or equivalent epicycles of all the planets, and retained in regard to the proper epicycles of the minor planets carried by the excentrick deferents. His hypotheſis, as briefly intimated by himſelf, and as explained by BHÁSCARA, ſuppoſes the

* As. Res. vol. 2. p. 249.
† As. Res. vol. 2. p. 250 Diagram fig. 2.
‡ Ibid.

epicycle, which repreſents the excentrick, to be augmented in the proportion which *Carna* (or the diſtance of the planet's place from the the earth's centre) bears to the Radius of the concentrick; and it is on this account, and not as a mere approximation, that the finding of the *Carna*, with the ſubſequent operation to which it is applicable, is diſpenſed with.*

The ſcholiaſt of Brahmegupta objects to his author's doctrine on this point, that, upon the ſame principle, the proceſs of finding the *Carna*, with the ſubſequent employment of it to find the Sine of the Anomaliſtick Equation, ſhould in like manner be omitted in the proper epicycles of the five minor planets; and he concludes therefore, that the omiſſion of that proceſs has no other ground, but the very inconſiderable difference of the reſult in the inſtance of a ſmall epicycle. For as remarked by another author,† treating on the ſame ſubject, the Equation itſelf and its Sine are very ſmall near the line of the apſides; and at a diſtance from that line, the *Carna* and Radius approach to equality.

Bha'scara, in the *Siromani*, quotes ſuccinctly Brahmegupta's doctrine, and the Scholiaſt's objection to it; and replies to the latter: and

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* For Rad: Periphery of the epicycle :: *Carna*: augmented epicycle.
And Circle: Sine of Anomaly :: augmented epicycle: Sine of Anomaly in augmented epicycle.
Laſtly *Carna*: Sine of Anomaly in augmented epicycle :: Rad: Sine of Anomaliſtick Equation.

$$\text{Whence Periphery} \times \frac{\text{Carna}}{\text{Radius}} \times \frac{\text{Rad.}}{\text{Carna}} \times \frac{\text{Sine of Anomaly}}{\text{Circle}} = \text{Sine of Anomaliſtick Equation.}$$

$$\text{And, abridging, Periphery} \times \frac{\text{Sine of Anomaly}}{\text{Circle}} = \text{Sine of Anomaliſtick Equation.}$$

Wherefore Circle: Periphery of epicycle :: Sine of Anomaly: Sine of Anomaliſtick Equation.
† In the *Marichi*.

in his notes in the *Vásaná-bháshya*, cites the text of BRAHMEGUPTA and CHATURVE'DA's reaſoning, which he tries to confute. His quotation agrees perfectly with the preſent text of the *Brahme-ſphuta-ſidd'hánta* and commentary of CHATURVE'DA' PRITHU'DACA SWÁMÍ, which is annexed to it.

THE paſſage, which has required ſo much preparatory explanation, is itſelf ſhort.

त्रिज्याभक्तःकर्णःपरिधिगुणोबाऽकोटिगुणकारः भ्रमऊन्मन्देनन्फलमाद्य समंनात्रकर्णोऽस्मात् ॥

'THE *Carna*, or longeſt ſide of the triangle, multiplied by the Periphery of the epicycle and divided by Radius, becomes the multiplier of the Sine and Coſine of Anomaly. The ſame reſult, as before, is obtained by a ſingle operation in the inſtance of the Anomaliſtick epicycle: and therefore *Carna* is not here employed.'

BHA'SCARA's words in the *Siromani* are theſe: 'Some ſay, that in this ſyſtem, in the operation of finding the Equation of Anomaly, the *Carna* or long ſide of the triangle is not employed, becauſe the difference in the two modes of computation is very inconſiderable. But others maintain, that, if the *Carna* be uſed, the Periphery of the epicycle muſt in this operation be corrected, by multiplying it by *Carna* and dividing by Radius. Wherefore the reſult is the ſame as by the former method; and on that account, they ſay, the *Carna* is not employed. It is not to be objected, why is not the ſame method uſed in the *Sighra* epicycle? For the principles of the two differ.'

In his notes on this part of his text, he cites, as before obſerved, the preciſe paſſage of Brahmegupta which has been inſerted above, and a portion of Chaturvéda's comment on it, and names the author.

In another inſtance Bháscara quotes in his *Siróman̂i* Brahmegupta by name, and the commentator by implication, (and fuller quotations of both occur in the notes and commentaries,) for a diſagreement in regard to the latitude of ſtars and planets meaſured from the ecliptick both on a circle drawn through its poles, and on one paſſing through the poles of the ecliptick, the latter termed *Sphuṭa* or apparent and the other *Aſphuṭa* or unapparent.* Bháscara remarks, that Brahmegupta has directed the latitudes of planets to be computed by one mode, and has given thoſe of the ſtars in the other, but has ſtated no rule for reducing the latitude of one denomination to the other, or for rectifying the true latitude from the meaſure given on the circle of declination. The reaſon he conſiders to be the little difference between them; (which is true in reſpect of the planets, though not ſo in the caſe of moſt of the ſtars;) and the frequent occaſion in aſtronomical computations, for the declination of ſtars, while their proper latitude is not an element in any calculation; whereas, in the caſe of the planets, both are employed on different occaſions: he adverts to a ſtrained interpretation propoſed by the commentator to conſtrue Brahmegupta's rule as adapted to the ſame denomination of latitude which is employed by him for the ſtars. Bháscara refutes that interpretation, and juſtifies Brahmegupta's text taken in its obvious and natural ſenſe.

* *Aſphuṭa Sara* is the true latitude of a ſtar of planet; *Sphuṭa Sara* is its declination ± declination of the point of interſection in the ecliptick.

THIS paſſage of the *S'iróman'i* * confirms what was ſaid by me, from other authority, in a former eſſay, † concerning the *Hindu* method of determining a ſtar's place with reference to the ecliptick, by the interſection of a circle of declination, and by taking the latitude and longitude of the ſtar to that point of interſection, inſtead of employing a perpendicular to the ecliptick.

THE only other paſſage, to which I ſhall draw the reader's attention, is one of conſiderable length, in which BRAHMEGUPTA, although he have rightly given the theory of Solar and Lunar Eclipſes, with the aſtronomical principles on which they are to be computed, affirms in compliance with the prejudices of *Hindu* bigots, the exiſtence of *Ráhu* as an eighth planet and as the immediate cauſe of eclipſes, and reprehends VÁRÁHAMIHIRA, A'RYABHAT'T'A, SRI'SHÉNA and VISHN'UCHANDRA for rejecting this orthodox explanation of the phenomenon. The paſſage is quoted by BHÁSCARA's commentator in the *Chintámani*, on the occaſion of a more conciſe text of the *S'irómaṅi* affirming the agency of *Ráhu* in eclipſes. ‡

THIS quotation from the *Brahme-ſidd'hánta*, compriſing ſeven couplets in the *Chintámaṅi*, has been verified in the text of the *Brahme-ſphut'a-ſidd'hánta* of BRAHMEGUPTA. §

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* ब्रह्मगुप्तादिभिःस्वस्वान्तरत्वान्नकृतःस्फुटः ॥ स्थित्यर्द्धपरिलेखादैागणितागतएवहि ॥ नक्षत्राणा स्फुटाएवस्थिरत्वात्यटिताःएवः ॥ दृक्कर्मणायनैतेषांसंस्कृतास्तेतथाध्रुवाः ॥ &c. *Góládhyáya* c. 3. v. 13 &c.

† As. Res. vol. 9.

‡ Part. 2. ch. 7. v. 10.

§ *Góládhyáya*.

All theſe, with numerous other inſtances in the annotations, and commentaries of the *Siró'maṅi*, which I refrain from adducing, leſt the reader's patience ſhould be tired, have eſtabliſhed to my entire conviction the genuineneſs of the text of the *Sphuṭa-ſidd'hánta* founded on a prior treatiſe entitled *Bráhme-ſidd'hánta*.

I am not unappriſed, that, under a feeling of great diſtruſt or unwillingneſs to admit the concluſions which follow from this poſition, a variety of hypotheſes might be formed to a different effect. Brahmegupta, ſuppoſing him to be entirely an original writer, may have referred to an imaginary work to give that kind of authority to his performance which the *Hindus* moſt fancy; or he may have fathered on a *puráńa* a ſynopſis of his own doctrine for the ſame purpoſe; or ſome other writer, from whatever motive, may have fabricated a pretended extract of a *puráńa* containing the heads of Brahmegupta's ſyſtem, and have given currency to it on the ſtrength of the reference in that aſtronomer's treatiſe to an anterior work. Theſe and other ſuppoſitions grounded on ſurmiſe of fraud and forgery may be formed. I ſhall not diſcuſs them: for I have no concern but with the facts themſelves. Bháscara, writing 650 years ago, declares, and ſo do all his commentators, that he has followed Brahmegupta as his guide. They quote numerous paſſages from his work; and Bha'scara affirms that Brahmegupta took the numbers of revolutions aſſigned to the planets in the great period termed *Calpa* from an earlier authority. The commentators, who wrote from two to four centuries ago, aſſert, that thoſe numbers were taken from a treatiſe in form of dialogue between Bhágavat (or Bra'hma) and Bhr̆gu, inſerted in the *Viſhńu-d'hermóttara-puráńa* and diſtinguiſhed by the title of *Bráhma* or *Paiṫamaha Sidd'hánta*. They cite parallel paſſages, which do in fact

exactly accord in ſenſe and import. They occaſionally quote obſervations on BRAHMEGUPTA by his ſcholiaſt CHATURVÉDA PRĬTHUDACA SWÁMI. A book is extant (a copy, partly deficient however, having come into my poſſeſſion with other aſtronomical collections;) and which conſiſts of a text under the title of *Brahme-ſphut'a-ſidd'hánta* accompanied by a continual commentary by CHATURVÉDA PRĬTHUDACA SWÁMÍ. The text contains the ſame aſtronomical doctrine which BHÁSCARA teaches, and which he profeſſes to have derived from BRAHMEGUPTA; and paſſages quoted by him in his text, or at more length in his notes, or by his commentators, or by other aſtronomical writers, as the words of BRAHMEGUPTA, are found verbatim in it. I conſider it therefore as the genuine text of the treatiſe uſed by BHA'SCARA, as BRAHMEGUPTA's; and ſeeing no reaſon for ſuſpicion and diſtruſt, I quote it as the authentick work of that celebrated aſtronomer.

As the evidence which has been here collected with reference to particular points, bears alſo upon other queſtions, I ſhall now ſtate further concluſions, regarding the hiſtory of Indian aſtronomy, which appear to me to be juſtly deducible from the premiſes. Thoſe concluſions will be ſupported, when neceſſary, by additional references to authorities.

BRAHMEGUPTA and VA'RA'HAMIHIRA, though named at the head of aſtronomers by BHA'SCARA and SATA'NANDA and by the herd of later writers, are not to be conſidered as the authors of the *Indian* ſyſtem of aſtronomy. They abound in quotations from more ancient aſtronomers, upon whoſe works their own are confeſſedly grounded. In addition to the names beforementioned,* thoſe of PRADYUMNA, LÁLA

* Page 221.

SINHA and LÁD'HÁCHÁRYA may be here ſpecified. But the *Bra'hme-ſidd'hánta* and the works of A'RYABHAT'T'A are what principally engages BRAHMEGUPTA's attention: and the five *Sidd'hántas* have been the particular ſubject of VARA'HÁMIHIRA's labors. He appears to have been anterior to BRAHMEGUPTA, being actually cited by him among other writers, whoſe errors are expoſed and corrected.

VA'RA'HAMIHIRA, conſtantly quoted as the author of the *Várâhi-ſanhitá* and *Pancha-ſidd'hánticá*, muſt be judged from thoſe works, which are undoubtedly his by the unanimous conſent of the learned, and by the teſtimony of the ancient ſcholiaſt BHAT'T'O'TPALA. The minor works, aſcribed to the ſame author, may have been compoſed in later times, and the name of a celebrated author have been affixed to them, according to a practice, which is but too common in *India* as in many other countries. The *Já'acárńava* for example, which has been attributed to him, may not improbably be the work of a different author. At leaſt I am not apprized of any collateral evidence (ſuch as quotations from it in books of ſome antiquity) to ſupport its genuineneſs, as a work of VA'RA'HAMIHIRA's.

IN the *Várâhi-ſanhitá*, this author has not followed the ſyſtem which is taught in the *Súrya-ſidd'hánta*. For inſtance his rule for finding the year of the cycle of 60 years, founded on the mean motions of Jupiter, ſhows that he employed a different number from that which the *Súrya-ſidd'hánta* furniſhes: viz. 364224 revolutions in a *yuga*, inſtead of 364200; and it appears from a quotation of the ſcholiaſt, that A'RYABHAT'T'A is the authority for that number of revolutions of Jupiter.

BEFORE the age of VA'RA'HAMIHIRA and BRAHMEGUPTA, and ſubſequently to that of GARGA, a number of illuſtrious aſtronomers

flouriſhed, by whom the ſcience was cultivated and promoted, but whoſe works unhappily are loſt, or at leaſt have not been yet recovered, and are at preſent known to us only by quotation. No leſs than ten intermediate writers are cited by BRAHMEGUPTA; of whom five at the leaſt are noticed by VA'RA'HAMIHIRA.*

THE proficiency of the *Yavanas* in aſtronomy was known to VA'RÁHAMIHIRA. He has mentioned it with applauſe †, and has more than once referred to the authority of their writers. The name of YAVANÁCHA'RYA, which occurs frequently in the compilations of *Hindu* aſtronomers, ‡ has apparently reference to an author of that nation; which is characteriſed by VARÁHAMIHIRA as a people of *Mléch'has* or barbarians. The title of *Rómaca Sidd'hánta* given by S'RÍSHÉNA to his aſtronomical treatiſe, which is quoted under this title by VARA'HAMIHIRA and BRAHMEGUPTA, may be preſumed alſo to carry ſome alluſion to the ſyſtem of the aſtronomers of the Weſt.

IF theſe circumſtances, joined to a reſemblance hardly to be ſuppoſed caſual, which the *Hindu* aſtronomy with its apparatus of eccentricks and epicycles bears in many reſpects to that of the *Greeks*, be thought to authorize a belief, that the *Hindus* received from the *Greeks*, that knowledge which enabled them to correct and improve

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* See before p. 221 223, and 243.

† म्लेच्छा हि यवनास्तेषु सम्यक् शास्त्रमिदं स्थितं ॥ ऋषिवत्ते पि पूज्यन्ते किं पुनर्दैवविद् द्विजः ॥

"For the YAVANAS are barbarians; but this ſcience is well eſtabliſhed among them; and they are revered like holy ſages: much more ſhall a prieſt who is learned in it be venerated."

‡ As. Res. vol. 9, p. 376.

their own imperfect aſtronomy, I ſhall not be inclined to diſſent from the opinion. There does indeed appear ground for more than a conjecture, that the *Hindus* had obtained a knowledge of *Grecian* aſtronomy before the *Arabs* began to cultivate the ſcience; and that the whole cluſter of aſtronomers mentioned by BRAHMEGUPTA, muſt be placed in the interval between the age of HIPPARCHUS, and poſſibly that of PTOLEMY, and the date of BRAHMEGUPTA's reviſion of the *Brahme-ſidd'hánta*.

IN reforming the *Indian* aſtronomy, BRAHMEGUPTA, and the aſtronomers who preceded him, did not take implicitly the mean motions of the Planets given by the *Grecian* aſtronomer. In general they are wider from the truth than PTOLEMY.† But, in the inſtance which is

† Mean Diurnal Motions of the Planets.

	BRAHMEGUPTA.					SÚRYA-SIDD'HÁNTA.					PTOLEMY.					LALANDE.				
	°	I	II	III	IV	°	I	II	III	IV	°	I	II	III	IV	°	I	II	III	IV
☉	0	59	8	10	22	0	59	8	10	10	0	59	8	17	13	0	59	8	19	48
☽	13	10	34	52	47	13	10	34	52	3	13	10	34	58	30	13	10	35	1	40
☽ − ☉	12	11	26	42	25	12	11	26	41	53	12	11	26	31	17	12	11	26	41	52
♂	0	31	26	28	7	0	31	26	28	11	0	31	26	36	53	0	31	26	39	23
☿	4	5	32	18	28	4	5	32	20	42	4	5	32	24	12	4	5	32	34	13
♃	0	4	59	9	9	0	4	59	8	48	0	4	59	14	26	0	4	59	15	53
♀	1	36	7	41	35	1	36	7	43	39	1	36	7	43	6	1	36	7	48	24
♄	0	2	0	22	52	0	2	0	22	53	0	2	0	33	31	0	2	0	35	38

In this comparative Table computed to fourth minutes, it will be remarked, that the *Hindu* aſtronomers moſtly agree to third minutes and differ in the fourths. They diſagree with PTOLEMY at the thirds, and give in almoſt every inſtance ſlower motions, than he does, to the planets, and ſtill ſlower than the truth. In the moon's ſynodical motion, however, they are very nearly correct. On the other hand, the Equation of the centre deducible from the epicycles (page 238) is a nearer approximation to the truth, than reſults from the excentricity aſſigned by PTOLEMY to the Orbits of the Planets.
For inſtance,

	°	I	II
Excentricity of the Sun's Orbit:			
Súrya Sidd'hánta and *Brahmegupta*, (Radius of the epicycle,)	2	10	30
Hipparchus and Ptolemy (Alm. l. 3. c. 4.) in parts, of which Radius contains 60.	2	29	30
Albátani (c. 28)	2	4	45
Greateſt equation of the ſun's centre.			
Súrya-ſidd'hánt, &c (computed by the commentators.)	2	10	32
Ptolemy (Ricc. Alm. nov.)	2	23	
Albátani	1	59	
Alphonſine Tables.	2	10	
Kepler, &c.	2	3	46
Lalande (3d Edit.)	1	55	39½

the ſubject of this paper, they made a nearer approach to accuracy than he had done, and muſt therefore have uſed other obſervations beſides thoſe which he has recorded.

The *Arabs* adopted in its totality Ptolemy's theory of the motions of the planets; which the *Hindus* have only in part. But the *Arabs* improved on his aſtronomy by careful obſervations: a praiſe to which the *Hindus* are not equally entitled. Alba'tani diſcovered the motion of the Sun's apogee, and ſuſpected from analogy a motion of the apſides of the minor planets*. The *Hindus* ſurmiſed the motion of the apogee of the Sun, and nodes and apſides of the planets, from analogy to the Moon's;† but were unable to verify the conjecture by obſervation; and have in fact merely aſſigned arbitrary numbers to the ſuppoſed revolutions, to bring out the places right, (or as nearly ſo as they had determined them,) relatively to the origin of the ecliptick in their ſphere, and conformably to their aſſumption of a grand conjunction of the planets, nodes, and apſides in that point of the ecliptick at a vaſtly remote period. Bha'scara, when treating of the manner of verifying or of finding the number of revolutions of the planets, &c. in a given period, teaches the mode of obſerving the planetary motions, but conſiders the life of man too ſhort for obſerving the motion of the apſides and nodes (the Moon's excepted); and certainly the revolutions aſſigned to them by him and other *Hindu* aſtronomers are too few, and the motions too ſlow, (the quickeſt not exceeding 7 degrees in 100000 years;) to have been aſſumed on any other ground but the arbitrary one juſt now ſtated. The aſtronomical inſtruments employed by the *Hindus*, of which Bh'ascara deſcribes nine, including one of his own invention, and comprehending the quadrant, ſemicircle and entire circle, beſides the armillary ſphere, horary ring,

* Montucla, p. 349.
† Bha'scara in *Vásanábháshya*.

gnomon and clepſydra,* were too rudely executed, whatever may be thought of their deſign, to enable the aſtronomers to make very delicate obſervations; and they were not aſſiſted, as in the preceſſion of the equinoxes, by the memory of a former poſition recorded in their ancient writings.

NOTE REFERRED TO FROM PAGE 228.

According to A'RYABHA'T'T'A as quoted by BRAHMEGUPTA and his ſcholiaſt PRI'T'HU'DACA SWA'MI',

One *Yuga* contains		Years	1,080,000
One *Mahá-yuga* =	4	*Yugas*	4,320,000
One *Manu-yuga* =	72	*Mahâyugas*	311,040,000
One *Calpa* = 14 *Manus* =	1008	*Mahâyugas*	4,354,560,000

☞ The *Calpa* began on Thurſday 1ſt *Chaitra ſuclá*, at the moment of ſun-riſe at *Lancá*.

Years expired from the commencement of the *Calpa* to the war of the *Bhárata* or beginning of the *Cali age*. - -	1,986,120,000
Add expired years of the *Cali* to the *Saca* era, - -	3,179
Years from the beginning of the *Calpa* to the commencement of the *Saca* era, - - -	1,986,123,179
Years expired from the commencement of the preſent *Mahá-yuga*, to the beginning of the *Cali age*, when there was a conjunction,	3,240,000
Revolutions of the earth round its own axis, in a quadruple *yuga*, or *Mahá-yuga*, - - - - -	1,582,237,500
Hence, deducting revolutions of the ſun, - -	4,320,000
Remain, Nycthemera, or *Sávana* days, in a *Mahá-yuga*, -	1,577,917,500

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* Góládhyáya, ch. 9.

☞ Length of the ſidereal year is there-

	d	g	ı	ıı		d	h	ı	ıı
fore according to Á'RYAB'HAT'T'A,	365	15	31	15	or	365	6	12	30

N. B. Á'RYAB'HAT'T'A taught the earth's diurnal revolution round its axis; a doctrine which BRAHMEGUPTA controverts; but to which his ſcholiaſt PRI'T'HÚDACA SWÁMI' inclines.

According to the *Pauliſá-ſidd'hánta* cited by BHAT'T'ÓTPÁLA on VARÁHAMIHIRA's *Sanhitá*, and by PRI'T'HÚDACA-SWÁMI on BRAHMEGUPTA's *Sidd'hánta*,

Crita-yuga,	4800 divine years =		1,728,000
Tréta,	3,600	=	1,296,000
Dwápara,	2,400	=	864,000
			3,888,000
Cali,	1,200	=	432,000
Mahá-yuga,		=	4,320,000

☞ This author's computation of the *Calpa* has not been found in any quotation. But he is cited as reckoning its commencement from midnight.

Years expired from the commencement of the preſent *Mahá-yuga* to the firſt conjunction of the planets, in the *Crita-yuga*, 648,000

Interval between that and the laſt conjunction, at the beginning of the *Cali-yuga*, - - 3,240,000

Years expired to the commencement of the *Cali-yuga*, 3,888,000

Mean ſolar (*Saura*) days, termed by other aſtronomers *Sávana* days; in one *Mahá-yuga*, - 1,577,917,800

☞ Length of the year, according to

	d	g	ı	ıı		d	h	ı	ıı
the *Paulisa-ſidd'hánta*,	365	15	31	30	or	365	6	12	36

N. B. The difference of 300 days in the computations of ARYAB'HATTA and PULISA, gives one day in 14,400 years, as is remarked by BRAHMEGUPTA.

Length of the year according to

	d	g	ı	ıı	ııı	d	h	ı	ıı	ııı	ıvı
the *Súrya-ſidd'hánta*	365	15	31	31	24 =	365	6	12	36	33	36
—— according to BRAHMEGUPTA -	d 365	g 15	ı 30	ıı 22	ııı 30 =	d 365	h 6	ı 12	ıı 9		

The computation of the *yuga* and *calpa*, according to theſe authorities, is well known; and need not be exhibited in this place. They make it begin on Sunday; the one at midnight, the other at ſunriſe, on the meridian of *Lanca*; and the elapſed years to the beginning of the *Cali* age are 1,972,944,000. (To which BRAHMEGUPTA adds 3,179 years to the *S'aca* era.) The *Súrya-ſidd'hánta* deducts 17,064,000 years; making the epoch of a ſuppoſed conjunction of planets by ſo many years later than the beginniug of the *Calpa*

REVOLUTIONS OF THE PLANETS.

	According to PULIS'A quoted by BHATT'ÓTPALA, In a *Mahá-yuga*.	According to the *Súrya-ſidd'hánta*, In a *Mahá yuga*.	According to BRAHMEGUPTA. In a *Calpa*.
Sun,	4,320,000	4,320,000	4,320,000,000
Moon (Periodical,)	57,753,336	57,753,336	57,753,300,000
Mars,	2,296,824	2,296,832	2,296,828,522
Mercury,	17,937,000	17,937,060	17,936,998,984
Jupiter,	364,220	364,220	364,226,455
Venus,	7,022,388	7,022,376	7,022,389,492
Saturn,	146,564	146,568	146,567,298
Days,	1,577,917,800	1,577,917,828	1,577,916,450,000

☞ A'RYABHAT'T'A ſtates the revolutions of Jupiter at 364,224. And VARA'HAMIHIRA's rule for the cycle of 60 years of Jupiter is founded on that number. The periods aſſigned by theſe two authors to other planets have not been aſcertained; except Saturn's aphelion, reckoned by A'RYAB'HAT'T'A at 54 revolutions in a *calpa*. A'RYAB'HAT'T'A's numbers are ſaid to have been derived from the *Páráſara ſidd'hánta*. (As. Res. vol. 2. p. 242.)

VII.

On the height of the HIMÁLAYA MOUNTAINS.

BY THE PRESIDENT.

WHEN I presented to the Society the narrative of a journey performed by Lieutenant WEBB, and Captain RAPER, to explore the sources of the Ganges, I had occasion to notice the observations mentioned to have been made for determining geometrically the altitude of remarkable peaks of the snowy mountains, and the inference which appeared to be fairly deducible, that this chain of mountains is among the most elevated in the known world, neither surpassed nor rivalled by any other but the *Cordillera* of the *Andes*.* I should have been justified by the premises in saying more: but I thought it right to speak thus guardedly; not having been then enabled to examine the particulars of the altitudes taken, the distances measured, and the calculations

* As. Res. vol. v. p. 445.

founded on them; nor to procure barometrical meaſurements tending to confirm or to correct concluſions drawn from thoſe grounds. But having been ſince furniſhed with further obſervations taken by Lieutenant WEBB, in proſecution of the ſame inquiry, and having compared them as well with thoſe before made by him and by the late Lieutenant Colonel COLEBROOKE, as with Lieutenant Colonel CRAWFORD's labours in the purſuit of the ſame inquiry; I conſider the evidence to be now ſufficient to authorize an unreſerved declaration of the opinion, that the *Himálaya* is the loftieſt range of Alpine mountains which has been yet noticed, its moſt elevated peaks greatly exceeding the higheſt of the *Andes*.

THIS had been long ſuſpected, or rather had been very generally believed in *India*, upon leſs concluſive evidence than will now be ſubmitted to the public. It was remarked, that this chain of mountains conſtantly covered with ſnow is viſible from the plains of *Bengal* at the diſtance of 150 miles* (it might have been ſaid at a ſtill greater diſtance). This fact demonſtrates great elevation. For the peak of *Teyde* or *Teneriffe* meaſuring nearly 12,000 feet † is diſcernible in clear weather at a diſtance of 120 miles, and appears like blue vapour ſcarcely darker than the ſky; and *Chimborazo*, the higheſt peak of the *Andes*, aſcertained to be more than 20,000 feet high,‡ is ſeen at a diſtance of little more than 60 leagues, the reſt of the *Cordillera* of the *Andes* being then concealed from view: but the *Himálaya* chain of mountains is viſible in the horizon, as a continued line extending through more than two points of the compaſs, at a diſtance equal to

* RENNEL's Memoir of a Map, p. 302. (2d. Edit.)

† 1,904 *French* toiſes.

‡ 3,220 *French* toiſes.

that laſt mentioned, appearing in clear weather like white cliffs with a very diſtinctly defined outline.

To juſtify the aſſertion, that the diſtance, at which the chain of ſnowy mountains continues to be viſible, exceeds 150 miles, it may be ſufficient to mention, that it is ſeen bearing Eaſterly of North, from *Patna* and from other ſtations (as *Bhágalpúr*, &c.) on the Southern bank of the Ganges. Now the latitude of *Patna* by aſtronomical obſervation is 25° 36′;* and that of *Cat'hmandú*, nearly due north of it, is 27° 42′† the difference being 126 geographic or about 146 Engliſh miles. But the neareſt of the *Himálaya* mountains are yet diſtant in a horizontal line above 25 miles from the laſt mentioned town; more than one valley and intermediate ridge being interpoſed; ſome of which, to a diſtance of ten miles, have been viſited by *Europeans*, without approaching within ſeveral days travelling diſtance of the foot of the *Himálaya*.‡

The continuation of the ſame chain of mountains divides *Bután* from *Tibet*, and is diſtinctly viſible from the plains of *Bengal*. Captain Turner and Mr. Saunders, on their journey to *Tiſholumbo*, after traverſing *Bután* and croſſing the frontier of *Tibet*, found themſelves near a range of mountains covered with everlaſting ſnow, which ſeemed to be but two miles diſtant from their route. Captain T. particularly noticed a conſpicuous peak held in high veneration by the *Hindus*, and named *Chamalári*. Both the travellers were ſatisfied, the one from the remarkable form of the peak, the other from the height and bear-

* Reuben Burrow.

† Lt. Col. Crawford.

‡ Genl. Kirkpatrick's account of the Kingdom of *Nepal*.

ings of the range, that the mountains, which they then viewed, are the ſame which are ſeen from *Purnea*, *Rájmahl*, and other places in *Bengal*.* Now, according to the ſurvey of Captain Turner's route, *Chamalári* is placed in Lat. 28° 5′ Long. 89° 18′; a poſition no leſs than 165 geographic miles from *Purnea*; and 200 from *Rájmahl*, which is ſituated in Lat. 25° 3′ and Long. 87° 44′ by obſervation.† From a commanding eminence on the frontier of *Tibet*, the travellers had an extenſive view of the mountains of *Bután*, covered with verdure to the very tops; and it appears from what is ſaid by them, that *Bután* contains no mountains on which ſnow continues during all ſeaſons of the year, and few on which it remains until the middle of ſummer. Theſe circumſtances ſeem to eſtabliſh beyond queſtion, the fact, that the ſnowy range, of which *Chamalári* is a part, is that which is ſeen from ſtations in *Bengal*, diſtant 165 and even 200 Geographic miles, anſwering to 191 and 232 *Britiſh* miles. Now it requires an elevation exceeding 28,000 feet to be barely diſcernible, in the mean ſtate of the atmoſphere, at ſo great a diſtance as that laſt mentioned; though a much leſs elevation, it muſt be acknowledged, may ſuffice under circumſtances of extraordinary refraction.

The preſumption, which was however raiſed on theſe grounds, was to my apprehenſion corroborated by obſervations, which I had myſelf the opportunity of making twenty years ago; and which gave, according to the note I have preſerved of them, 1° 1′ for the uſual altitude of a conſpicuous peak of the *Himálaya* viewed from a ſtation in *Bengal*, which, according to the conſtruction of Rennel's map, was not leſs

* Captain Turner's narrative, p. 203 (2d Edit.) Phil. Trans. vol. 79.
† Reuben Burrow.

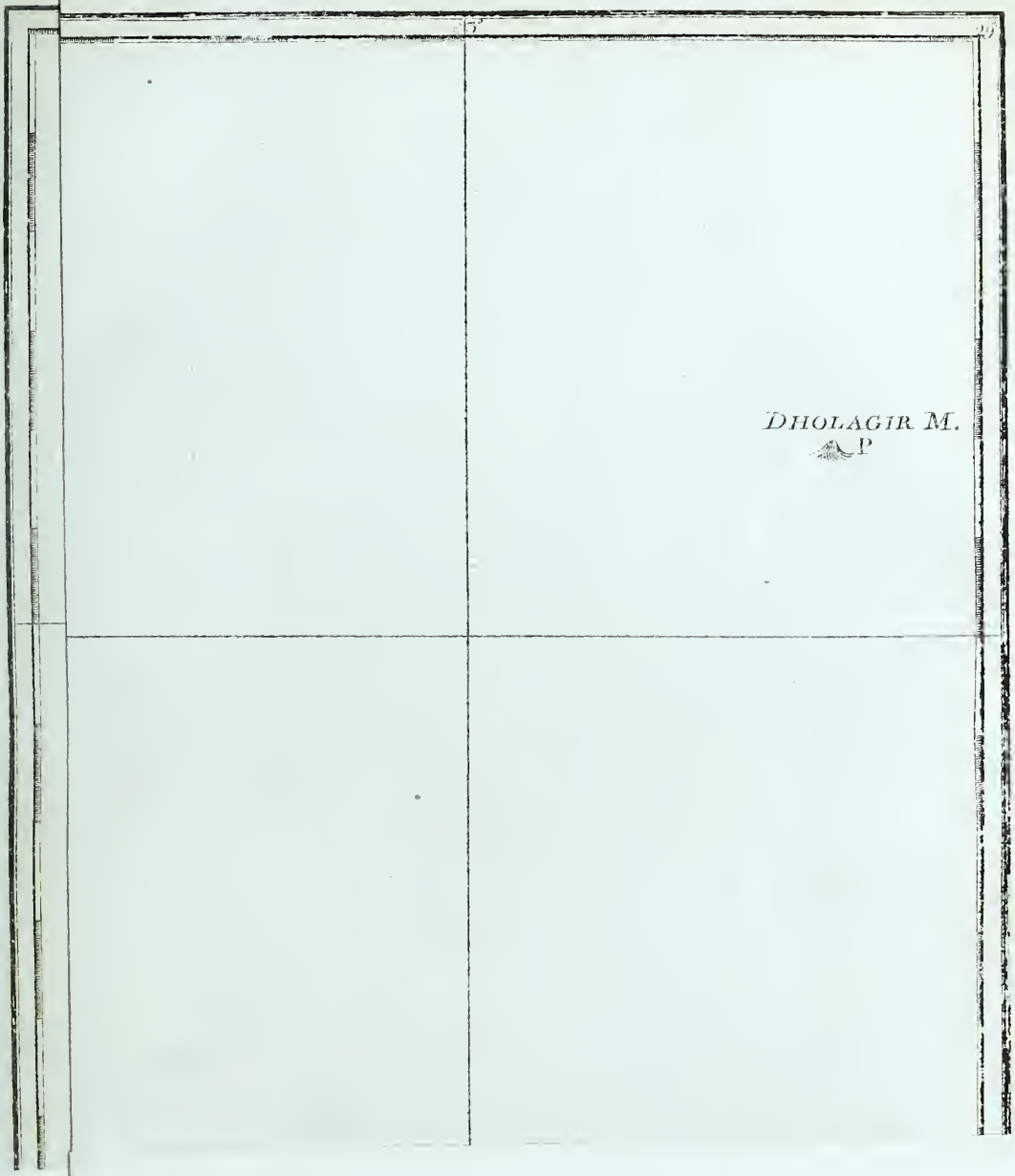
diſtant than 150 Engliſh or about 130 Geographic miles. If this diſtance might be relied on, the height to be inferred from that obſervation of altitude, after a due allowance for terreſtrial refraction, would conſiderably exceed that of *Chimborazo*, being not leſs than 26,000 feet above the level of the plains of North *Bengal*. But, as the diſtance was not aſcertained with ſufficient accuracy for the purpoſe of confidently grounding on it a calculation of this nicety, I propoſed to determine it by obſervations of the bearings, of the ſame peak from two places diſtant enough to afford an adequate baſe, the length of which might be found by correct ſurvey. Not having had the means of completing the inquiry upon the principle here explained, I recommended it to the attention of the late Lieutenant Colonel COLEBROOKE, by whom it was proſecuted during his ſurvey of *Rohilkhand*, and it has been further purſued to a ſatisfactory reſult by his aſſiſtant Lieutenant WEBB, during his journey towards the ſources of the Ganges, and finally during a ſurvey of the province of *Górakhpúr*.

COLONEL COLEBROOKE's notice was alſo drawn to the ſubject by the communications of Dr. FRANCIS BUCHANAN and Lieutenant Colonel CRAWFORD, who both viſited *Nepal* in 1802, and who were convinced by the information they received there, from intelligent perſons, that the ſources of the Ganges are on the ſouthern face of the *Himálaya*, and that theſe mountains are of vaſt height. He had likewiſe a knowledge of a ſurvey by Lieutenant Colonel CRAWFORD executed in 1805 along the northern frontier from *Behar* to *Rohilkhand*; in which bearings were taken of every remarkable peak of the ſnowy range, which could be ſeen from more than one ſtation; and conſequently the diſtance of thoſe peaks from the places of obſervation, and their geographical poſitions relatively to the plains of *Hinduſtán*, were determined by the in-

terſection of the bearings and by calculation. Colonel CRAWFORD had alſo taken altitudes, from which the height of the mountains might be computed, and which gave, after due allowance for refraction, the elevation of conſpicuous peaks, at least equal to that abovementioned. But the drawings and journal of this ſurvey have been unfortunately loſt.

THE obſervations inſtituted and completed by Lieutenant Colonel COLEBROOKE, while in *Róhilkhand*, were two: one taken at *Pilibhít*, where the elevation of a peak diſtant 114 Engliſh miles, according to bearings from two ſtations, the diſtance between which was meaſured, was found to be 1° 27′; the other at *Jét'hpúr*, where the elevation of the ſame peak diſtant 90 Engliſh miles, was obſerved to be 2° 8′. I find among his papers numerous other obſervations of the bearings and appearance of the chain of ſnowy mountains as ſeen from many ſucceſſive ſtations. But the only altitudes, which have been preſerved, are thoſe above mentioned.

IN calculating from theſe obſervations of altitude, allowance was firſt made for refraction at the ſame rate as for celeſtial objects of the ſame apparent altitude: and, from the obſerved elevation ſo corrected, was deduced a height of 20,019 feet for the mountain as viewed from *Pilibhít*, and 20,598 for the ſame as ſeen from *Jét'hpúr*, or 20,308$\frac{1}{2}$ feet on a medium of both obſervations. But the allowance for refraction being much too great, amounting to $\frac{2}{9}$ths of the contained arc in one inſtance and $\frac{3}{13}$ths in the other, the computation was again made, allowing $\frac{1}{8}$th of the intercepted arc for terreſtrial refraction, and the reſult ſhowed a height approaching to 22,000 feet above the level of the plains of *Róhilkhand*.


DHOLAGIR M.
P

V:3

Reduced Copy

of Part of

LIEUT.^T W.^M WEBB's

SURVEY

in

OUDE

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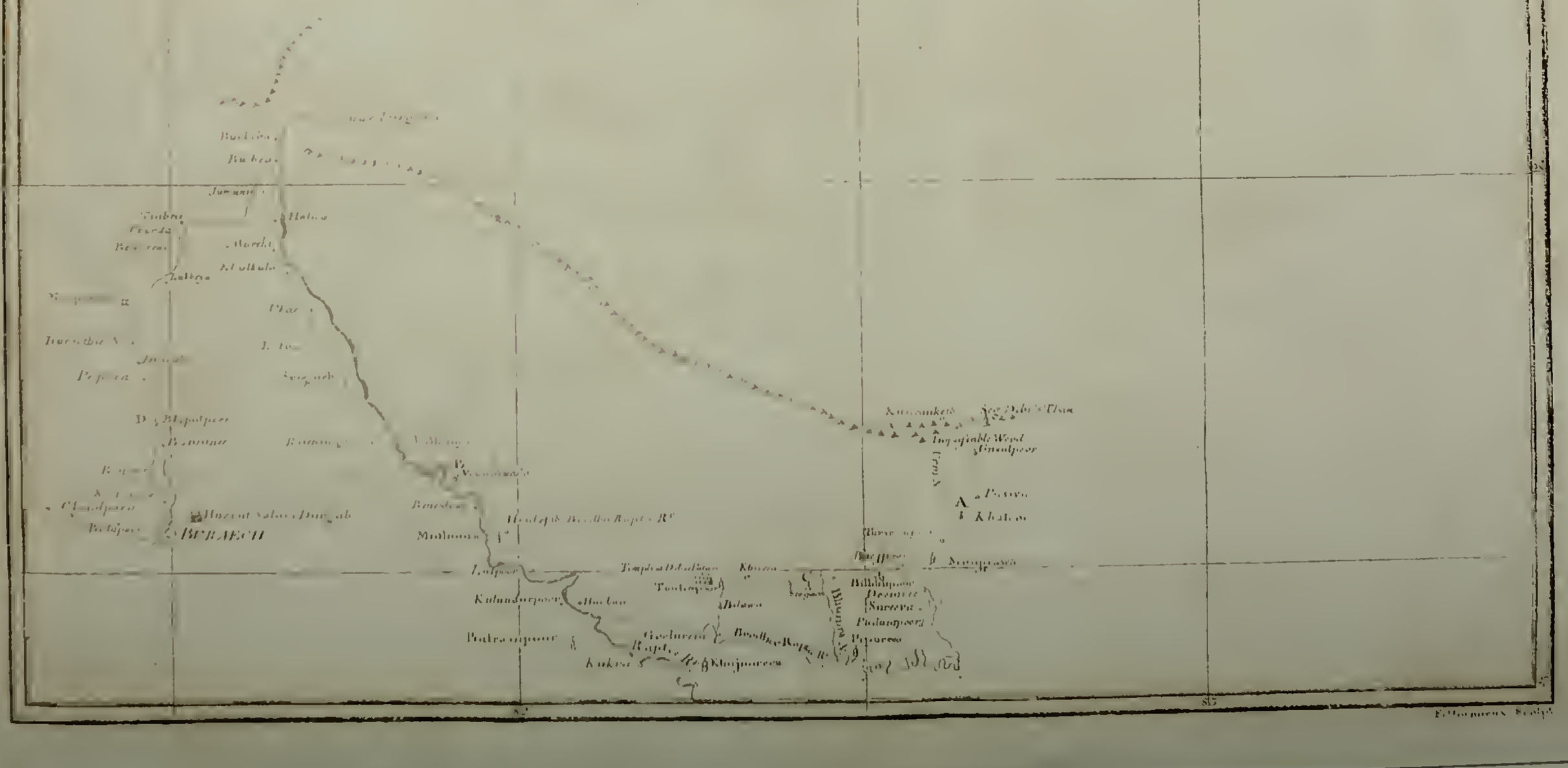

However this allowance of an eighth part of the contained arc ſtill exceeds the mean of terreſtrial refraction: as appears from the trials conducted by General Roy and Colonels Williams and Mudge,* and eſpecially from thoſe of the laſt mentioned obſerver. They found terreſtrial refraction ſubject to great variation, amounting to no leſs than $\frac{1}{3}$d of the contained arc in ſome inſtances, and ſo ſmall as $\frac{1}{35}$th of the intercepted arc, and even leſs, or abſolutely 0, in others. But, in the numerous obſervations of thoſe gentlemen, the extreme inſtances are few; and the range of variableneſs is commonly within narrower limits, from $\frac{1}{7}$th to $\frac{1}{14}$th, being on a mean either $\frac{1}{11}$th or $\frac{1}{12}$th part. The trials, moſt to be depended on, being thoſe which were conducted by means of correſpondent and contemporary obſervations, give a mean of $\frac{1}{11}$th. It appears alſo, that the refraction is leaſt variable where the ray paſſes through the air at a conſiderable diſtance from the ſurface of the earth, for the greateſt part of its course: which is eminently the caſe in the inſtance under conſideration; and eſpecially in ſome which will be ſubſequently noticed, where the altitude of the mountains was taken from elevated ſpots: and, in all, the ray muſt paſs for a great part of its courſe through a ſtratum of the atmoſphere of much leſs denſity than in the experiments of General Roy and Colonel Mudge, to which reference has been made.

It follows from theſe conſiderations, that the mean terreſtrial refraction ſhould not be taken at more than $\frac{1}{11}$th of the arc contained between the object and ſtation. This allowance agrees with that which Delambre directs to be made: it exceeds what was found by Legendre, (viz. $\frac{1}{14}$th); and it approaches very near to Maskelyne's eſtimate of $\frac{1}{10}$th

* Phil. Trans. vol. 80, 85, and 87.

But from Major LAMBTON's obſervations in the peninſula of *India*, terreſtrial refraction was found to vary from $\frac{1}{4}$th to $\frac{1}{15}$th*, or on a medium $\frac{1}{8}$th of the contained arc. As this mean refraction may be thought more applicable to the north of *India*, than that deduced from the trials made in the climate of *Great Britain*, I ſhall compute from altitudes reduced by this as well as the preceding correction for refraction, and contraſt the reſults with ſimilar calculations in which the refraction ſhall be taken at the utmoſt quantity which any paſt experience could juſtify, viz. $\frac{1}{3}$d of the arc.

To compute from the data, we have, in an oblique plane triangle, the angle (B) at the baſe of the mountain, which exceeds a right angle by half the contained arc; or (which is the ſame thing) by half the angle at the earth's centre ſubtended by that arc; the angle (S) at the ſtation of obſervation, which is the ſum of the obſerved altitude (corrected for refraction) and half the contained arc; and one ſide (A), which is the chord of the contained arc, or diſtance between the baſe of the mountain and ſtation of obſervation, differing but a few feet, in the caſes before us, from the circular arc itſelf. The angles and one ſide of the triangle being thus known, the other two ſides may be found; one of which, ſubtending the angle S, is the height of the mountain, or perpendicular from its ſummit to the middle of its baſe. The obſervations at *Pilibhít* and *Jét'hpúr*, calculated upon this principle, and with an allowance of $\frac{1}{11}$th for refraction, give 22436 and 22146, for the elevation of the peak obſerved from thoſe ſtations; or on a mean 22291 feet above the level of the plains of *Rohilkhand*; or about 22800 feet above the level of the ſea.

* Page 102 of this Volume.

In the ſame manner may be calculated the height of the peak, ſituated according to the information of the mountaineers near the ſource of the *Jamuná*, and meaſured from the ſummit of *Nágún-ghâtí*, near *Lálúrí*, under an angle of 3° 17′, and from that of *Chandra-badaní*, under one of 2° 50′. The poſition of the mountain, deduced from horizontal angles taken at both ſtations, is ſettled by Mr. Webb in lat. 31° 23′, long. 78° 31′.* The latitude of the ſtations, determined by aſtronomical obſervations made at the next places of encampment,† is 30° 32′ and 30° 20′; and the diſtances, taking the longitudes as inferred from ſurvey, are 54′.2 and 63′.2 geographic miles reſpectively. Whence, allowing $\frac{1}{11}^{th}$ for refraction, we have 20895 and 21855 feet; or, with an allowance of $\frac{1}{6}$, 20503 and 21320 feet; for the elevation of the mountain above thoſe ſtations. Their reſpective heights are yet unaſcertained: but *Chandra-badaní* was by Mr. Webb thought the higheſt, contrary however to what the reſult of the preſent calculation indicates. The height of *Nágún-ghâtí* was eſtimated by him at 5000 feet; and this gueſs is corroborated by a trigonometrical meaſurement of a mountain called the *Khanjar* near *Bhuwan-dévi*,‡ ſeen the preceding day, and found to be 3297 feet above the valley. It is diſtantly ſupported by barometrical meaſures of mountains in a different part of the ſame chain, as will be noticed further on.

The elevation of the *Jámunávatárí* appears then to be not leſs than 25000 feet above the valley. It is however right to obſerve, that this meaſurement of the height of that mountain above the ſummit of the paſſes from which the angles were obſerved, is not entirely to be relied on; as the diſtances are not determined with ſufficient preciſion, being

* *Aſiatick* Reſearches, vol. 11. p. 442.

† MS. Journal.

‡ It is to be regretted that more frequent opportunities did not occur for ſimilar meaſurements.

dependent on the relative poſition of the ſtations in longitude, concluded from a ſurvey performed by means of a route meaſured by time in a very uneven country.

It might be expected, that uſe ſhould be made of numerous other obſervations, which were taken from various elevated ſituations among the lower mountains, eſpecially thoſe which exhibited much larger angles; on the preſumable ground, that the height of any ſelected point among the numberleſs ſnowy peaks of the *Himálaya*, would be beſt aſcertained by angles taken at the neareſt poſitions approaching it. No doubt ſuch would be the caſe, could a ſurvey be leiſurely performed in the mountains, chooſing the fitteſt ſtations upon a previous view of the country, and ſatisfactorily identifying the point to be obſerved. But a haſty journey (more was not in this inſtance practicable) among mountains nearer to the object, afford leſs means of an accurate meaſurement than a ſurvey carefully conducted at a remoter diſtance in the champaign country. Inſtead of keeping in view, from day to day, during the progreſs of ſurvey, the ſame ſelected point, and being fully aſſured of its identity by the uniformity, or at leaſt the very gradual alteration of its appearance, the traveller through the mountainous ſkirts of the *Indian* Alps loſes ſight of thoſe objects for ſucceſſive days as he proceeds along the vallies, and finds it impracticable, when he emerges to higher ground, his route leading him over ſome mountain, to diſcern from its ſummit the loftieſt peak now perhaps intercepted from his view by one nearer though of leſs elevation; or to diſcriminate and recognize among innumerable glacieres which have varied their aſpect with his change of place, the particular ſnowy peak before contemplated by him from another ſide, in a different point of view, and with another aſpect.

On theſe conſiderations, and after carefully inſpecting Mr. Webb's journal, in which I find obſervations of unnamed ſnowy peaks ſeen from the ſtations of *Rét'hal* * and *Bahmencót'hí* † under angles of nine and ten degrees; with others, from more diſtant ſtations, of mountains ſuppoſed to be known, as the peak near *Gangávatárí* ſeen from *Nágún-ghátí* and *Chandra-badaní*,‡ and *Cédár-nát'h* from the laſt mentioned ſtation;§ I do not deem any of theſe points to be ſo verified as to be made the certain grounds of a correct meaſurement of altitude. The horizontal diſtance of the near glacieres appeared to the travellers, in more than one inſtance, to be only ten miles; ‖ but this, being a mere gueſs, cannot ſerve for the baſis of correct calculation. Employed as a conjectural meaſure, it gives 9000 feet for the height of the objects above the lofty ſpot whence they were viewed.

The poſition of *Cédár-nát'h* is not confidently ſtated,¶ the materials for determining it being inſufficient. Suppoſing however that of *Gangávatárí* to be more nearly correct, the pyramidical peak in the vicinity of that celebrated place, if indeed the ſame which was ſeen and meaſured from *Nágún-ghátí*, is 17784 feet above the ſummit of that paſs eſteemed to be 5000 feet high.

But leaving theſe conjectures and doubts, let us paſs to more certain obſervations and more exact meaſurements. To Colonel Crawford I am indebted for the communication of obſervations made by

* 10° 18′. 9° 55′. 9° 42. 9° 19′. 8° 19′ bearing reſpectively N. 62° 49′ E. N. 59° 04′ E. N. 54° 56′ E. N. 49° 42′. N. 45° 28′ E. and further diminiſhing as the bearings grew more Northerly.

† 9° 55′. 9° 14′. 8° 17′ bearing N. 43° 35′ E. N. 39° 12′ E. N. 28° 17′ E, reſpectively.

‡ 3° 1′ and 2° 50′.

§ 2° 34′.

‖ *Aſiatick* Reſearches, II. p. 515 and 552.

¶ Ibid. p. 442.

him at *Cat'hmándu* Another ſet, much more numerous, was taken by him during an extenſive ſurvey along the frontier, but it is not at preſent within his reach. If not actually loſt, as was believed when a preceding paragraph of this eſſay was written, the journal of his obſervations is probably in *England*, and when there found will confirm what is here ſtated upon other grounds.

At preſent what we poſſeſs of that laborious ſurvey, is the protaction of it, ſhewing the poſitions of the mountains as they were determined by croſs bearings taken from a great number of ſtations between *Púrnea* in *Bengal*, and *Balrámpúr* in *Ayudh*. This document, however, is invaluable for the purpoſe of the preſent inquiry.

Colonel Crawford, during a long ſojourn at *Cat'hmándú* in 1802, took the angles of ſeveral ſelected points, of which he determined the diſtances by trigonometrical meaſurement, having taken the bearings from various ſtations in the valley of *Népál*, the relative ſituations of which were aſcertained by a trigonometrical ſurvey proceeding from a baſe of 852¾ feet, carefully meaſured four times and verified by another baſe of 1582 feet meaſured twice. The poſitions of the ſame mountains were alſo ſettled by obſervations of them made from the plains of *Behar* in the progreſs of the great ſurvey which has been mentioned.

The angles of elevation of the mountains above the ſtations of *Sambhú* and the queen's garden near *Cat'hmándu*, were taken with an aſtronomical ſextant and an artificial horizon. Among the moſt remarkable is an obſervation of a mountain pointed out as mount *Dhaibun*. It was ſeen under an angle of 5° 4′ 21″ and aſcertained to be diſtant 35⅝ g. m. The elevation calculated from this meaſure is 20140 feet above the ſta-

tion from which the altitude was taken, and which is itſelf more than 4500 feet above the level of the ſea, as concluded from barometrical obſervations to be ſubſequently mentioned. Another ſeen under a ſimilar angle, 5° 3′ 58″, but leſs diſtant by four miles, exceeds the elevation of the ſtation by 17819 feet. Both theſe mountains are but little to the eaſtward of north, from *Cat'hmándu*. The following are as little north of eaſt: viz. one nearly in the poſition of the *Cála-bhairava*,* diſtant 59 geo. m. with an altitude of 2° 48′ 6″, and conſequently 20025 feet high; another in its vicinity, with an angle of 3° 23′ 6″, diſtant 48 g. m. and elevated 18452 feet; and a third, as much more remote, being 68 g. m. with an altitude of 2° 7′ 21″, and a conſequent elevation of 18662 feet, above *Cat'hmúndu*.

All thoſe mountains are perceivable from *Patna*: the firſt or the ſuppoſed *Dhaibún*, at a diſtance of 162 g. m. and *Cála-bhairava*, or the mountains in its vicinity, at that of 153,150 and 145 g. m. Theſe are the neareſt of the *Himálaya* which are viſible from that city. The moſt remote are ſeen in the N. E. quarter at the prodigious diſtance of 195 g. m. aſcertained by their poſition which is determined by bearings taken by Colonel Crawford from ſtations approaching within a hundred miles of their ſcite.

Mount *Dhaibún*, or at leaſt the peak which was indicated to Colonel Crawford under that name, and which is not ſurpaſſed by any of the points meaſured from *Cat'hmándu*, was viewed by General Kirkpatrick, if indeed it be the ſame mountain, from a poſition ten miles nearer to it on mount *Bhírbandí*:† and his animated deſcription of the

* Genl. Kirkpatrick's account of *Nepál*.

† Account of *Nepál*. p. 138. It is right to obſerve that the map annexed to that publication places *Dhaibún* and other mountains as *Dhúncha* and *Ghirkhú*, much nearer to *Cat'hmándú*, than they are by Colonel Crawford's ſurvey. The latter is however moſt to be depended on.

ſublime proſpect contains preſumptive evidence, that the remoter glacieres of the *Himálaya* are ſtill more elevated: for he ſpeaks of a neighbouring mountain not leſs ſtupendous, yet ſurpaſſed by one of the pyramidical peaks of the ſnowy chain ſeen peeping over its towering ſummit. It may readily be credited, that the more acceſſible mountains which approach *Cat'hmándu*, as *Jibjibia*, *Dhaibún* and *Dhúnchá*, may be inferior in height to the abrupter peaks in the chain of the *Himálaya*.

Among the loftieſt in that chain is one diſtinguiſhed by the name of *Dhawala-giri* or the white mountain, ſituated, as is underſtood,* near the ſource of the *Gandhac* river called in its early courſe *Sálagrámí* from the ſhiſtous ſtones containing remains or traces of ammonites found there in the bed of the river and thence carried to all parts of India, where they are worſhipped under the name of *Sálagráma*; the ſpiral retreats of antediluvian molluſcas being taken by the ſuperſtitious *Hindu* for viſible traces of Vishnu.

A high peak, among the moſt conſpicuous of thoſe which are ſeen from the plains of *Górakhpúr*, and on that account ſelected by Mr. Webb for a meaſurement, conducted by means of obſervations taken at different ſtations in that province, was pointed out to him as recognized by the mountaineers to be *Dholagir (Dhawala-giri)*. Mr. Webb took the bearings from four ſtations, and altitudes from three; and the particulars of his obſervations are as follow.

At ſtation A, ſituated near *Khatúr*, bearing of the ſnowy peak P, corrected for magnetic variati-

* Kirkpatrick: *Nepál*. *Sálagráma* ſtones are found in great abundance near *Muctináth*, and more ſparingly at *Dúm dher cánd* ſtill nearer to the ſource of the *Gandac*. Colonel Crawford's MS.

on and error of adjuſtment by an azimuth obſerved at the time, ... N. 30° 12 E.
Altitude, ... 2° 48′
At ſtation B, *Nowá newádá* on the *Rapti*.
Bearing of P. ..... N. 49° 30′ E.
At ſtation C, two furlongs W. of *Séúgaon*.
Bearing of P. ..... N. 35° 49′ E.
Altitude, ... 2° 19′
At ſtation D, two furlongs W. of *Bhópetpúr*.
Bearing of P, ... N. 60° 1′ E.
Altitude, ... 1° 22′
B bears from A by the ſurvey, W. 2° 5′ N. diſtant, 43,4 B. M.
D bears from A. W. 7 5 N. 73,5 B. M.
The bearing of C from A, is not uſed, the ſide A C meaſuring only 16,3 B. M.
C to B W. 13° 54′ N. diſtant 29,4 B. M.
C to D W. 15° N. 60 B. M.
B to D W. 14° 3′ N. 30,5 B M.

From theſe data Mr. Webb computes the diſtance of the peak (P) from the ſtations A, C and D* at the numbers undermentioned: viz. From the ſtation A, by the triangle A P B, 89,6, and by the triangle A P D, 89,1; mean of both computations 89,35 miles or 471768 feet. From the ſtation D, by the laſt triangle, 135,9, and by C P D, 136,8; mean of both, 136,35 miles, or 719928 feet. From C, by the laſt of theſe triangles, 103,4, and by C P B, 102,3; mean of both 102,85 miles, or 543048 feet. He remarks that ſeveral other bearings of the ſame peak were taken from different ſtations; and that, by laying off the rhumb-lines of

* See the annexed map.

bearing on the map, they interſect at very inconſiderable diſtances from the poſition of the peak as deduced from thoſe which were ſelected for calculation.

Let us proceed to compute the height of *Dhawalagiri* (vulg. *Dhólágir*) with the foregoing meaſures of diſtance and the obſerved altitudes.

At the ſtation A. we have the diſtance 471768 feet, 77,85 geographic miles,* or in parts of a circle 1° 17′ 51″; the chord of which in feet is 471758. The altitude obſerved being 2° 48′, and the refraction being taken at $\frac{1}{12}^{th}$ of the intercepted arc, the angles are S 3° 20′ 26″ 15‴ and P 86° 0′ 38″ 15‴, with the ſide S B 471758; whence we have the ſide B P, or height of the mountain, 27558 feet.

By a ſimilar calculation of the altitude of the ſame mountain obſerved from the ſtations C and D; viz. 2° 19′ and 1° 22′, or corrected for refraction 2° 11′ 32″ and 1° 12′ 6″, with the diſtances above found, which in parts of a circle are 1° 29′ 36″ 36‴ and 1° 58′ 48″, and, reduced to the chords of the arcs in feet, 543031 and 719893, the height comes out 27900 and 27573; or on a mean of the three, 27677 feet above the plains of *Gorak'hpúr*; and reckoning theſe to be 400 feet above the mouth of the *Ganges* as inferrible from the deſcent of the ſtream of rivers, the whole height is more than twenty-eight thouſand feet above the level of the ſea.

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* The geographic mile, or ſixtieth part of a degree of a great circle, is here taken at 6060 feet. The length of the meridional degree in different latitudes, accor ing to the lateſt meaſurements, being 60995 fathoms in la itude 66° 20′, 60820 in latitude 52° 2′, 60783 in latitude 46° 12′ and 60487 in latitude 11° 6′; whence may be concluded 60600 nearly between the latitudes 27° and 31°; and this meaſure is employed without correction or modification, though the poſition of the arcs be at acute an les to the line of the meridian; greater preciſion in reducing the diſtances to parts of a great circle appearing to be unneceſſary, as the utmoſt accuracy would make little difference in the computed height of a mountain.

The following table exhibits a comparison of this result, with other computations made on different rates of refraction.

Station.	Distance in miles.	Interc. arc in deg.	Alt. by obs.	Height, allowing for refraction, $\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{1}{11}$	$\frac{1}{12}$	$\frac{1}{13}$	$\frac{1}{18}$
A	$89\frac{35}{100}$	1° 17′ 51″	2° 48′	24875	26663	27110	27476	27558	27626	27855
C	$102\frac{85}{100}$	1° 29′ 36″.6	2° 19′	24348	26716	27308	27792	27900	27991	28294
D	$136\frac{35}{100}$	1° 58′ 48″	1° 22′	21338	25494	26554	27384	27573	27773	28286
			Mean	23520	26091	26784	27551	27677	27797	28145
			Extreme difference	3537	1222	774	408	342	365	439

It is apparent from inspection, that the observations at the stations A and D agree best, and if that computation be nearest the truth, wherein the extreme differences are least, the conclusion will be, that the height is about 27550 feet; such being the elevation deduced from the mean of observations calculated according to middle refraction.

The limit of error arising from refraction must be taken at less than 850 feet, as the observations at A and C coincide for the height of 26690 feet, $\frac{1}{6}^{th}$ of the contained arc being allowed for refraction; and those at C and D, for an elevation of 28290 feet, $\frac{1}{18}^{th}$ being allowed; while those at A and D do so for the mean altitude of 27565 feet, refraction being taken at the middle rate of $\frac{1}{12}^{th}$; and a larger allowance then $\frac{1}{6}^{th}$ of the intercepted arc, which would exceed mean celestial refraction for like altitudes, cannot be requisite, without very wide disagreement in observations made on different days, which would mark extraordinary refraction: but that is not the case with those in question.

The limits of error in respect of the observations themselves, whether for the distance, or for the altitude, are more confined, since the

uncertainty in the diſtance, amounting to a quarter of a mile in one inſtance, and half a mile in the reſt, induces uncertainty in the computed elevation to no greater extent than 76 or 99 feet for the nearer ſtations, and 180 for the moſt remote. An error of a whole minute in an obſervation of altitude affects the conſequent calculation of height in the proportion of about 200 feet for the more diſtant ſtation, and 130 to 150 for the nearer. But the inſtrument, which was uſed, ſhould, with due care, give angles true within that quantity; and the obſerver was enjoined to take the angles to the neareſt minute.*

It would be an extreme ſuppoſition, that the errors have in every inſtance been the higheſt poſſible, and on the ſide of exceſs. Aſſuming however, that they are ſo, the elevation, as obſerved from the two neareſt ſtations, is not reduced below 26457 and 26467, or, on the mean of both, 26462 above the plains of *Górakh'púr*.

We may ſafely then pronounce, that the elevation of *Dhawalagiri*, the white mountain of the *Indian* Alps,† exceeds 26862 feet above the level of the ſea; and this determination of its height taken on the loweſt computation of a geometrical meaſurement, is powerfully corroborated by the meaſure of an inferior, though yet very lofty mountain obſerved from ſtations in *Rohilkhand*.

It may be ſatisfactory to bring this meaſurement to the teſt of compariſon with the calculation of heights from like obſervations of ſmall angles at great diſtances in a caſe where the elevation is otherwiſe known

* Inſtructions, quoted in *Aſiatick* Reſearches, vol. 11, p. 448. The writer of theſe was acquainted with the inſtrument, and knew the degree of preciſion which it comports.

† *Sans. Dhawala* white, *Giri*-mountain. Vulg. *Dhoulagir*, the white mountain. Kirkpatrick's *Nepaul*, p. 287. It is the *Mont-blanc* of the *Himálaya*.

or more preciſely determined. This we are enabled to do in the very inſtance moſt to be deſired, that of *Mont-blanc* heretofore conſidered to be the loftieſt mountain of the old continent. Its altitude as ſeen from *Pregny*, a ſtation half a league from *Geneva*, near the lake, exhibits an angle of 3° 14′, according to an obſervation by De Luc.* The diſtance is ſtated by him in round numbers 227000 *French* feet; but appears from Sir G. Shuckburgh's ſeries of triangles† to be over-rated; the diſtance of *Geneva*, a little more remote, being no more than 225098 *Engliſh* feet. Calculating from this ſide, and the angle obſerved by De Luc, with an allowance of $\frac{1}{11}^{th}$ of the arc for refraction, the height is found 13713 feet above *Pregny*, or 15122 feet above the level of the ſea. De Luc himſelf computed it from the ſame obſervation, differently employed in a manner which is little affected by uncertainty in the refraction or the diſtance, though ſubject to other error, at 2391 *French* toiſes equal to 15289 *Engliſh* feet: and Sir George Shuckburgh, by a trigonometrical meaſurement in which he uſes from one ſtation a ſide of a triangle 20679 feet, and from another one of 142362 feet, and corrects the obſerved angles by an allowance for refraction equal to $\frac{1}{10}^{th}$ of the contained arc, makes the elevation of *Mont-blanc* 14411 and 14453, or, on a mean of the two, 14432 feet above the lake of *Geneva*, and 15662 above the ſea.

These inſtances may authorize an inference, that, in ſimilar meaſurements of *Dhawalagiri*, *Dhaibún*, and other mountains of the *Himálaya*, from ſtations ſome as near, others twice or thrice as diſtant, the uncertainty reſpecting the accuracy of the reſult is not ſo much greater as to render that reſult vague and dubious.

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* Modifications de l'atmoſphere, § 763.

† Philoſoph. Trans. vol. 67. The diſtance is not there ſtated, but is eaſily calculated from the angles and diſtances exhibited.

Barometrical measurements, though less to be depended upon than a geometric one, would have been desirable as showing that no very material error has by any oversight crept into it. In the absence of any observations of the barometer on the nearest accessible heights, we are in possession of some made on summits of mountains belonging to the intermediate chain. For instance, at *Chísápání* fort on the route from North *Bihár* towards *Cat'hmándú* in *Népál*, the barometer was noted on two days at an interval of more than a month (23d February and 28th March 1793,) and both observations gave the same length of the column of mercury 24.63. On one of those days the barometer was observed at a spot a little more elevated, near the cold spring which gives name to the place,* 24.43: and the temperature shown by the thermometer is also given, 65° Fahrenheit's scale at 9 o'clock, and 67° at 11 in the forenoon.† A meteorological journal was kept by Dr. F. Buchanan at *Cat'hmándú*, for nearly ten months (April 1802 to February 1803,)‡ and the mean height of the barometer in that period is 25. 2. The greatest height being (in May) 25.62; and the least (in August) 24.83.§ On a minute inspection of it, the changes, though observations were made at four different hours of each day, are small, seldom amounting to the tenth of an inch within the day, and by no means corresponding to the changes of temperature shown by the thermometer.

To compute the elevation of the stations at *Chísápání* and *Cat'hmándú*

* *Népál*; *Chísó* cold, *Pá'i* water. *Sans. Sis'ira-páníya.*

† Kirkpatrick, *Népál*. p. 52 and 331.

‡ MS.

§ The barometer, by which the journal was kept, gave less length to the column of mercury, than another, with which it was occasionally compared, and which was constantly higher by a quarter of an inch. The latter agrees more nearly with General Kirkpatrick's barometer, which in March exhibited 25,87 for the length of the column of mercury at *Cat'hmándú*. The measure of it must be therefore taken as doubtful to one quarter of an inch.

under the want of correſponding obſervations of the thermometer and barometer at the foot of the mountains, we muſt either ſeek in ſome journal, which may have been preſerved, a contemporary obſervation at a ſtation (a very diſtant one) in *Bengal*, or elſe be content to take the mean height of the barometer in *Bengal*, where it is very ſtationary and ſeemingly unaffected by changes of temperature.

For here, as in moſt countries near the tropicks, the barometer has a very confined range, and does not vary with the fluctuations of the temperature, owing to contrary but equal variations of denſity and elaſticity of the air or other countervailing cauſes not inveſtigated. The column of mercury ſtands, within a few tenths of an inch of the ſame height at all ſeaſons of the year;* and exhibits, but within narrower limits, the phenomenon of diurnal tides, which alſo do not correſpond with the riſe and fall of the thermometer.† Towards the end of February, the ſeaſon when the mountains of *Népál* were viſited by General Kirkpatrick, the barometer does not vary in *Bengal* ſo much as the tenth of an inch above and below 30 inches, while the thermometer in the ſhade ranges 10°, (from 70° to 80° on a medium,) and much more in an open expoſure, between morning and noon. In the months of December and January, the ſeaſon when the column of mercury is at its maximum,‡ the mean elevation of the barometer is 30.07, while that of the thermometer is 68°. At *Cat'hmándú*, during the ſame ſeaſon of the year, the mean height of the barometer is 25.28, while the thermometer is 52°; ſeldom altering ſo much as the tenth of an inch, and never more than $1\frac{1}{2}$ tenths, in the compaſs of one

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* *Aſiatick* Reſearches, vol. 2, p. 471.

† Ibid, vol. 4, p. 202.

‡ *Aſiatick* Reſearches, vol. 2, p. 479.

day, nor during the whole ſeaſon ſo much as two tenths for the ſame hour of the day.

The laſt of the two methods propoſed ſeems therefore preferable, as the barometer is ſhown by the journal kept at *Cat'hmándú* to be as little variable in *Népál* as it is in the plains of *India;* and contemporary obſervations at places very remote (no other could be found) would produce no greater degree of accuracy, ſince a like ſtate of the atmoſphere in reſpect of elaſticity, or in regard to humidity and other circumſtances affecting its denſity excluſive of temperature, is hardly to be preſumed to prevail through an expanſe of many hundred miles between places ſo differently ſituated; the one on the open plain within the reach of influence of the ſea, the other in the midſt of mountains at the foot of the loftieſt alps. I ſhall therefore take the mean height of the barometer in *Bengal,* towards the end of February, or 30 inches, and the obſerved height at the ſpring of *Chíſápání* at the ſame ſeaſon of the year 24.43: and in like manner, the mean length of the column of mercury for both *Calcutta* and *Cat'hmándú*, in the winter ſeaſon, when the mean temperature at the one place as much exceeds the zero of the ſcale adapted to the meaſurements of heights, as it is ſhort of it at the other. This appears to be 68° at *Calcutta* and 52° at *Cat'hmándú*: the mean of both, or 60°, differing by leſs than $1\frac{1}{2}$° from the zero of the ſcale. The correſponding lengths of the column of mercury are 30 07 and 25.28 reſpectively.

Proceeding on theſe grounds to calculate the heights of the places, we find from the difference of logarithms,* $753\frac{1}{2}$ *French* toiſes or 803 *Engliſh* fathoms in one inſtance, and 892 *French* toiſes or $950\frac{3}{4}$ *Engliſh* fathoms on the other: needing little correction for the difference of

* De Luc. Mod. de l'atmoſphere, § 576 and 631.

temperature, the thermometer being near the zero of the ſcale.* The elevation thus found, corrected however † for expanſion of mercury and variation of the denſity of the air, as indicated by the thermometer, is 5818 *Engliſh* feet or 969¾ fathoms for *Chíſápání*, and 4784 feet or 797⅓ fathoms for *Cat'hmándú*,‡ above the plains of *Bengal*. Hence may be inferred the following approximated meaſures of other ſtations where barometrical obſervations were alſo made, unaccompanied however by obſervations of the thermometer.

			Feet.
Chandragiri,	M	(22.5*)	7989†
Tambékhán,	M	(23.75‡)	6488
Chíſápání,	M	(23.8‖)	6453
Cumhara,	M	(24.22*)	5943†
Bhírbandi,	M	(24 28§)	5875

* Zero of De Luc's ſcale, 16.75 of Reaumur's, anſwering on Fahrenheit's ſcale, to 69.32
General Roy's (Philos. Tranſ. vol. 67, page 740.) adapted to *French* toiſes 61.4
Thermometer at *Chíſápání*, 65°, that at *Calcutta* being 75°; the mean is, ... 70
Thermometer at *Cat'hmándú*, ... 52
At *Calcutta*, ... 68

Mean of both..... 60

† According to the mean of the rules propoſed by General Roy and Sir George Shuckburgh; and nearly in conformity to De Luc's, excepting the reduction of 8° in his ſcale: the numbers being 0.454 for the multiplication of the difference of thermometers, and 0.00244 for that of the mean of both thermometers above 32° Fahrenheit.

‡ By another barometer which ſtood a quarter of an inch higher, the elevation of *Cat'hmándú* above *Calcutta* is 4510 feet; or 4600 nearly, above the ſea.

* Eſtimated. Kirkpatrick, *Népál*, p. 331 and 332.

† Doubtful.

‡ Kirkpatrick, *Népál*, p. 70.

‖ Ibid. p. 57.

§ Much beneath the ſummit of the mountain: ibid. p. 139 and 333.

Sibudhol valley, - - - -	(24·48¶)	5711

Alſo, as before,

Cold ſpring *Chíſápání*, - - - - -	5818
City of *Cat'hmándú*, - - - - -	4784

And (by a trigonometrical meaſurement of mountains encompaſſing the valley of *Népál*,** ſelecting from it mountains ſouth of *Cat'hmándú*,) *Chandragiri* M. above *Cat'hmándú* 3682 feet, and above the ſea,†† - - - - 8466

Palchu M. (above *Cat'hmándú* 4210 feet,) - - 8994

It does not ſeem then, that the elevation of the paſs of *Nágún-ghátí*, whence the mountain near *Jamunáwatárí* was obſerved, need be thought overrated at ſo little as the loweſt of theſe heights which command a ſimilar extenſive view of the *Himálaya*.

To recapitulate the reſult of this minute examination of meaſurements of the *Indian* Alps, the following are ſtated as differences of elevation which may be received as near approaches to a correct determination of the height, and as fully ſubſtantiating the poſition which was advanced, at the beginning of this paper.

Dhawalagiri or *Dhólágír*; above *Gorakhpur*, which is eſtimated to be 400 feet above the ſea;

¶ Ibid. p. 334.

** Colonel CRAWFORD, MSS.

†† This mountain, by General KIRKPATRICK's doubtful obſervation of the barometer (22.5), is 7989 feet above the plains of *Bengal*.

On a mean of two neareſt obſervations and at the loweſt computation, - - - - - Engliſh feet 26462

On a mean of three obſervations with middle refraction, 27677

Above the ſea at the loweſt computation, - - 26862

Yamunávatárí, or *Jámautrí*; above the ſummit of *Nágúnghátí*, which is eſtimated to be 5000 feet higher than the ſea, 20895

Above the ſea, - - - - - - 25500

A mountain ſuppoſed to be *Dhaibun*; above *Cat'hmándú*, which appears by a barometrical meaſurement to be at leaſt 4600 feet higher than the ſea; - - - - 20140

Above the ſea, - - - - - - 24740

A mountain not named, obſerved from *Pilibhít* and *Jét'hpúr*; above *Rohilkhand*, which is eſtimated at 500 feet above the ſea:

On a mean of obſervations at both ſtations, 22291, or more exactly, - - - - - - - 22268

Above the ſea, - - - - - - 22768

A mountain not named, obſerved from *Cat'hmándú*, and ſituated in the direction of *Cálabhairavi*; above the valley of *Népál*, 4600 feet higher than the ſea, - - - - 20025

Above the ſea, - - - - - 24625

Another near it; above the valley of *Népál*, - - 18662

Above the ſea, - - - - - 23262

A third in its vicinity; above the valley of *Nepál*, - 18452

Above the ſea, - - - - - 23052

I TAKE this opportunity of adding to the former communication of Captain RAPER's account of the journey to *Bhadrínáth* and to *Rétal*, and *Bét'hárí* on the route towards *Gangáwatárí*, the narrative of the profecution of the journey towards the fource of the *Bhágirat'hi* by the *Múnfhí*, who was fent from the laft mentioned ftation to explore that fource, and who actually penetrated feveral miles beyond *Gangáwatárí*. It is taken from the field book which was kept by him, and of which the original has been delivered to me by Lieutenant WEBB. The route is laid down from this journal in Lieutenant WEBB's map of a furvey of the Ganges within the mountains, inferted in the laft volume of the *Afiatick* Refearches.*

IT will be obferved, that the *Múnfhí* croffed the Ganges feveral times on *Sangas*, or bridges confifting of one or two fir trees laid acrofs from bank to bank. The breadth of the river, or, which is the fame thing, the length of the bridge, was, in the firft fuch inftance which occurred, 56 paces. At the fecond bridge the breadth of the river croffed was 46 paces; half of which confifted of rocks in the middle of the river, and the other half only appears to have been the breadth of the ftream. In the third inftance the diftance from bank to bank was 51 paces; but one-third of this was rock, leaving two-thirds only or 35 paces for the width of the ftream. The fourth bridge was 54 paces long; but the fifth, 28 only: and the fixth appears to have been no more than 25 paces. This was below the confluence of the

* Vol. XI. p. 447.

Bhágirat'hí with a rival ſtream named *Kédárgangá;* and conſiderably ſhort of the termination of the *Múnſhí's* journey. He has not ſpecified the breadth of the river where laſt ſeen by him: but, at *Gangáwatrí*, an expanſion of the ſtream is deſcribed by him to be 40 cubits wide and 2 deep; with ſcarcely any current. The river was traced 3 miles further amidſt the ſnow.

Sunday, 1ſt May 1808. *Set off from Bet'hári, Pergh. Taknúr in Garhwál.*

Left hand.	Bearings by Compaſs.	Paces.	Right hand.
Road level. Ganges diſtant 200 paces. Name of the place *Bet'hárîban.*		622	Acroſs the Ganges. The River *Idrar* in ſight; diſtant $\frac{1}{2}$ coſs. Name of the place *Sálkában.*
Mauza *Kiárkhí* in ſight diſtant $\frac{1}{2}$ coſs. A ſmall ſtream from the mountain flows towards the Ganges. The river 100 paces diſtant. Road over rocks: difficult.		320	
Road level over rocks. Ganges very near.		800	R. *Jamca*; diſtant $\frac{1}{2}$ coſs.
Aſcent. Ganges 400 or 500 paces diſtant.		150	
Deſcent. Ganges 250 paces off.		128	
Over rocks near the river; extremely difficult.		192	
A ſmall ſtream from the mountain falls into the Ganges.		11	
A grotto reſembling a veranda, near the road.		56	

Left hand.	Bearings by Compass.	Paces.	Right hand.
Torrents, fifty or ſixty paces wide, running with great violence towards the river, 200 paces off.		857	
A grotto capable of containing ten or fifteen perſons: River as before.		135	
Aſcent.		80	
Level road on the high ground. Ganges 400 paces diſtant. A village in ſight, $\frac{1}{4}$ coſs off.			
Aſcent. Ganges $\frac{1}{4}$ coſs off.		540	
Level. River as before.		200	
Over rocks; very difficult.		320	
A grotto capable of containing 25 perſons.		240	
Road level. River ſtill as before.		408	
Deſcent: to the bank of R. Soar.		309	
Croſs R. Soar, by a *Sanga*.		14	
The water touched the bridge and flowed with rapidity. Ganges $\frac{1}{2}$ coſs diſtant. Ma. Murar in ſight on an eminence.			
Aſcent.		32	
Road along the ſide of the mountain.		1208	A large village, *Sâlang*, and river of the ſame name; diſtant $\frac{1}{2}$ coſs.

Left hand.	Bearings by Compáſs.	Paces.	Right hand.
Deſcent.*		320	
Road along the ſide of the mountain.		174	
Deſcent to the bank of the *Cúchián* N.		560	
Ford of the *Cúchián* N.†		5	
Aſcent of mount *K'hontá.*‡	North 3 points East.	848	
Road deſcends.		704	
Aſcends again.		128	
Deſcends.		205	
Ford of the *Taur* N.§		2	
Road along the ſide of the mountain.‖		997	
Level.	N. 2 pts. E.	59	
Aſcent of mount *Tuwárá.*¶		2264	
Deſcent.	N. 4 pts. E.	176	
Aſcent. A large grotto ſeen.		168	
Deſcent along the ſide of the mountain to the banks of the *Tiar* R. Ganges $\frac{1}{2}$ coſs off.		1392	

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* Ganges 500 paces off.

† Ganges $\frac{1}{4}$ coſs off. The village of *Cúchián* in ſight on the height.

‡ Name of the place *Agrákhá*. Ganges $\frac{1}{2}$ coſs diſtant.

§ This ſtream comes from North 7 points Weſt. Ganges ſtill $\frac{1}{2}$ coſs diſtant. Rained at noon. We eat bread on the bank of the ſtream.

‖ Lower down, a grotto capable of holding 25 perſons.

¶ Village of *Tuwárá* in ſight. A ſmall grotto. Ganges $\frac{1}{4}$ coſs diſtant.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Ford the *Tíar.**	N. 5 pts. E.	13	
Road level; a little undulating.†		1283	
Total		16,865 paces.	

Monday, 2d May, proceeded.

Road leads over rocks of the Ganges. Stream distant 500 paces.	N. 3 pts. E.	288	River *Datai* in sight ½ cos distant. It comes from mount *Kailás*. N. 6 pts. E.
Ascent of Mount *Capar Khola*. Ganges ¼ cos distant.		1248	Flows with great rapidity.
Road level. A small grotto. Ganges ¼ cos distant.	N. 1 pt. E.	464	
Road undulating to the banks of the *Khótmári*. Ganges ½ cos distant.		496	
Ford the stream.‡		3	
Ascent.	N. 2 pts. E.	112	
Road level on the high ground.		208	Water of the Ganges ap-
Along the side of the mountain. Ganges ½ to ¼ cos distant.		960	peared like mud.
Crossed the *Réri*;§		8	
Descent along the side of the mountain. Ganges 1 cos distant.		1336	
Ascent. Ganges 400 paces off.	N. 6 pts. E.	355	

* The stream comes from N. 2 points E.

† Ganges 500 or 600 paces distant. Stopped for the night in a large grotto or place sheltered by rocks. Rained the whole night.

‡ It comes from N. 1 point W. Falls in a cataract of 20 cubits high.

§ It comes from S. 7 points E. Ganges less than 1 cos distant. Halted at noon to eat bread. It rained.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Along the side of the mountain.*		1280	
Road level. Ganges 200 paces distant.	N. 2 pts. W.	1486	R. *Nar* 1 cos distant. Comes from N. 2 points E. A cataract 7 cubits high.
Road level.	N. 3 pts. E.	193	
Road level. A grotto seen. Ganges 500 paces off.		200	
Road level.		888	R. *Rúnká*, 1 cos distant,
Road level.†		42	N. 7 points E. A hot spring.
Road level to the banks of the *Calyání*.		349	from the side of the mountain called *Rársicund*, on the bank
Cross the Rivulet.		2	of the Ganges.
Ganges $\frac{1}{2}$ cos distant.			
A *Dhermsala* at *Banghéli*. Some fields of cultivation. Ganges 600 paces off.	N. 7 pts. E.	214	The *Malícha* falls into the Ganges. It flows from N. 7 points E.
Level. Ganges 500 paces distant.		266	
Ascent along the side of the mountain. Ganges $\frac{1}{4}$ cos distant.	N. 5 pts. E.	1110	
Descent by a similar path. Ganges 200 paces off.		1154	
Ford of the *Banghéli* N. It flows from N. 2 pts. W.		11	
Road level.‡		280	
Road level to the Ghat.		186	
Crossed the Ganges by a *Sángá*	N. 7 pts. E.	56	

* The *Réri* falls into the Ganges. This is 50 paces [wide].

† A small stream from the mountain's side falls into the Ganges.

‡ A deserted hut of herdsmen. Ganges 300 paces off.

Left hand.	Bearings by Compass.	Paces.	Right hand.
or ſpar bridge 1 ½ pace wide.*			
		128	Aſcent. Ganges 200 paces diſtant.
		320	Road level.
		80	Along the ſide of the mountain.
		800	Same. A torrent croſſes the road.
		249	Level, along the edge of the Ganges:†
		480	Road level.‡
R. *Kanéla* in ſight, a coſs diſtant: comes from N. 3 pts. W.		152	
		800	Road level: a grotto ſeen. Ganges 200 paces diſtant.
		1280	Road level.§
		120	Road level. ¶
Total.		17,609	Paces.

Tuesday, 3d May.

	N. 2 pts. E.	325	Road level to *Déoráñí* a Rivulet from N. 5 pts. E.
		3	Forded the *Déoráñí.*

* The ſtream was 30 cubits below the bridge. The *Sángá* conſiſted of two or three ſpars with a few pieces of wood tied on them. It was not a ſafe bridge. Having croſſed, have now the Ganges on the left hand.

† A fir tree, which had fallen in, reſted againſt the bank.

‡ A grotto ſeen: might hold 50 people.

§ A torrent from the mountain paſſes cloſe to the road.

¶ Stopped for the night at a large grotto capable of containing 40 perſons, 200 paces from the Ganges. Slight rain all night.

Left hand.	Bearings by Compaſs.	Paces.	Right hand.
	N. 5 pts. E.	378	Road to *Déoráni ghát* of the Ganges.
		46	Croſſed the Ganges by a *Sángá* or bridge of ſpars.*
Aſcent.	N. 2 pts. W.	40	
Level road.		400	
Deſcent.		40	
Level.		688	
Over the ſnow.		182	
Road level.	N. 2 pts. E.	48	
Aſcent.		40	
Level. A ſmall grotto ſeen.		120	
Croſſed the Ganges at the *Ghát Lóhárinág* by a *Sángá* or bridge of ſpars.†		51	
		358	Road almoſt level, over rocks.
		59	Road level.
	N. 4 pts. E.	1095	Road level, along the mountain's ſide. Ganges 100 paces off.
		19	Croſſed the *Lótgárh* by a *Sángá* conſiſting of 4 timbers.‡

* It conſiſted of three ſmall ſpars and was ½ a pace wide; very dangerous and terrifying. Went over it in a ſitting poſture ſliding along. The wooden part 24 paces, of which 11 very dangerous and 13 more eaſy. The reſt (22 paces) on rocks in the Ganges. The ſtream 7 cubits below the bridge.

† 2 paces wide, and five cubits above the ſtream. Wood 25 cubits. Rock 11 cubits. Wood 10. Rocks 5. Ganges again on the left hand.

‡ It was 2 paces wide, and was touched by the water, which flowed with great rapidity. This ſtream comes from *Himáchal* N. 7 points E.

Left hand.	Bearings by Compaſs.	Paces.	Right hand.
		480	Over rocks on the edge of the Ganges.
		296	Over ſnow, which had fallen on the bank of the Ganges.
	N. 7 pts. E.	184	Proceeded over rocks in the Ganges.
		464	Aſcent of the mountain, which was very ſteep. Climbed, holding by the graſs and ſmall ſhrubs.
		88	Deſcent towards the Ganges: went in a ſitting poſture.
		16	Road level.
		40	Aſcent; very ſteep and difficult.
		104	Level.
		48	Aſcent; very difficult. Overhangs the Ganges.
		112	Level. Ganges 200 paces off.
		131	Aſcent; ſteep and difficult.
		56	Deſcent; extremely ſteep.
		462	Aſcent. Ganges 250 paces off.
		272	Level. Ganges 150 paces diſtant.
		64	Over rocks on the edge of the Ganges.
		168	Deſcent from rocks; very ſteep.

Left hand.	Bearings by Compaſs.	Paces.	Right hand.
The *Jelárí* R. in ſight, one coſs diſtant, comes from N. 7 points E. and ſnowy mountains ſeen N. 7 points W. diſtant one coſs.		831	Over rocks of the Ganges; but leſs difficult.
		1544	Road level; over ſtones in the bed of the Ganges.*
		156	Level.
		192	Aſcent.
		232	Deſcent.
		145	Over the rocks of the Ganges: very rough and difficult.
		192	Aſcent.
		320	Level, along the bank of the Ganges.
		96	Aſcent.
		200	Deſcent.
		653	Over rocks of the Ganges: Extremely rough and difficult.
	N. 4 pts. E.	11	Croſs the *Bhélá* by a *Sângá*.†
		135	Level.
	N. 7 pts. E.	54	Croſs the Ganges at the *Ghât* of *Súkhí*, by a *Sángá*.‡
Aſcent, along the ſide of the mountain.	N. 7 pts. W.	659	
Along the ſide of the mountain to *Súkhí*. Ganges one coſs diſtant.	N. 7 pts. E.	1654	

* A cave or grotto ſeen, and a ſmall one capable of containing 50 perſons.

† Five cubits above the water. The ſtream comes from S. 1 pt. E.

‡ One pace wide, five cubits above the water. The old one had been broken down and a new one had been recently erected. The greateſt part of the diſtance in croſſing was over rocks, viz. Rock 26. Wood 17. Rock 11.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Along the side of the mountain.		840	
Ascent.		552	
Descent. Ford the *Choraki* N.*		1248	
Road level. Ford the *Pakchahár*.†		523	
Road level. Ford the *Gangótrí* N. This flows from N. 7 points W.		117	
Ascent to *Jhálá*; which is 100 paces from the Ganges.‡		184	

4th May.—Proceeded at noon, when the snow was a little cleared away.

Road level.	N. 2 pts. W.	496	
Ford the *Nibáni* N. It comes from S. 7 points E. Ganges 200 paces off.		11	
Along the side of the mountain.	N. 7 pts. W.	640	
Descent. Ganges 2 to 300 paces off.		699	
Road level.	N. 5 pts. E.	400	
Cross the *Shinán* by a *Sángá* §		32	
Road level.		40	
In the Shallow bed of the Ganges.		70	

* Comes from N. 7 points W. Ganges 200 paces off.

† It comes from S. 1 point W. Ganges 100 paces off.

‡ Slight rain. Snowy mountains on all sides and apparently very near. In the middle of the night much snow fell. In the morning the whole forest and the surface of the ground, and roofs of houses, were covered with snow. Halted till noon of next day.

§ The stream comes from N. 2 points W.

Left hand.	Bearings by Compaſs.	Paces.	Right hand.
Over ſtones in the Ganges.		37	
In the ſhallow water of the river.		59	
Over ſtones.		35	
In the ſhallow water.		11	
Over ſtones along the edge of the river.		562	
In the ſhallow water.*		48	
Along the banks of the Ganges.†	N. 2 pts. E.	336	
Aſcent.		48	
Along the ſide of the mountain.		528	
Over the rocks of the Ganges, very rough and difficult.		1000	
Croſs the *Gongtí* by a *Sángá*.‡		22	
Road level. Ganges 250 paces off.	N. 7 pts. E.	531	
Croſs the *Harſilá* by a *Sángá*.§		14	
Road level. Village of *Cachórá*.		280	
Aſcent of the mountain near *Cachórá*.		160	
Level road.		320	
Continued aſcent of the ſame mountain.		424	

* Two channels of the river here unite.

† The melted ſnows deſcending from the mountains.

‡ The water touched the bridge. Stream comes from N. 5 points E.

§ The ſtream comes from N. 7 points E.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Descent.*		1024	
Road level.		368	
Ascent. along the side of the mountain.		256	
Descent. Along the side of the mountain. River very near.		533	
Cross by a *Sángá* near *Dherálí* †		14	
Level road over the rocks of the Ganges.		144	
Cross the Ganges by a *Sángá*. ‡		28	
The deserted village of *Súkhia* in sight across the Ganges.		96	Level road to the temple of *Mahádéva*.§
Khera N. descends from *Cailás*.		96	Arrived in the evening at *Dherálí* in Pergunna *Tacnúr*. ‖
		Total 9002	

5th May.—Proceeded from Dherálí.

S. 5 pts. E.	160	Ascent.
	400	Descent. Ganges 200 paces off.
	416	Level road. A stream from the mountain crosses the road.

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* A stone representing *Mahádéva*, on a mountain said to be *Cailas*, was in sight from *Cachórá*, bearing N. 5 points E.

† 5 Cubits above the water.

‡ At the *Ghát* of *Dherálí*. The water rises within 5 cubits of the bridge. The Ganges is now on the left hand.

§ Containing a stone *linga* to represent the deity. It was buried in the sand. The temple said to have been founded by *Sancaváchárya*. Other houses to the number of five or six.

‖ Containing near 25 huts, of which only 5 inhabited.

Left hand.	Bearings by Compass.	Paces.	Right hand.
		792	Over rocks on the edge of the river.
		14	Crossed the *Gangásárti* by a *Sángá.**
	S. 5 pts. E.	1000	A stream from the mountain crosses the road. Ganges 250 paces distant.
		320	Road level: but over rocks.
		96	Level: over snow.
		864	Level: over rocks. Ganges 300 paces distant.
		160	Level: over snow.
		480	Level: over rocks. Ganges 200 paces distant.
		80	Level: over snow.
		400	Level: Ganges 200 paces distant.
	N. 5 pts. E.	480	Ascent.
		320	Level: Ganges 400 paces distant.
		496	Descent: Ganges 300 paces distant.
R. *Gúmgúm* in sight, one cos distant.†		80	Level: A torrent from the mountain S. 1 point E.
		160	Level.
		249	Over snow. A stream from *Changthanga.*

* The stream is very rapid and comes from Mt. *Cailás*, S. 3 points E.

† Comes from N. 2 points. Is crossed by a *Sángá* on the road to *Bhót (Thibet.)*

Left hand.	Bearings by Compass.	Paces.	Right hand.
		240	Level: Ganges 300 paces off.
	N. 6 pts. E.	488	Level.
		80	Over snow.
		533	Level. A stream from *Changla* crosses the road.
		445	Level. Ganges 4 or 500 paces distant.
		1064	Along the side of the mountain.
		14	Cross the *Laconga* by a *Sángá*.*
		240	Level.
		240	Ascent of Mt. *Ratúnti*.
		312	Level: over rocks.
		120	Ascent.
		96	Level: over rocks.
		64	Level: over snow.
		160	Level. Ganges 300 paces off.
		64	Ascent.
		560	Along the side of the mountain.
R. Jáhní-gangí from the *Himáchal* mountains. Comes from N. 6 points E. Flows with great rapidity; and joins the Ganges. A *Sa'nga'* over it, leads towards *Bhót* (Thibet.)	N. 5 pts. E.	1588	Level: over rocks.
		184	Level: over rocks.†
		512	Road undulating. Descent by means of a short ladder.
		16	Level. A stream from the mountain crosses the road.

* It comes from Mt. *Cailás* S. 5 points E. Ganges 200 paces off.

† *Cál-bhairo*: a mere heap of stones, with no idol. Walnut trees. Ganges 500 paces off.

Left hand.	Bearings by Compass.	Right hand.
		25 Croſs the Ganges by a *Sángá* at *Bhairógháti.**
A figure of Bhairólál.†	168	
Aſcent.‡	144	
	Total 15032	

6th May.—Proceeded on the journey.

Aſcent by means of ladders. N. 7 pts. E.	299
Aſcent of the mountain.§	400
Level: over rocks.‖	1080
Level: a plain.	80
Level: over rocks.¶	1035
Level.**	336
Along the ſide of the mountain. N. 6 pts. E.	840
Level ††	400
Level. Over rocks. Ganges 400 paces off.	2000

* The ſtream appeared to be 500 cubits below the bridge.

† Carved in the ſtony ſcarp of the mountain. Two idols of ſtone, daubed with minium. Pilgrims make offerings here and proceed.

‡ Halted in a grotto which might contain 100 perſons.

§ A temple of wood, containng an image of *Bhairólál.*

‖ A ſtream from *Banlago* croſſes the road in three places, towards the Ganges. Comes from S. 7 pts. W. Ganges 500 paces off.

¶ A ſtream from Mount *Matwári* croſſes the road.

** Halted in a grotto of *Matwári.* Ganges 400 paces diſtant.

†† A ſtream near the deſerted village of *Himún,* from the mountain, acroſs the road.

Left hand.	Bearings by Compaſs.		Right hand.
Level. Over rocks.*		752	
Level. A ſtream from *Teráli*, croſſes the road.		452	
Level. Halted in the grotto of *Teráli*. Fir trees. Ganges 400 paces diſtant.		576	
Level.	N. 7 pts. E.	40	A ſtream from the ſnow on the other ſide of the river Diſtant $\frac{1}{4}$ coſs.
Level. Road croſſed by a ſtream from the mountain.		411	
Level. Over rocks.†		444	
Level: over rocks.‡		1392	
Level. A ſtream from *Otſaro* croſſes the road.		818	
Level: over rocks.§		1064	
Level: over rocks.‖		1120	
Level: over rocks.¶		3200	

* A ſtream near *Bhandrá* (formerly a village), comes from the mountain acroſs the road.

† Grotto of *Otſaro* capable of containing 20 perſons. Ganges 300 paces off.

‡ Many torrents from the mountain croſs the road and fall into the Ganges. River 250 paces diſtant.

§ A foaming torrent croſſes the road called *Megmerá* or *Shírcai*. Falls into the Ganges.

‖ A grotto capable of holding 10 perſons. Ganges 250 paces off.

¶ A torrent paſſes near the road. Falls into the Ganges. The river 200 paces diſtant.

Left hand,	Bearings by Compass.	Paces.	Right hand.
Level: over rocks.		104	R. *Bhój* from S. 2 points E. Distant $\frac{1}{2}$ cos.
Level: over rocks.*		1104	
Level: over rocks †		584	
Level: over rocks. *Télálóní.*‡		176	
Level: along the edge of the river.§		1448	
Level. Arrive at *Gangáwatrí* ‖		580	
	Total	20,839	

* *Patágní*, where the *Pándus* are said to have performed a sacrifice. Ganges 200 paces off.

† A torrent falls into the Ganges. *Pakora* and *Cachorí*: a spot surrounded with red marks; where the *Pandus* are said to have prepared their victuals. River 300 paces distant.

‡ A spot named from salt and oil which might formerly be perceived; but not so now.

§ *Gauricund*, a pool in which the water collects, and whence a stream proceeds. Confluence of *Kédárgangá* from S. 5 pts. E. with *Bhágirat'hí* or Ganges from N. 7 pts. E. Hindus shave and bathe here preparatory to visiting *Gangáwatrí*.

‖ On the banks of the Ganges. A wooden temple containing the footstep of *Gangá* on a black stone *Súryacund*, *Vishnucund* and *Brahmecund*, within the Ganges, being names assigned to distinct portions of the river: where pilgrims bathe. The last is 40 cubits wide and 2 deep. It is the pure *Gangá* unpolluted by water of any other stream. *Bhágirat'hí síla*, a large rock in the river, on which the king *Bhágirat'ha* worshipped the deity. The river comes from N. 7 pts. E. and has very little current. Scarcely any trees, but the *Bhójpatr* (birch?). On all sides snow. A large temple roofed with wood, containing an image of *Gangá* in red stone, a small female figure of silver, images of *Mahádéva* and *Párbatí* in red stone represented with the human form, *Bhágirat'ha*, *Annapúrná dévi*, *Vishnu*, *Brahmá* and *Ganésa* in red stone. A *Bráhmen*, who is an inhabitant of *Dherálí*, attends here during three months, *Vaisak'h*, *Jyst'h* and *Asarh*. Scarcely any but *Bairágís* and *Sannyásís* come here: the road being in the highest degree difficult, and the place amidst snow most inhospitable.

Left hand.	Bearings by Compaſs	Paces.	Right hand.
			7th May—Proceeded onwards.
Road level: over the rocks of the Ganges.	N. 7 pts. E.	1320	
Road level: the river might now and then be perceived amidſt the ſnow.		1416	
Road level: on rocks in the Ganges.*		496	
The Ganges might now and then be perceived under the ſnow.†		968	
Along the bank of the Ganges; over rocks.‡		760	
Over ſnow, filling the bed of the Ganges.§		2640	

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* The breadth ſtill leſs than at *Gangáwatrí*. On one ſide the road is practicable. On the other a perpendicular wall of rock. In the bed of the river ſaw a rock 2 or 3 paces wide and 5 long, bathed by the river on both ſides, and overhanging the ſtream; the depth of water being very ſmall. This rock exhibits a ſimilitude of the body and mouth of cow. It is called *Gao-múc'h*.

† An image of black ſtone might be ſeen in the ſnow; but could not be approached, for fear of being buried in the ſnow. The road was over the ſnow of the Ganges.

‡ A large cavern quite capable of containing 100 perſons: conſiſts of ſeveral apartments.

§ The river was not once ſeen, nor was any ſound of its current heard. The ſnow being ſoiled appeared like the earth of cultivated fields.

Left hand.	Bearings by Compass.	Paces.	Right hand.
Over rocks along the banks of the Ganges, which here showed itself.*		520	

8th May.

Set off to return by the same road towards *Dherâli*: there being no other practicable route.

The sequel of the field book is kept in a similar manner: but it is thought unnecessary to translate it.

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* In front was a steep mountain like a wall of rock, from an angle of which the Ganges appeared to come. Beyond the present station was nothing but snow, nor any road, but that termination of the valley. From dread, none would venture into the water of the Ganges. The snowy tops of the mountains appeared of various height; and not the least sign of vegetation: nothing but snow, masses of which were falling from the mountains. As the people in company were deterred from advancing, and there appeared no road by which to penetrate, and further progress seemed full of peril and of terror, I was under the necessity of returning to *Gangáwatri*.

VIII.

An account of the Meaſurement of an Arc on the Meridian extending from Latitude 10° 59′ 49″ to 15° 6′ 0″.65 North.

By Major WILLIAM LAMBTON,

33rd REGIMENT OF FOOT.

IT is with much ſatisfaction that I have it in my power to ſtate to the Society, the ſucceſs which has attended a further extenſion of the grand meridional arc, and the concluſive reſults from another ſeries of aſtronomical obſervations at a ſtation near *Gooty*, in latitude 15° 6′ 0″.65. I am thereby enabled to ſet aſide entirely thoſe doubtful obſervations at *Dodagoontah*, ſo often mentioned in my former communications; not however without ſome regret at the neceſſity of ſo doing; becauſe I wiſhed to have noticed the progreſſive increaſe of the degrees on the

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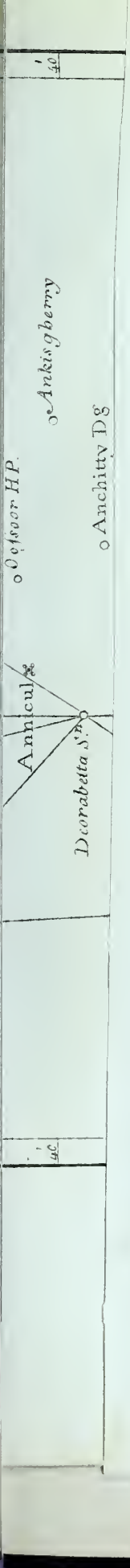

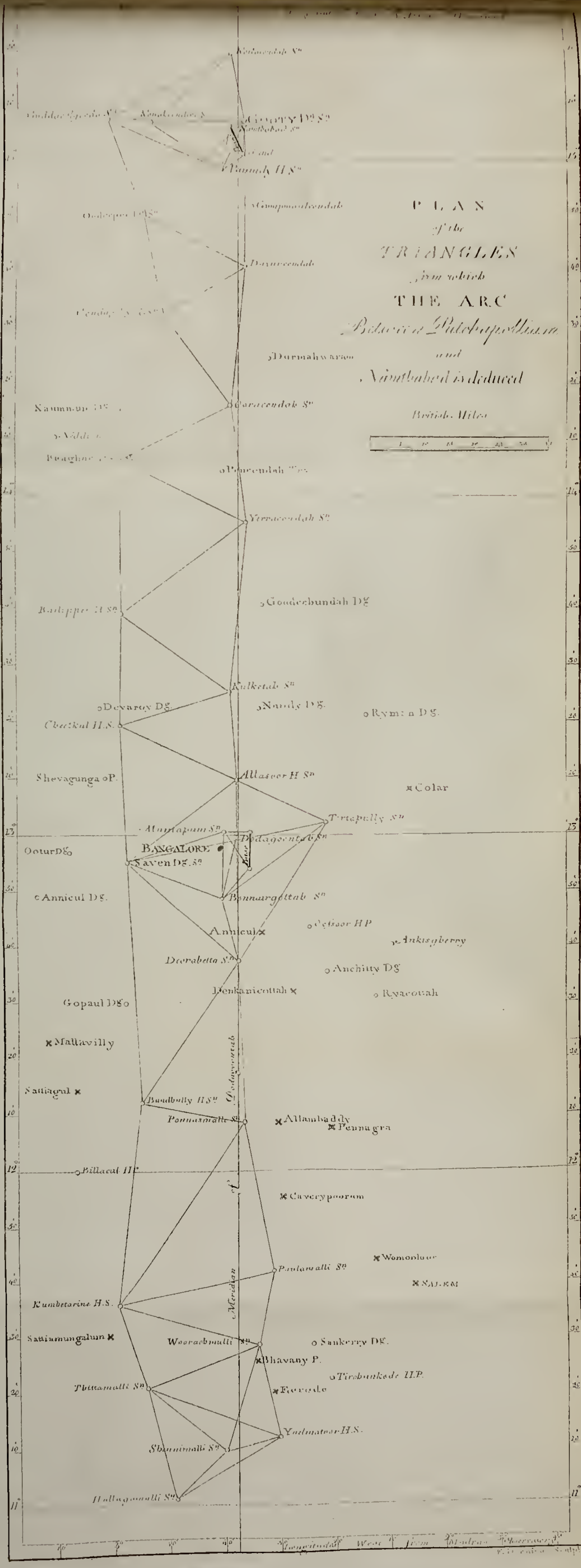
PLAN
of the
TRIANGLES
from which
THE ARC
Between Putchapolliam
and
Namthabad is deduced
British Miles
Darmahwaram
Paracondah Sn
Yerracondah Sn
Goodeebundah Dg
Kulkotah Sn
Devaroy Dg
Nandy Dg
Rymen Dg
Cheetkul H.S.
Shevagunga P.
Allasoor H Sn
Colar
Tertepully Sn
Ootur Dg
BANGALORE
Saven Dg Sn
Annicul Dg
Bonnargottah Sn
Annicul
Oossoor H P
Ankisgherry
Deorabetta Sn
Anchitty Dg
Denkanicottah
Ryacotah
Gopaul Dg
Mallavilly
Sattiagul
Boodbully H.Sn
Ponnasmalli Sn
Allambaddy
Pennagra
Billacal H.
Caverypooram
Palanmalli Sn
Womonloor
SALEM
Meridian
Kumbetarine H.S.
Sattiamungalum
Wooraebmulli Sn
Sankerry Dg
Bhavany P.
Tirebunkode H.P.
Thittamalli Sn
Eerode
Yedmatoor H.S.
Shunimalli Sn
Hallagonmalli Sn
Longitude West from Madras

meridian, as I advanced to the northward, by arcs not more than two degrees in amplitude. However as the caſe ſtands at preſent, it is fully ſatisfactory. The whole arc is 6° 56′ 22″.25, and it may be conſidered as conſiſting of two ſections; one of 2° 50′ 10″.5, the ſouthern one, which gives the degree 60473 fathoms nearly, for the latitude 9° 34′ 44″, the middle point of that degree, as appeared from my laſt paper, (in the commencement of the preſent volume of the Reſearches.) The other ſection is 4° 6′ 11″.28 in amplitude, and lies to the northward of the former. This gives the degree due to the middle point, or latitude 13° 2′ 55″ equal 60487.27 fathoms. Alſo the degree due to latitude 11° 37′ 49″, the middle point of the whole arc is 60480.42 fathoms. So that for latitude 9° 34′ 44″ the degree is 60472.91 fathoms, and for latitude 11° 37′ 49″ the degree is 60480.42 fathoms, alſo for latitude 13° 2′ 55″ the degree is 60487.27 fathoms. Theſe being deduced from actual obſervations, afford a regularity in the increaſe exceeding my moſt ſanguine expectations.

The recent meaſurement, is a continuation of the former triangles, in 1805 and 1806, commencing on the diſtance *Paughur* and *Yerracondah*, and terminating at the ſtation of obſervation about three miles Weſt from *Gooty*, where a baſe line has been meaſured as a verification to the preſent, and a foundation for a further extenſion of a future ſeries of meridional triangles. And to render this account of what has already been done complete, I have here included the whole number of triangles, from the baſe in *Coimbetoor*, to that near *Gooty*. A particular account of the meaſurement of the baſe near *Bangalore*, has already been given in the 10th volume of the *Aſiatick* Reſearches, of courſe it is not neceſſary to repeat it here. That baſe is therefore only taken up as a new datum, from which the triangles are carried ſouthward to the ſtations *Ponnaſſmalli* and *Kumbetarine* hill, and northerly to *Pau-*

ghur and *Yerracondah*, and then recourſe is had to the laſt meaſured baſe near *Gooty*. Hence what is given here, together with what appears in the 10th and preſent volumes of the Reſearches, will furniſh an entire account of the whole arc in its preſent ſtate of progreſs, and its future extenſion will, I hope, be more in the order of time, as a meridional ſeries will be chiefly attended to; and it may be gratifying to the intelligent reader, who is intereſted in ſubjects of this nature, to know that theſe operations are to be extended through the *Dekkan*; which, if no local difficulties occur, may be carried to the northern confines of the NIZAM's dominions, conſiderably beyond the latitude of 20 degrees. It however may be doubtful as to the practicability of extending it ſo far, in the preſent ſtate of that country, but I hope I ſhall have no difficulty in penetrating as far as the latitude of 18 degrees, and perhaps my next obſervations may be on the banks of the *Goodavery*. It is ſcarcely neceſſary to mention here, that the number of years elapſed ſince the commencement of this arc in 1803, has been owing to the time taken up in extending the ſurvey, over the whole Peninſula. The baſe near *Gooty* has been the foundation of a ſeries of triangles connecting *Maſulipatam* with *Goa*, which I expect will be completed in 1813, and after that my whole attention will be directed to the northward, where having only the meridional ſeries to attend to, my progreſs in that direction muſt conſequently be more rapid.

BESIDES the purpoſe of extending this arc to the northward, there is another object of equal importance, which is the meaſurement of a perpendicular arc, in a latitude as far north as it is poſſible to penetrate. It is from theſe perpendicular arcs, that a ſcale is obtained for computing the relative longitudes; and when this ſurvey is carried

through the *Circars*, it will be of great importance to determine the positions of places along the sea coast. Some of those places, according to Major RENNELL's account, are laid down from observations formerly made under the direction of Colonel PEARSE, on his route from *Madras* to *Calcutta*, in 1784; but his route was chiefly inland after crossing the *Kistna*, touching the coast in very few places; and his positions are laid down only in latitude. Others are fixed from Major STEPHEN's survey; but the data seem to have been insufficient. Even astronomical observations are incompetent to fix the relative longitudes of a number of places within a few miles of each other. To determine the measure of a degree perpendicular to the meridian affords the only correct means: and these low latitudes with great nicety in the observations is necessary. It therefore becomes an important desideratum to obtain, an accurate scale for computing longitudes, and the more northern latitudes afford the surest results.

I HAVE already noticed that these meridional operations were begun in 1805. The base near *Bangalore*, measured in 1804, was the first foundation, and its height above the sea was determined from a series of triangles brought from the *Coromandel* coast, and commencing from a base near *St. Thomas's Mount*. The perpendicular height above the sea of every great station, was determined in the usual manner, by using the contained arcs between two stations, a method so well known, that it is needless to explain it here. An account of those heights, with the terrestrial refraction as observed at every station in going direct from sea to sea, is given in the 10th volume of the Asiatick Researches.

IN 1805, on my return from the *Malabar* coast; the meridional trian-

gles were begun at *Paughur* and *Yerracondah*, (ſee the plan), and brought down to the baſe near *Bangalore*, from which other triangles had been extended ſoutherly in 1804, for the purpoſe of obtaining ſides of a great length, for meaſuring a perpendicular arc, but which anſwered exceedingly well for the meridional ſeries. In the beginning of 1806, that ſeries was reaſſumed, and carried down to the *Coimbetoor* country, where a baſe was meaſured, and a choice collection of zenith diſtances obſerved, an account of which was given in my laſt communication, which gives the particulars of the ſouthern ſection of this arc.

In 1811, the triangles were again taken up at *Paughur* and *Yerracondah*, and carried up to *Gooty*, for determining as uſual the height of that baſe above the ſea; but when that meaſurement was computed and reduced to the level of the ſea, the triangles were computed back to the diſtance *Paughur* and *Yerracondah*, differing from the ſame diſtance brought from the baſe near *Bangalore* $1\frac{4}{10}$ feet, which, proportioned to the meaſured baſe near *Gooty*, will make a difference of $3\frac{6}{10}$ inches, ſuppoſing it to have been computed as a ſide of the laſt triangle, brought out from the baſe near *Bangalore*. The ſuperintendence of theſe triangles was intruſted to Lieutenant Riddell, of the Company's ſervice, while I was meaſuring the baſe, and obſerving zenith diſtances; and thus terminated theſe operations; a ſummary account of which I have thought it neceſſary to give, becauſe they have been carried on at intervals only, and in point of time, bear but a ſmall proportion, to that taken up on the geographical ſcale.

In the preſent volume of theſe Reſearches, I have given the general formulæ for determining the figure and dimenſions of the earth, taking my own meaſurements as ſtated in that account, and the different meaſurements in *England*, *France*, and at the *Polar Circle*, from which a

mean result is had, for determining the rates of the *Polar* to the equatorial diameter.

The present degree in latitude 11° 37′ 19″ compared with the *English*, *French*, and *Swedish* measurements, will give an ellipticity of $\frac{1}{300.55}$, but I forbear making any deductions till I have done all that I mean to do in the meridional measurements, and until I know further respecting the operations carried on in *England*.—When these arcs are extended as far as it is practicable, some final conclusions may then be drawn with respect to the figure and dimensions of our earth. For what has been done by those eminent men sent out to different countries in the last century, seems to have left the question more involved in uncertainty than it was before. Bouguer appears to have been the most correct, and had he taken any other measurement made in the northern latitudes, rather than that of Maupertuis, to compare with his own, his hypothesis might have been near the truth.—The degree given by the Abbe de La Caille is as inconsistent as that of Maupertuis; and he draws a conclusion equally inconsistent with the doctrine of rotatory motion, viz. that the meridians in the southern hemisphere have a different curvature to those in the northern, or that the degrees of longitude in the same latitude are different in the two hemispheres. I wish to see that measurement put to the test. Maupertuis has been found by the members of the *Swedish* academy, to be out upwards of 200 fathoms, which circumstance cannot but tend to lessen our confidence in the *Abbé's* performance at the *Cape of Good Hope*.

In the sequel of this paper, I have added, as in my last, a table, shewing the perpendicular heights of the stations above the level of the sea. The base lines are all on the table land, and it may be curious to notice their comparative heights. The table land in the neighbourhood

of *Bangalore*, and towards *Coſcotta* is upwards of 3000 feet above the ſea. The table land, or rather the general height of the low country in *Coimbetoor* (for it is much undulated) is about 900 feet. Towards *Tinnevelly* it falls to between four and five hundred feet. The fall to the northward of *Bangalore* is very rapid after paſſing *Nundydroog*, and the ſummit of *Paughur*, which riſes high from its baſe, is nearly upon a level with the table land near *Bangalore*. The mean height of the baſe near *Gooty* is 1182 feet, which is nearly the mean height of the flat country extending round *Gooty* and *Bellary* from which plain the mountains and hills riſe like iſlands from the ſea. Theſe facts being eſtabliſhed, it is not difficult to account for the different temperatures in the different diſtricts, at the ſame, and at different ſeaſons of the year. In carrying on my geographical operations I have been particular as to the heights, and the general ranges of mountains, for they form the moſt prominent features of the country, and ſuch information might aid the reſearches of intelligent medical men, in their inveſtigation of the cauſes of thoſe diſeaſes, which are ſo fatal in ſome parts of the Peninſula. There are ſome remarkable facts with reſpect to the country to the weſtward of *Bangalore*. After paſſing the range of hills, in which *Savendroog*, *Paughur*, and ſeveral other ſtations are ſituated, the country has a ſudden deſcent, and continues low, conſiderably to the weſtward of *Seringapatam*, where it begins again to riſe towards the mountains called the weſtern ghauts, which are in general from two to three thouſand feet higher than thoſe which form the eaſtern ghauts. *Seringapatam* therefore, and all the country north and north-eaſterly towards the ceded diſtricts, is a valley, upwards of a thouſand feet below the table land round *Bangalore*, deſcending as we advance to the northward. The *Savendroog* range forms a kind of barrier to the eaſt, but a more complete one is formed to the weſtward, by thoſe ſtupendous mountains which form the ghauts, a num-

ber of which are from five to ſix thouſand feet above the ſea. The countries of *Canara* and *Malabar* lie immediately below theſe ghauts, and the ſea is every where in ſight. Theſe countries are low, but broken, and much interſperſed with back-water, rivers, and extenſive ravines, ſhaded with foreſt and jungle, and filled with population; for the upland is barren, and it is in theſe ravines and on the banks of the rivers, where all the inhabitants reſide. In the month of February the low country becomes exceſſively hot, and the vapour and exhalation ſo thick, that it is difficult to ſee to the diſtance of five miles. I have viewed this curious laboratory from the tops of ſome of the higheſt mountains, where I was ſcarcely able to bear the cold. The heat increaſing during the months of March and April, a prodigious quantity of this moiſture is collected, which remains day and night in a floating ſtate, ſometimes aſcending nearly to the height of the mountains, where it is checked or condenſed by the cold, but immediately after deſcending it is again rarified, and becomes vapour before it can reach the earth; and in this ſtate of floating perturbation it remains, till the ſetting in of the weſtern monſoon, when the whole is condenſed into rain, ſome falling on the low country, ſome among the mountains, and what eſcapes is blown acroſs the *Myſoor*, and immediately over this valley, which I have juſt mentioned. This account is foreign to my preſent purpoſe, but I truſt I ſhall be pardoned for the digreſſion, as it is a ſtatement of facts relative to a part of the country, which has been a grave both to Europeans and Natives, ever ſince the fall of *Seringapatam*.

I HAVE alſo added a ſhort table of the latitudes and longitudes of places, depending on the meridional arc. It is not my intention here to animadvert on the geography of the Peninſula, as we have had it

handed to us in the printed maps. Theſe it is true, are erroneous, but when we conſider the materials from which they have been compiled, and the total impoſſibility of procuring better, we muſt allow that great credit is due to thoſe gentlemen who have had the perſeverance and induſtry to compile them. I can now ſpeak with confidence with reſpect to the Peninſula in general, in which, in the courſe of this and the next year, every place of note will be laid down from *Cape Comorin*, to *Goa* on the weſt, and *Maſulipatam* on the eaſt, including all the interior. Theſe which fall within the limits of the meridional triangles, will ſerve as a ſpecimen of what has been done elſewhere, and the reader can compare their poſitions with those in the printed maps. I only hope that the next maps of the Peninſula, if any ſhould be publiſhed, will be conſtructed from other materials beſides what are furniſhed by military marches, and perambulators. Theſe may do in the hands of a Quarter Maſter General who wants the actual diſtances that troops have to march, and not the diſtances reduced to the chords of arcs; nor does it matter to him whether the armies march on the ſurface of a ſpheroid, or of a ſphere, or on a flat. But when ſuch materials are intended for geographical purpoſes, it becomes neceſſary to have the outlines at leaſt, of a general map, on correct principles, ſo that his diſtances, however crooked and winding, may be adjuſted, and fitted to thoſe laid down with mathematical accuracy. Under theſe limitations, the materials furniſhed from military marches may be eminently uſeful.

I SHALL conclude by expreſſing my earneſt hope that nothing will happen to prevent my fulfilling what I have here held out to the learned reader: and were any incitement wanted to accelerate my exertions, it would neceſſarily ariſe from reflecting on the liberal and flattering

treatment which I have experienced from this, and the ſupreme Government; and which muſt ever continue to animate my zeal; and excite the moſt lively feelings of gratitude.

W. LAMBTON.

Bellary, Nov. 17, 1812.

TRIANGLES *connecting the Baſe in* COIMBETOOR *with the Baſe near* BANGALORE.

In the preſent volume, page 44, the diſtance from *Hallagamalli* to *Yaelmatoor*, is brought out in the 10th triangle from the baſe line.—This diſtance is the baſe for proceeding northerly.

ANGLES.

At Hallagamalli Station.

BETWEEN	AND	°	′	″		′
Thittamalli ſtation	Yaelmatoor ſtation.....	72	11	51	}	51.25
				51.5		
Shennimalli ſtation	Thittamalli ſtation.....	59	20	59.5	}	60.3
				59		
				61.25		
				61.5		

At Shennimalli Station.

Hallagamalli ſtation	Thittamalli ſtation.....	84	00	13.5	}	15.56
				16.5		
				15.5		
				16 75		

At Shennimalli Station (continued.)

BETWEEN	AND	°	′	″	
Woorachmalli ſtation.....	Yaelmatoor ſtation.....	56	51	35.5 36 35.75	35.75
	Kumbetarinemalli ſtation....	53	22	28.5 30.25 28.5	29.08

At Yaelmatoor Station.

Shennimalli ſtation	Woorachmalli ſtation.....	93	31	35.75 33	34.37
Hallagamalli ſtation	Thittamalli ſtation.....	51	55	10 12.75	11.37

At Thittamalli Station.

Shennimalli ſtation	Hallagamalli ſtation	36	38	45.62 46.25 47 25	46.37
Hallagamalli ſtation	Yaelmatoor ſtation.....	55	53	3.5 0.75 2.5	2.25
Shennimalli ſtation	Woorachmalli ſtation	61	19	22.5 23.62 23.75 24.7	23.66
Woorachmalli ſtation.....	Yaelmatoor ſtation.....	42	5	6 5.25 8 5 7 5 9 75	7.4
Woorachmalli ſtation.....	Kumbetarinemalli.....	87	23	44.5 43.5 43.5 44.75 42.25	43.7

At Woorachmalli Station.

BETWEEN	AND	°	′	″	″
Shennimalli ſtation	Yaelmatoor ſtation	29	36	57·75	
				56 75	
				55·75	56 65
				58.25	
				54 75	
	Kumbetarinemalli.....	37	47	48 25	
				41	45 08
				46	
Thittamalli ſtation	Shennimalli ſtation	50	43	45 37	
				45 5	
				47.62	46.4
				47 88	
				45.63	
Kumbetarinemalli.....	Thittamalli ſtation	37	3	61.85	
				54.6	58.68
				59 6	
Thittamalli ſtation	Yaelmatoor ſtation	80	20	42.87	
				42.63	43 07
				42.37	
				43.63	
Paulamalli ſtation	Kumbetarinemalli.....86		4	25.5	
				25	23.5
				22	
				21.5	

At Paulamalli Station.

Kumbetarinemalli ſtation.....	Woorachmalli ſtation.....65		49	1	
				0 75	2 12
				4 5	
				2 25	
Ponnaſſmalli ſtation	Kumbetarinemalli	91	22	1.5	2.12
				2.75	

At Kumbetarinemalli Station.

Ponnaſſmalli ſtation.....	Paulamalli ſtation	43	48	33.25	
				35.25	
				34 75	34 15
				35.25	
				32.25	

Kumbetarinemalli Station (continued).

BETWEEN	AND	°	′	″		
Weorachmalli ſtation.....	Paulamalli ſtation	28	6	38.75		
				39.25		
				38.75	37	8.5
				37.5		
				35		
Thittamalli ſtation.....		55	32	23.58		
				21.57	22	57

At Ponnaſſmalli Station.

Kumbetarinemalli ſtation.....	Paulamalli ſtation	44	49	36.04		
				35.04	34	71
				33.04		

PRINCIPAL TRIANGLES.

Hallagamalli from Yaelmatoor 130600.5 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
	Hallagamalli station,.....	72 11 51.25	—1.4			72 11 49.5	
	Yaelmatoor station,.....	51 55 11 37	—1 11			51 55 09.75	
1	Thittamalli station,.....	55 53 02 25	—1.14			55 53 00.75	
		180 00 01 87		″ 3.65	+1.22	180 00 00.00	
	Thittamalli from {Hallagamalli station, ...						124171.3
	Thittamalli from {Yaelmatoor station, ...						150195.2

Hallagamalli from Shennimalli station 71520.2 feet.

	Hallagamalli station, ...	59 21 00.31	″ —0.54			59 20 59.75	
	Shennimalli station,.....	84 00 15.56	—0.84			84 00 14.5	
2	Thittamalli station,.....	36 38 46.37	—0 50			36 38 45.75	
		180 00 02.24		″ 1.88	+0.36	180 00 00.0	
	Thittamalli from {Hallagamalli station.....						124168.7
	Thittamalli from {Shennimalli station,.....						107409.5

The above Base will be found in the commencement of this volume; in the 7th triangle.

Shennimalli from Yaelmatoor: 60265.1 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
	Shennimalli station,	56 51 35.75	−0.32			56 51 35.4	
	Yaelmatoor station,	93 31 34.37	−0.78			93 31 33.6	
3	Woorachmalli,	29 36 56.65	−0.35			29 36 51	
		180 00 06.77		1.45	+5.32	180 00 00 0	
	Woorachmalli from {Shennimalli station,						121724.6
	Woorachmalli from {Yaelmatoor station,						102117.6

This Base is in the 9th triangle of the same Researches.

Shennimalli from Thittamalli station 107409.5 feet.

	Shennimalli station,					67 56 51.8	
	Thittamalli station,	61 19 23.66	−0.95			61 19 22.7	
4	Woorachmalli station,	50 43 46.4	−0.87			50 43 45 5	
						180 00 00.0	
	Woorachmalli station from {Shennimalli station,						121724.9
	Woorachmalli station from {Thittamalli station,						128592.3

Shennimalli station from Woorachmalli 121724.6 feet.

	Shennimalli station,					67 56 51.8	
	Woorachmalii station,	50 43 46 4	−0.87			50 43 45.5	
5	Thittamalli station,	61 19 23 66	−0.95			61 19 22.7	
						180 00 00.0	
	Thittamalli station from {Shennimalli station,						107409
	Thittamalli station from {Woorachmalli station,						128592.

Yaelmatoor from Thittamalli station 150195.2 feet.

	Yaelmatoor station,					57 34 11.75	
	Thittamalli station,	42 05 07.4	−0.84			42 05 06.5	
6	Woorachmalli station,	80 20 43.07	−1.31			80 20 41.75	
						180 00 00.0	
	Woorachmalli from {Yaelmatoor station,						102112.5
	Woorachmalli from {Thittamalli station,						128593.7

Thittamalli from Woorachmalli station 128592.8 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distance in Feet.
		° ′ ″	′ ″			° ′ ″	
	Thittamalli station, ...	87 23 43.7	—1.36			87 23 41.75	
	Woorachmalli station, ...	37 03 58.68	—0 73			37 03 57.25	
7	Kumbetarinemalli, ...	55 32 22.57	—0 76			55 32 21.00	
		180 00 04.9		2.85	+2.1	180 00 00.00	
	Kumbetarinemalli station from	Thittamalli station, ...					94003.4
		Woorachmalli station, ...					15580 9

The above Base is the mean distance found in the three triangles on the following different Bases, viz. *Shennimalli* from *Thittamalli*, *Shennimalli* from *Woorachmalli* and *Yaelmatoor* hill from *Thittamalli* station; differing in the extremes only one foot.

Shennimalli from Woorachmalli 121724.4 feet.

	Shennimalli station, ...	53 22 29.08	—1.14			53 22 28	
	Woorachmalli station.....	87 47 45.08	—2.16			87 47 43	
8	Kumbetarinemalli, ...	. . .				38 49 49	
						80 00 00	
	Kumbetarinemalli from	Shennimalli, ...					193989.1
		Woorachmalli, ...					155801.6

The side Shennimalli from Woorachmalli is the mean distance found in the triangles, Shennimalli. Yaelmatoor hill, Woorachmalli and Shennimalli, Thittamalli, Woorachmalli —

Woorachmalli from Kumbetarinemalli 155801.6 feet.

	Woorachmalli station, ...	86 04 23.5	—0 75			86 04 22	
	Kumbetarine station, ...	28 06 37.85	—1.36			28 06 37	
9	Paulamalli station, ...	65 49 02.12	—0.84			65 49 01	
		180 00 03.47		2.95	+ 0 52	180 00 00	
	Paulamalli from	Woorachmalli, ...					80470.9
		Kumbetarinemalli.....					170388 5

Kumbetarine from Paulamalli 170388.5 feet.

	Kumbetarinemalli, ...	43 48 31 15	—1.63			43 48 32.5	
	Paulamalli station, ...	91 22 02.12	—3.45			91 21 54.5	
10	Ponnassmalli station, ...	44 49 34.71	—1 66			44 49 33.0	
		180 00 10 98		6.74	+ 4.94	180 00 00.0	
	Ponnassmalli station from	Kumbetarinemalli, ...					241632. 9
		Paulamalli station, ...					167319.6

DESCRIPTION OF THE GREAT STATIONS.

Hallagamalli A hill with a pagoda on the top, about ſeven miles S. W. from *Shennimalli.* The ſtation is on the platform of the pagoda.

Shennimalli. A hill near a reſpectable village of that name on the great road from *Ferode* to *Daraporam.* The ſtation is on the higheſt part of the hill, a few hundred feet N. W. from the pagoda. It is marked as uſual with a platform and ſtone.

Yáélmatoor. A well known hill about ſix miles E. N. E. from *Shennimalli,* with a pagoda near the top. The ſtation is on a ſtone platform a little way to the N. W. of the pagoda, on the higheſt part of the hill.

Thittamalli. A ſmall hill with a pagoda near the top, and lies about thirteen miles S. eaſterly from Sattimungalum. The ſtation is on a rock, above where the pagoda ſtands, and a little way north from it.

Woorachmalli. A peaked hill about two miles N. E. from *Bhavany* on the weſt bank of the *Cauvery.* The ſtation is on the platform of the pagoda, on the top of the hill.

Paulamalli.—A very large mountain below the ghauts in the northern diſtrict of *Coimbetoor.* The *Cauvery* river runs a little way to the weſtward of it. This mountain is well known, and is a few miles northerly from *Bhavany,* where the collector reſides. On the very ſummit there is a pagoda, and the ſtation is on the platform of that pagoda marked.

Kumbetarinemalli.—Another prodigious mountain in the northern diſtrict of *Coimbetoor*, about ſeven miles northerly from *Sattimungalum*. The mountain is well known there, and the road aſcends from that ſide. The ſtation is on the top of the peak near a ſmall pillar and a place of worſhip. It is in the middle of a platform built of mud and ſtones.

Ponnaſſmalli.—A great mountain well known in that part of the country. It has a double top, but the ſtation is on the northernmoſt one, and cannot be miſtaken. It is on a platform with a marked ſtone in the middle. *Allambaddy* lies about ſeven miles eaſt from this mountain.

TRIANGLES *taken up at the Baſe near Bangalore, and continued back to Ponnaſſmalli and Kumbetarine.*

ANGLES.

At the N. end of the Baſe (near Bangalore.)

BETWEEN	AND	°	′	″	″
S. end of the Baſe	Muntapum ſtation	89	19	21.5	
				19.75	
				20.25	20.75
				21.5	

At the S. end of the Baſe.

BETWEEN	AND	°	′	″	″
N. end of the Baſe	Muntapum ſtation	33	43	60.4	
				58.15	
				61.27	60 06
				60.43	

At the S. end of the Baſe (continued.)

BETWEEN	AND	°	′	″	
Muntapum ſtation	Bonnairgottah ſtation	106	09	36.25 39.76 36.5 38.38	37.72

At the Muntapum Station.

N. end of the Baſe	S. end of the Baſe	56	56	40.62 41.4 42.25	41.42
S. end of the Baſe	Bonnairgottah ſtation	35	3	56.05 54.75 54.25 57.75 57.5	56.05
Bonnairgottah ſtation	Tirtapully ſtation	97	26	51.53 55.25	53.39

At the Muntapum center.

Bonnairgottah ſtation	Tirtapully ſtation	97	28	55.75 54.85 55 55.5	55.27
Savendroog ſtation		69	50	45.25 47.75	46.5

At Dodagoontah Station.

Savendroog ſtation	Bonnairgottah ſtation	61	34	54 50 49 55 50	51.29

At Dodagoontah Station (continued.)

BETWEEN	AND	°	′	″		
Referring flag	Savendroog ſtation	104	4	29·5	}	29.68
				31·25		
				29		
				27·3		
				32·5		
				28·5		
Referring lamp	Pole ſtars W. elong. 19th	1	31	53		
	1805, July 22d			56.25		
	8th.....			51.25		
	12th.....			48.5		
	17th.....			46.25		
	18th.....			47·5		
	19th.....			45·5		
	23d			45·5		
	26th.....			43·5		
	26th.....			44·5		

At Bonnairgotta Station.

S. end of the baſe	Muntapum ſtation	38	46	30.02	}	31.15
				32.28		
Muntapum ſtation	Tirtapully ſtation.....	51	7	53·25	}	54.62
				53.6		
				57		
Tirtapully ſtation.....	Muntapum ſtation.....	51	5	56.65	}	56.91
				56·55		
				59·55		
				54·9		
Muntapum center.....	Savendroog ſtation.....	70	52	25.06	}	23.91
				22.77		
Dodagoontah ſtation	Savendroog ſtation	83	20	14.75	}	16.17
				17.5		
				16 25		

At Tirtapully Station.

Muntapum ſtation	Bonnairgottah ſtation.....	31	25	15.03	}	16.15
				17.27		

At Tirtapully Station (continued.)

BETWEEN	AND	°	′	″		
Muntapum center	Bonnairgottah ſtation	31	25	7.97	}	8.96
				9.95		
Deorabetta ſtation	Savendroog ſtation	46	42	26.25	}	24.5
				22.75		

At Deorabetta Station.

Savendroog ſtation	Tirtapully ſtation	79	40	54	}	52.9
				52		
				53		
				52.75		
				52.75		
Savendroog ſtation	Bundhullydroog	97	47	58.5	}	57.75
				58.25		
				56.5		
Bundhullydroog	Ponnaſſmalli ſtation	36	19	24	}	23.33
				24		
				23		

At Savendroog Station.

Muntapum center	Bonnairgottah ſtation	39	16	50.25	}	50.88
				50.75		
				50.25		
				51.25		
				51.75		
				51.05		
Tirtapully ſtation	Deorabetta ſtation	53	36	48	}	47.5
				48		
				47.25		
				46.75		
Deorabetta ſtation	Bundhullydroog ſtation	41	41	41.25	}	40.93
				40.5		
				40.75		
				41.5		
				40.25		
				41.75		
				40.5		

At Bundhullydroog Station.

BETWEEN	AND	°	′	″	′
Savendroog ſtation.....	Deorabetta ſtation.....	37	30	28.5 31.75	30.12
Deorabetta ſtation	Ponnaſſmalli ſtation.....	66	43	2.75 3.25 3 4	3.25
Ponnaſſmalli ſtation	Kumbetarinemalli	85	12	57.19 54 7 55.94 53.95 55.2	55.4

At Ponnaſſmalli Station.

Deorabetta ſtation.....	Bundhully ſtation	76	57	35 34.25 34.25	34.5
Bundhully ſtation	Kumbetarinemalli	67	12	36.75 36.75 37.5 35.25 33.25 36.25	35.96

At Kumbetarinemalli Station.

Bundhullydroog	Ponnaſſmalli ſtation.....	27	34	34 36 34.25 35.5 37 37.5 37.5	35.96

PRINCIPAL TRIANGLES.

N. end of the base from S. end of the base 39793.7 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ′	″	″	″	° ′ ″	
	N. end of the base,	89 19 20.75	—0.12			89 19 20	
	S. end of the base,	33 44 00.06	—0 06			33 43 59.3	
11	Muntapum station,	56 56 41.42	—0.05			56 56 40.7	
		180 00 02.23		0.24	+1.99	180 00 00 0	
	Muntapum station from N. end of the base,						86365.9
	Muntapum station from S. end of the base,						47475.03

S. end of the base from Muntapum station 47475.03 feet.

	S. end of the base,	106 09 37.72	— 0.3			106 09 35. 9	
	Muntapum station,	35 03 56.05	—0.08			35 03 54.5	
12	Bonnairgottah station,	38 46 31.15	—0 07			38 46 29.6	
		180 00 04 92		0.47	+4.45	180 00 00.0	
	Bonnairgottah station from S. end of the base,						43551 7
	Bonnairgottah station from Muntapum station,						72811.7

Muntapum station from Bonnairgottah station 72811.7 feet.

	Muntapum station,	97 26 53 39	—1.07			97 26 53 9	
	Bonnairgottah station,	51 07 54 62	—0 37			51 07 51 2	
13	Tirtapully hill station,	31 25 16 15	—0.41			31 25 11.9	
		180 00 04. 16		1.85	+2.31	180 00 00.0	
	Tirtapully station from Muntapum station,						108746.8
	Tirtapully station from Bonnaigottrah station,						138192.9

Bonnairgottah station from Tirtapully station 138192.9 feet.

	Bonnairgottah station,	51 05 56.91	—0.4			51 05 56.5	
	Tirtapully station,	31 25 08.96	—9.4			31 25 09	
14	Muntapum center,	97 28 55.27	—1.1			97 28 54.5	
		180 00 01.14		1.9	—0.76	180 00 00.0	
	Muntapum center from Bonnairgottah station,						72815.8
	Muntapum center from Tirtapully station,						103705.1

Muntapum center from Bonnairgottah 72815.6 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″			° ′ ″	
	Muntapum center,	69 50 46.5	—0.6			69 50 46	
	Bonnairgottah station,	70 52 23.91	—0.6			70 52 28.5	
15	Savendroog station,	39 16 50.88	—0.5			39 16 50.5	
		180 00 01.29		1.7	—01.1	180 00 00.00	
	Savendroog station from {Muntapum center,						108661.6
		{Bonnairgottah station,					107968 7

Bonnairgottah from Savendroog station 107968.7 feet.

	Bonnairgottah station,	83 20 16.17	—0.79			83 20 15.4	
	Savendroog station,					35 04 53.8	
16	Dodagoontah station,	61 34 51.29	—0.58			61 34 50.8	
						180 00 000	
	Dodagoontah station from {Bonnairgottah,						70556.7
		{Savendroog station,					121933.9

With the sides *Muntapum* center from *Tirtapully* hill 108705.1 feet, and *Muntapum* center from *Savendroog* 108661.6 feet and the included angle at *Muntapum* center 167° 19′ 29.3″, the side *Savendroog* station from *Tirtapully* hill is found 216038.9 feet.

Again with the sides *Bonnairgottah* from *Tirtapully* 138492.9 feet and *Bonnairgottah* from *Savendroog* 107968.7 feet, and the included angle at *Bonnairgottah* 121° 58′ 19″, the side *Savendroog* from *Tirtapully* is found 216038.8 feet, differing from the above $\frac{1}{10}$ of a foot, and of which the mean is 216038.85 feet.

Savendroog from Tirtapully station 216038.85 feet.

	Savendroog station,	53 36 47.5	—1.9			35 36 45.5	
	Tirtapully station,	46 42 24.5	—1.9			46 42 22.5	
17	Deorabetta station,	79 40 52.9	—2.8			79 40 52	
		180 00 04.9		6.6	— 1.7	180 00. 000	
	Deorabetta station from {Savendroog station,						159828.8
		{Tirtapully station,					176775 8

Savendroog station from Deorabetta 159828.8 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″	″	″	° ′ ″	
	Savendroog station,	44 41 40.93	—14			44 41 39 5	
	Deorabetta station,	97 47 57.75	—4			97 47 52	
18	Bundhullydroog station,	37 30 30 12	—15			37 30 28.5	
		180 00 08.8		6.9	1.9	180 00 00.00	
	Bundhullydroog from {Savendroog station,						260072
	{Deorabetta station,						184620.5

Deorabetta station from Bundhullydroog 184620.5 feet.

	Deorabetta station,	36 19 23.33	—1.25			36 19 22	
	Bundhully station,	66 43 03.25	—1.47			66 43 03 5	
19	Ponnassmalli station,	76 57 34.5	—1.78			76 57 34.5	
		180 00 01.08		4.5	+3 42	180 00 00.0	
	Ponnassmalli station from {Deorabetta station,						174071.7
	{Bundhullydroog,						112251.8

Bundhullydroog from Ponnassmalli 112251.8 feet.

	Bundhullydroog station,	85 12 55.4	—2.66			85 12 52.5	
	Ponnassmalli station,	67 12 35.96	—1.71			67 12 33.5	
20	Kumbetarinemalli station,	27 34 35.96	—1.54			27 31 34	
		180 00 07.32		5.91	+1.41	180 00 00.0	
	Kumbetarinemalli from {Bundhully station,						223551.4
	{Ponnassmalli station,						241637.7

Here appears a difference of $4\frac{8}{10}$ feet, in the distance from *Ponnassmalli* to *Kumbetarine* hill as given by the triangle, from whence it may be inferred, that had the base been computed from bringing the triangles from the northward, it would have exceeded the measurement by $7\frac{7}{10}$ inches.

DESCRIPTION OF THE GREAT STATIONS.

N. and S. end of the base line, near *Bangalore* are both defined by ſquare maſſes of ſtone maſonry having each a circle and a point in the

center of the maſs. The firſt is near the village of *Banſwaddy* nearly a quarter of a mile S. eaſterly from it. The ſecond lies about half a mile S. eaſterly from a ſmall village named *Agrarum*, which is upwards of three miles N. E. from *Beygoor*.

Muntapum ſtation. There are two ſtations made uſe of, the one is in the center of the *Muntapum*, and the other a few feet to the weſt of it, but is now defaced. The *Muntapum* (a ſmall *Hindoo* building on four pillars,) lies about four miles north from *Bangalore*, a little way to the weſtward of the *Nundydroog* road. It is a noted object and ſeen at a great diſtance.

Dodagoontah ſtation. This is the great ſtation of obſervation at which the poſition of the meridian line is determined. It lies half way between the north end of the baſe and the *Muntapum*, and is marked by a large well built ſtone platform of a circular form, and about ten feet in diameter. Its foundation is about two feet and a half under ground, having a large ſtone at the bottom, with a circle whoſe center correſponds with the center of the circle above, over which the plummit of the inſtrument was ſuſpended during the obſervation.

Bonnairgottah ſtation. A ſmall rocky hill cloſe to the village of that name, lying about ten miles nearly ſouth from *Bangalore*. The ſtation is on a platform of clay on the top of the hill, with a marked ſtone in the middle.

Tirtapully ſtation. A ſmall hill, upwards of ſeven miles E. S. E. from the *Eedgah* near *Ooſcottah*. It is well known in that neighbourhood, and the ſtation is on its ſummit, being a platform of clay and ſtones with a marked ſtone in the middle. It is cloſe to the road leading from *Ooſcottah* to *Malloor*.

Deorabetta ſtation. This is a ſmall hill upwards of ſeven miles ſouth from *Annicul* with a pagoda on the top. The ſtation is on the platform of the pagoda, marked by a ſmall mill ſtone.

Savendroog ſtation. The ſtation is on the ſummit of the eaſt peak of the droog, about forty or fifty feet north eaſterly from the *Muntapum.* The circle is inſerted on the rock.

Bundhullydroog or *Eekrumgherry ſtation.* This is a large mountain ſouth of the *Cauvery* river, in the northern diſtrict of *Coimbetoor,* upwards of thirteen miles nearly eaſt from *Sattiagul.* The ſtation is on the platform of a ſmall building on the higheſt pinnacle of the droog. There is another building cloſe to it to the weſt. A circle is marked on the building over which the inſtrument ſtood, but there was erected a pyramid of brick ſeveral feet high to ſerve as a mark to be taken from the other ſtations, and which may probably remain for many years. The village of *Bundhully* is a little way to the eaſtward.

TRIANGLES *taken up at Deorabetta and Savendroog, and continued to the ſide Paughur from Yerracondah.*

ANGLES.

At Deorabetta Station.

BETWEEN	AND	°	′	″	″
Savendroog ſtation	Allaſoor ſtation	47	20	36.68	
				38.18	
				37.93	38.73
				38.93	
				41.93	

At Savendroog Station.

BETWEEN	AND	°	′	″		
Deorabetta ſtation	Allaſoor hill	78	57	48		
				48		
				47·25		47·5
				56·75		
Allaſoor hill ſtation	Cheetkul hill ſtation	55	41	36		
				35·5		34·92
				33·25		

At Allaſoor Station.

Deorabetta ſtation	Savendroog ſtation	53	41	39.87		
				42		39·59
				37·75		
				38.75		
Savendroog ſtation	Cheetkul ſtation	62	10	44·5		
				44·75		43 71
				41.87		
Cheetkul ſtation	Kulkotah ſtation	60	45	47 75		
				47·75		48
				46.5		
				50		

At Cheetkul Station.

Savendroog ſtation	Allaſoor hill ſtation	62	7	47·75		47·87
				48		
Allaſoor hill ſtation	Kulkotah ſtation	42	19	21.75		19.62
				17·5		
Kulkotah ſtation	Bailippee ſtation	71	36	29.25		
				29		
				26.75		27·54
				27		
				25·75		

At Kulkotah Station.

BETWEEN	AND	°	′	″	
Cheetkul hill ſtation	Allaſoor ſtation	76	54	54·75	
				49·75	
				52·25	52
				50·75	
				52·5	
	Bailippee ſtation	53	34	3	
				5·5	
				3·5	3·7
				3·5	
				3	
Bailippee ſtation	Yerracondah ſtation	59	20	36.25	
				38	
				37·25	37.1
				36,5	
				37 5	

At Bailippee Station.

Kulkotah ſtation.....	Cheetkul ſtation.....	54	49	32 75	
				35·75	35·12
				34	
				38	
	Yerracondah ſtation	72	20	57·5	
				58·5	57·5
				59·75	
				54·25	
Yerracondah ſtation.....	Paughur ſtation	54	7	38	
				41	39 56
				39·75	
				39·5	

At Yerracondah Station.

Kulkotah ſtation.....	Bailippee ſtation.....	43	18	29·75	
				31·25	30 37
				30.12	

At Yerracondah Station (continued.)

BETWEEN	AND				
Bailippee station.....	Paughurdroog station.....	63	20	45·5 44·25 45 44·25 46·75	45·15

At Paughurdroog Station.

Yerracondah station	Bailippee station.....	62	31	43·75 44·5 43·75 41·75 43·75 42·25	43·29

PRINCIPAL TRIANGLES.

Savendroog from Deorabetta station 159328.8 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
	Savendroog station, ...	° ′ ″ 78 57 47.5	—″2.26			° ′ ″ 78 57 45.1	
	Deorabetta station,.....	47 20 38.73	—1.55			47 20 37	
21	Allasoor station,.....	53 41 39.59	—1.69			53 41 37 9	
		180 00 05.82		″5.4	+″0.42	180 00 00.0	
	Allasoor hill from {Savendroog station, ...						145859.1
	Allasoor hill from {Deorabetta station, ...						194662.8

Savendroog from Allasoor hill 145859.1 feet.

	Savendroog station, ...	55 41 34 92	—1.3			55 41 32.8	
	Allasoor station, ...	62 10 43.71	—1.4			62 10 41.5	
22	Cheetkul station,.....	62 07 47.37	—1.4			62 07 45.7	
		180 00 06.5		4.2	+2.3	180 00 00.0	
	Cheetkul station from {Savendroog station, ...						145924.8
	Cheetkul station from {Allasoor station, ...						136292.3

Allasoor hill from Cheetkul hill 136292.3 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″				° ′ ″	
	Allasoor station	60 45 48	—0.8			60 45 48.2	
	Cheetkul station	42 19 19.62	—0.8			42 19 19.8	
23	Kulkotah station	76 54 52	—1.1			76 54 52	
		179 59 59.62		2.6	—2.98	180 00 00.0	
	Kulkotah hill from Allasoor station						94211.8
	Kulkotah hill from Cheetkul station						122100.6

Cheetkul hill from Kulkotah station 122100.6 feet.

	Cheetkul station	71 36 27.54	—1.2			71 36 25.3	
	Kulkotah station	53 34 03.07	—1.0			53 34 01.7	
24	Bailippee station	54 49 35.12	—1.1			54 49 33	
		180 00 06.36		3.3	+3.06	180 00 00.0	
	Bailippee station from Cheetkul station						120180.9
	Bailippee station from Kulkotah station						141745

Kulkotah station from Bailippee station 141745 feet.

	Kulkotah station	59 20 37.1	—1.8			59 20 35.3	
	Bailippee station	72 20 57.5	—1.8			72 20 55.7	
25	Yerracondah station	48 18 30.37	—1.6			48 18 29	
		180 00 04.97		5.2	—0.3	180 00 00.0	
	Yerracondah from Kulkotah station						180883.3
	Yerracondah from Bailippee station						163290.5

Bailippee station from Yerracondah 163290.5 feet.

	Bailippee station	54 7 39.56	—1.6			54 7 37	
	Yerracondah station	68 20 45.15	—1.8			68 20 42.5	
26	Paughur station	62 31 43.29	—1.8			62 31 40.5	
		180 00 08.00		5.2	+2.8	180 00 00.0	
	Paughurdroog from Bailippee station						164184.0
	Paughurdroog from Yerracondah station						119131.

DESCRIPTION OF THE GREAT STATIONS.

Allaſoor Station.—A rocky hill cloſe to the *Nundydroog* road, near twelve miles north from *Dodagoontah*. The ſtation is on the higheſt part of the rock to the weſtward of a ſmall hollow running acroſs the top. The circle is on the rock.

Cheetkul Station.—It is a hill about a mile to the S. W. of a large village of that name, lying on the road from *B. Ballapoor* or *Davaroydroog*. The ſtation is marked on the top of the rock. There is a very large ſtone cloſe to the ſouth of the rock.

Kulkotah Station.—A hill near a village of that name, near ſeven miles N. W. from *Nundydroog*. The ſtation is on a platform at the ſummit, cloſe to a high rock with a pillar upon it to the S. E. of the platform. A ſtone with a circle defines the ſtation.

Bailippee Station.—A hill in the jungle, upwards of five miles preciſely eaſt from *Mudgherry*. The ſtation is on its ſummit marked as uſual.

Yerracondah Station.—A hill in the ceded diſtricts, about twelve miles S. S. E. from *Pencondah*. There is no village very near it, but it is well known; the ſtation is on the higheſt part, and is on a large platform built of looſe ſtones and mud, with a ſtone and circle in the middle. The aſcent is on the eaſt ſide.

Paughur Station.—A large droog, well known on the northern boundary of *Myſoor*. The ſtation is on a circular platform on the top of a ſquare maſs of building where the flag ſtaff ſtood, and is in the center of the Sultan's battery, the largeſt circular fortified rock on the top of the droog. A circular ſtone with a hole in it defines the ſtation.

Measurement of the Base Line near Gooty.

EXPERIMENTS MADE FOR COMPARING THE CHAINS.

PREVIOUS TO THE MEASUREMENT.				AFTER THE MEASUREMENT.			
MONTH.	Excess of the old Chain.		REMARKS.	MONTH.	Excess of the Old Chain.		REMARKS.
1811.	A. M.	P. M.		1811.	A. M.		
	DIVISIONS.	DIVISIONS			DIVISIONS.		
April 10th,	31	30		May 11th,	38.25		
	30	30.5			37.5		
	30	30			38.5		
	30	30			39		
	31	31	Mean temperature during these experiments,		39		Mean temperature during these experiments was.....89.6
	30	30			39		
	31	31			38.5		
	30	29.5			38.5		
	31	30			39		
	31.5	30	A. M. 81.3		38		
	31				37		
	30.5		P. M. 101.6		37		
	31						
Mean	30.62	30,2		Mean	38.27		

TABLE containing the particulars of the Measurement.

No. of the Hypothenuse.	Length of each in feet.	Angles of Elevation and Depression.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.	REMARKS.
				Ascents.	Descents.	Above.	Below.		
		° ′ ″	FEET.	FEET.	FEET.	INCHES.	INCHES.		
1	1300	0 12 39	.00084		4.78	30		98.2	Commenced 12th April 1811.
2	700	0 2 42	.00021		0.55		9.8	88	
3	900	0 22 33	.01935		5.90		10.8	103.7	
4	1100	0 30 57	.04466		9.90		12.3	89.6	
5	800	0 15 54	.00856		3.70			96	

Number of Hypothenuse.	Length of each in feet.	Angle of Elevation and Depression.	Deductions from each Hypothenuse.	Perpendicular.		Commencement from the last.		Mean Temperature.	REMARKS.
				Ascents.	Descents.	Above.	Below		
		° ′ ″	FEET.	FEET.	FEET.	INCHES.	INCHES.		
6	5000	14 00	.00415		2.04		10.8	101.4	
7	4000	5 37	.00052	0.65		15.2		80.2	
8	8000	2 15	.00016		0.52	9		95.2	
9	8000	5 00	.00088		1.16			100 8	
10	9000	23 09	.02043		6.06		10.5	92.1	
11	6000	09 09	.00210		6.60		5.7	107.1	
12	7000	31 45	.02986		1.47		16.1	83.3	
13	8000	30 00	.03048		6.98		13	104.7	
14	4000	28 57	.01420		3.37		8.5	114.5	
15	7000	34 12	.03465		6.96			81.5	
16	7000	23 06	01582		4.70		1.5	95.7	
17	9000	23 57	.02187		6.27		4.5	92.1	
18	9000	25 15	.02421		6.61	15.5		96.6	
19	8000	21 03	.01504		4.90	5		98.8	
20	9000	15 57	.00963		4.18		4.6	89.1	
21	8000	14 12	.00680		3.30		3.7	98.1	
22	9000	12 30	.00603		3.27		2.2	90.1	
23	7000	01 15	.00004	0.25			4.5	110.8	
24	7000	19 15	.01099		3.92			89.2	
25	9000	10 55	.00450		2.86	5.7		96.4	
26	9000	08 06	.00252		2.12		4.2	100.9	
27	8000	07 00	.00168		1.63		12.1	88.2	
28	10000	13 22	.00760		3.89	2.2		110.3	
29	6000	16 27	.00684		2.87		5.3	89.3	
30	9000	23 54	.02178		6.26		10.7	106.1	
31	8000	17 49	.01072		4.15	14		92.5	
32	7000	00 45			0.15	8.3		107.1	
33	7000	Level					3.2	99.8	
34	16000	12 44	.01104	5.93			5.8	104.9	
35	8000	01 08	.00002		0.26		8.5	103.5	
36	6000	08 33	.00186		1.49	1.8		104.9	
37	13000	13 27	.01001		5.09		5.7	108 9	
38	9000	17 12	.01125		4.50		13.0	81.8	
39	2000	01 35	.00002	0.09				99.7	
40	7000	17 24	.00896		3.51		18.7	110.8	Completed 4th
41	5000	20 00	.00845		2.91		6.5	80.4	May 1811.
Descent from the termination of the Base to the ground.							27.0		
Tot.	32600		43673	6.92	138.6	106.7	239.2	97.13	

N. end of the Base above S. end of the Base in perpendicular height 142.98 feet.

At the commencement, the old chain exceeded the new one 30.41 divisions of the micrometer equal to .01218 feet.

	FEET.
Therefore 326×100.0218 feet, will be the meaſure in terms of the new chain equal - - - - - - - - - - - - -	32603.9707
At the concluſion the old chain exceeded the new one 38.27 diviſions of the micrometer and had therefore increaſed 7.86 diviſions, equal to .00315 feet. Hence $326 \times \frac{0.00315}{2} = 0.5133$ feet, the correction for the wear, which add - - - - - - - - - - - - -	+0.5133
The ſum of the deductions from col. 4th, is 0.43673 feet which being increaſed in the ratio of 100.01218 feet will be 0.43678 which ſubſtract - - - - - - - -	—0.4368
Hence the apparent horizontal diſtant will be - - -	32604.0472
The correction for the expanſion and reduced to the ſtandard temperature of 62° will be $\frac{(97.13-50)\times.0074-(62-50)\times.01237}{12}$ $\times 32604.0472$. will be 5.4429 feet, which add - - - -	+5.4429
Hence the corrected meaſure of the baſe for the temperature of 62° will be - - - - - - - - - - - - - - - - -	32609.4901
Which being reduced to the level of the ſea by taking the mean height of the baſe, and which is 1181.5 feet above the level of the ſea will be - - - - - - - - -	32607.6000

TRIANGLES *taken up at the Base near Gooty, and continued back to the side Paughurdroog from Yerracondah.*

ANGLES.

At the N. end of the Base.

BETWEEN	AND				
Gootydroog station.....	S. end of the base.....	87 27	16.5		
			21.5		
			20.5		
			17		
			15		16.45
			16.5		
			15		
			14		
			13.5		
			15		
S. end of the base	Paumdy station	35 04	8		
			7		
			7.5		5.9
			4		
			3		

At the S. end of the Base.

Gootydroog station.....	N. end of the base.....	27 13	59		
			67.5		
			69		
			70.5		
			58.5		
			64.5		62.64
			65.5		
			64		
			55.5		
			56.5		
			58.5		

At the S. end of the Baſe (continued.)

BETWEEN	AND	°	′	″		
N. end of the baſe	Paumdy ſtation	105	2	69.5		
				56.5		
				64		
				65.5		″
				62.5		65.19
				69		
				68.5		
				66		
Gootydroog ſtation	Namthabad ſtation	27	14	2.64		
Namthabad ſtation	Paumdy ſtation	105	03	5.19		
∠. N. end of the baſe	Paumdy ſtation	105	3	05.19		
∠. Gootydroog ſtation	N. end of the baſe	27	14	02.64		
∠, Paumdy ſtation	Gootydroog ſtation	132	17	07.83		

At Paumdy Station.

N. end of the baſe	S. end of the baſe	39	52	50.5		
				49		
				49		
				50		49.75
				50		
				50		
Namthabad ſtation	N. end of the baſe.....	0	28	53.5		
				53 5		
				55.5		54
				54		
				53.5		
Gootydroog ſtation	S. end of the baſe.....	26	26	19		
				20.5		
				18.5		
				20		
				21.5		19.69
				21 5		
				18 5		
				18		

At Paumdy Station (continued.)

BETWEEN	AND	°	′	″	″
Konakoondloo ſtation	Gootydroog ſtation	78	44	50	
				52.5	
				50.5	
				52	
				52.5	51.61
				52	
				52	
				51	
				51.5	
Gootydroog ſtation	Guddakulgooda ſtation	88	42	29	
				29	
				27.5	
				25	
				27 5	29.35
				28.5	
				29.5	
				25	
				35	
				37.5	
N. end of the baſe	Namthabad ſtation.....	0	28	54	
	South end of the baſe.....	39	52	49.5	
S. end of the baſe	Namthabad ſtation.....	40	21	43.5	

At Konakoondloo Station.

		°	′	″	″
Gootydroog ſtation	Koelacondah ſtation	41	26	16	
				18	
				16	
				20	18.57
				21	
				21	
				18	
Paumdy ſtation	Gootydroog ſtation.....	36	01	43	
				39.5	
				43	
				36 5	41.53
				41	
				46.5	

At Koelacondah Station.

BETWEEN	AND	°	′	″		
Gootydroog ſtation	Guddakulgooda ſtation	71	59	9.5		
				8		
				8.5		
				9		
				7.5		11.15
				9.5		
				7.5		
				18		
				17		
				17		
Kanakoondloo ſtation	Gootydroog ſtation	58	55	62.5		
				56.5		
				64		60.8
				63		
				58		

At Guddakulgooda Station.

Gootydroog ſtation.....	Ooderpudroog ſtation.....	69	26	22.5		
				27.5		
				24		
				27.5		21.63
				18.5		
				18.5		
				17.5		
				17		
Paumdy ſtation	Gootydroog ſtation	24	14	38.5		
				33		
				35		36.17
				40		
				37		
				33.5		

At Guddakulgooda Station.

Gootydroog ſtation	Koelacondah ſtation	30	12	35.5		
				34		
				55		
				47.5		45.63
				54		
				54.5		
				39		
				45.5		

At Gootydroog Station.

BETWEEN	AND	°	′	″	″
N. end of the baſe	S. end of the baſe	65	18	48	
				35·5	
				44·5	
				47	
				47	
				47	41.19
				38	
				39	
				33	
				42	
				32	
Paumdy ſtation	S. end of the baſe	21	16	32.75	
				37	
				36.5	32.65
				29.5	
				27.5	
N. end of the baſe.....	Namthabad ſtation	2	31	59.5	
				57	58.5
				57.5	
				60	
Paumdy ſtation	Konakoondloo ſtation.....	65	13	28.5	
				31	
				26	27.83
				29.5	
				25.5	
				26.5	
Konakoondloo ſtation.....	Koelacondah	79	37	38 5	
				48.5	
				40.5	43.17
				45·5	
				43·5	
				42.5	
Koelacondah ſtation	Guddakulgooda	77	47	72.5	
				64	
				58.5	65.4
				74	
				58	
Guddakulgooda ſtation.....	Paumdy ſtation.....	67	2	57	
				59	56.17
				52.5	

At Gootydroog Station (continued.)

BETWEEN	AND	°	′	″	
Ooderpudroog ſtation.....	Cuddakulgooda.....	44	37	48	
				49.5	
				53	
				46.5	48.9
				52	
				49	
				41.5	
Davurcondah ſtation.....	Ooderpudroog ſtation.....	46	17	57.5	
				58	
				48.5	
				46.5	
				48	
				50.5	50.68
				50.5	
				50.5	
				48.5	
				52	
				47	
Namthabad	N. end of the baſe.....	2	31	58.5	
N. end of the baſe.....	S. end of the baſe.....	65	18	41.19	
S. end of the baſe.....	Namthabad	67	50	39.69	

At Ooderpudroog Station.

Cuddakulgooda ſtation.....	Gootydroog ſtation.....	65	55	49	
				53	
				50	
				47	
				46	
				56	53.3
				52.5	
				60	
				60 5	
				59	

At Ooderpudroog Station.

BETWEEN	AND	°	′	″		
Gootydroog ſtation.....	Davurcondah	71	17	20.5		
				15.5		
				20.5		″
				23.5	}	19.5
				24.5		
				15.5		
				16.5		
Davurcondah ſtation	Condapilly ſtation	51	25	61.5		
				63.5		
				59.5		
				57	}	64.5
				72.5		
				69.5		
				68		

At Davurcondah Station.

Gootydroog ſtation	Ooderpudroog ſtation	62	24	54.5		
				52.5		
				53	}	53.75
				55		
				53.5		
				54		
Ooderpudroog ſtation	Condapilly ſtation	59	4	11.5		
				18		
				15		
				18	}	14.62
				15.5		
				11		
				12		
				16		
Condapilly ſtation.....	Ooracondah ſtation	53	14	42.5		
				42.5		
				38.5	}	40.1
				37		
				40		

At Condapilly Station.

BETWEEN	AND	°	′	″		
Davurcondah ſtation.....	Ooderpudroog ſtation	69	29	34		
				37		
				44		
				47·5	}	43·14
				47·5		
				47		
				45		
Ooracondah ſtation.....	Davurcondah ſtation.....	84	41	16		
				13·5		
				13·5	}	16,25
				18·5		
				19		
				17		
Paughurdroog ſtation.....	Ooracondah ſtation.....	52	40	2		
				1·5		
				4·5		
				0·5	}	2,81
				1·5		
				4·5		
				2·5		
				5·5		

At Ooracondah Station.

Paughurdroog ſtation.....	Condapilly ſtation	79	34	36.5		
				36		
				41	}	38.17
				36 5		
				36.5		
				42.5		
Condapilly ſtation	Davurcondah ſtation	42	3	73 5		
				72		
				66.5		
				64 5	}	64 81
				68		
				57		
				58		
				59		

At Ooracondah Station (continued.)

BETWEEN	AND	°	′	″	
Yerracondah ſtation	Paughurdroog ſtation.....	70	58	32	
				30	
				31.5	30.6
				30	
				29.5	

At Yerracondah Station.

Paughurdroog ſtation	Ooracondah ſtation.....	55	32	28.5	
				33	
				34.5	
				34.5	33.44
				34.5	
				33.5	
				34.5	
				34.5	

At Paughurdroog Station.

Ooracondah ſtation.....	Yerracondah ſtation.....	53	28	59	
				62.5	
				60	61.5
				63.5	
				63.5	
				60.5	
Condapilly ſtation.	Ooracondah ſtation.....	47	45	22.5	
				21.5	
				21.5	21.7
				21	
				22	

PRINCIPAL TRIANGLES.

N. end of the base from S. end of the base 32067.6 feet.

Number.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″				° ′ ″	
	N. end of the base,	35 04 5.9	—0.03			35 04 5.7	
	S. end of the base,	105 03 5.19	—0.15			105 3 4.8	
27	Paumdy station,	39 52 49.75	—0.04			39 52 49 5	
		180 00 00.84		″ 0.22	″ +0.62	180 00 00.0	
	Paumdy station from N. end of the base,						49110.4
	Paumdy station from S. end of the base,						29218.8
	N. end of the base,	87 27 16.45	—0.07			87 27 16.3	
	S. end of the base,	27 14 02.64	—0.03			27 14 2.6	
28	Gootydroog station,	65 18 41.19	—0.03			65 18 41.1	
		180 00 00.28		0.13	+0.15	180 00 00.0	
	Gootydroog station from N. end of the base,						16423.3
	Gootydroog station from S. end of the base,						35852.7

S. end of the base from Gootydroog station 35852 7 feet.

	S. end of the base,	132 17 7.83	—0.29			132 17 7.5	
	Gootydroog station,	21 16 32.65	+0.04			21 16 32.7	
29	Paumdy station,	26 26 19.69	+0 06			26 26 19.8	
		180 00 00.17		″ 0.19	″ —0.02	180 00 00.0	
	Paumdy station from S. end of the base,						29218.7
	Paumdy station from Gootydroog station,						59571.8
	S. end of the base,	27 14 02.64	—0.03			27 14 2.61	
	Gootydroog station,	67 50 39.69	—0.04			67 50 39.65	
30	Namthabad station,	. . .				84 55 17.74	
						180 00 00.0	
	Namthabad from S. end of the base,						33336.3
	Namthabad from Gootydroog station,						16471.8

S. end of the base from Paumdy station 29218.8 feet.

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″				° ′ ″	
	S. end of the base,	132 17 7.83	−0.29			132 17 7.5	
	Paumdy station,	26 26 19.69	+0.06			26 26 19.8	
31	Gootydroog station,	21 16 32 65	+0.04			21 16 32.7	
		180 00 00.17		0.″19	−0.″02	180 00 00.0	
	Gootydroog station from S. end of the base,						35852.9
	Gootydroog station from Paumdy station,						59572.7
	S. end of the base,	105 03 5.19	−0.15			105 03 5.04	
	Paumdy station,	40 21 43.5	−0.05			40 21 43.45	
32	Namthabad station,	. . .				34 35 11.51	
						180 00 00.0	
	Namthabad from S. end of the base,						33334.9
	Namthabad from Paumdy station,						49707.4

Gootydroog station from Paumdy station 59.572 feet.

	Gootydroog station,	65 13 27.83	−0.41			65 13 27.5	
	Paumdy station,	78 44 51.61	−0.51			78 44 51.2	
33	Konakoondloo station,	36 01 41.58	−0.36			36 01 41.3	
		180 00 01.02		1.28	−0 26	180 00 00.0	
	Konakoondloo from Gootydroog station,						99334.6
	Konakoondloo from Paumdy station,						91959.1
	Gootydroog station,	67 02 56.17	−0.50			67 02 55.7	
	Paumdy station,	88 42 29.35	−0.91			88 42 28.5	
34	Guddakul station,	24 14 36.17	−0 48			24 14 35.8	
		180 00 01.69		1.89	−0.20	180 00 00.0	
	Guddakul station from Gootydroog station,						145044.1
	Guddakul station from Paumdy station,						133596.

The above base, is a mean distance obtained by the 29th and 31st Triangles.

Gootydroog station from Konakoondloo 99334.6 feet.

Numbers.	TRIANGLES.	Observed Angles.	Differences	Spherical Excess.	Error.	Angles for Calculation.	Distances in Feet.
		° ′ ″	″	″	″	° ′ ″	
	Gootydroog station,	79 37 43.17	—0.75			79 37 42.2	
	Konakoondloo station,	41 26 18.57	—0.49			41 26 17.8	
35	Koelacondah station,	58 56 00.8	—0.54			58 56 00.0	
		180 00 02.54		1.78	+0.76	180 00 00.0	
	Koelacondah station from {Gootydroog station,						76749.2
	{Konakoondloo station,						114073.3

Gootydroog station from Koelacondah 76749.2 feet.

	Gootydroog station,	77 48 5.4	—1.00			77 48 4.5	
	Koelacondah station,	71 59 11.15	—0.39			71 59 10.5	
36	Guddakul station,	30 12 45.63	—0.69			30 12 45	
		180 00 02.18		2.58	—0.40	180 00 00.0	
	Guddakulgooda station from {Gootydroog station,						145043.5
	{Konakoondloo station,						149075.9

Gootydroog station from Guddakulgooda 145043.8 feet.

	Gootydroog station,	44 37 48.5	—1.06			44 37 47.4	
	Guddakulgooda station,	69 26 21.63	—1.30			69 26 20.4	
37	Ooderpeedroog station,	65 55 53.3	—1.24			65 55 52.1	
		180 00 03.43		3.60	—0.17	180 00 00.0	
	Ooderpeedroog station from {Gootydroog station,						148736.1
	{Guddakulgooda station,						111599.7

The distance from *Gootydroog* to *Guddakulgooda*, as a Base in the above triangle is a mean distance obtained by the 34th and 36th triangles.

Ooderpeedroog from Gootydroog station 148736.1 feet.

	Ooderpeedroog station,	71 17 19.5	—1.52			71 17 18	
	Gootydroog station,	46 17 50.68	—1.20			46 17 49.5	
38	Davurcondah station,	62 24 53.75	—1.34			62 24 52.5	
		180 00 03.93		4.06	—0.13	180 00 00.0	
	Davurcondah from {Ooderpeedroog station,						121317.2
	{Gootydroog station,						158943.1

Davarcondah from Ooderpeedroog station 121317.2 feet.

Numbers.	TRIANGLES.	Observed Angles.	Differences.	Spherical Excess.	Error.	Angles for Calculation.	Distance in Feet
		° ′ ″	″				
	Davarcondah station,	59 4 14.62	—0.70			59 4 13.9	
	Ooderpeedroog station,	51 26 4.5	—0.87			51 26 3.8	
39	Condapilly hill station,	69 29 43.14	—0.94			69 29 42.3	
		180 00 02.26		2.5	—0.24	180 00 00.0	
	Condapilly station from	Davurcondah station,					101273.8
		Ooderpudroog station,					111105.4

Davurcondah from Condapilly station 101273.8 feet.

	Davarcondah station,	53 14 40.1	—0.80			53 14 39.9	
	Condapilly station,	84 41 16.25	—1.32			84 41 15.5	
40	Ooracondah station,	42 4 4.81	—0.78			42 04 4.6	
		180 00 01.16		2.29	—1.74	180 00 00.0	
	Ooracondah station from	Davarcondah station,					150503.1
		Condapilly station,					121102.6

Condapilly station from Ooracondah station 121102.6 feet.

	Condapilly station,	52 40 02.81	—1.07			52 40 21	
	Ooracondah station,	79 34 38.17	—1.56			79 34 36.9	
41	Paughurdroog station,	47 45 21.7	—1.05			47 45 21	
		180 00 02.68		3.68	—1.0	180 00 000	
	Paughurdroog from	Condapilly station,					160889.4
		Ooracondah station,					130073.9

Paughurdroog from Ooracondah station 130073.9 feet.

	Paughurdroog station,	53 29 01.5	—1.4			53 28 59.75	
	Ooracondah station,	70 58 30.6	—1.14			70 58 28.6	
42	Yerracondah station,	55 32 33.44	—1.16			55 32 31.65	
		180 00 05.54		3.70	+1 84	180 00 00.0	
	Yerracondah station from	Paughurdroog station,					126783.3
		Ooracondah station,					149135.4

The diſtance from *Paughurdroog* to *Yerracondah*, will be found common; by referring to the 26th triangle, it will appear, that there is a difference of $1\frac{2}{10}$ feet, in the ſame ſide *Paughurdoog* from *Yerracondah* from whence it may be inferred that had the baſe been computed from bringing the triangles from the ſouthward, it would fall ſhort of the meaſurement by $3\frac{6}{10}$ inches.

For the purpoſe of reducing the tereſtrial arc, the following angles, with their including ſides, have been uſed to obtain ſides more conveniently ſituated with the meridian of *Dodagoontah* ſtation to which the whole arc is reduced.

The angle at *Bonnairgottah*, between *Dodagoontah* and *Deorabetta* with the including ſides, from which the angle at *Dodagoontah* ſtation between *Boonairgottah* and *Deorabetta* is found $14^{\circ}\ 48'\ 36''.6$; and alſo the direct diſtance from *Dodagoontah* to *Deorabetta* is 135931.3 feet. The angle at *Dodagoontah* ſtation is then corrected to make it as an obſerved angle which becomes $14^{\circ}\ 48'\ 35''.77$.

DESCRIPTION OF THE GREAT STATIONS.

Baſe near Gooty.—N. end;—In the flat cotton ground about three miles weſt from *Gooty*, and near the village of *Namthabad*. It is ſituated on a riſing ground, marked by a circular platform of brick and chunam

with a ſtone and circle, the center of which aſcertains the extremity of the baſe.

S. end, lies nearly a mile north of the village of *Eeranapully* and is ſimilarly marked, with the former one. Under the maſonry of both theſe platforms, the extremities of the baſe are alſo defined by ſtones with circles, fixed when the foundation was laid and correſponding with thoſe above.

Namthabad Station.—Lies about ſeven hundred and twenty five feet nearly north, from the North end of the baſe, being exactly in the ſame line, with the extremities of the baſe, and marked in the very ſame manner, to define the ſtation.

Paumdy Station.—A long hill running nearly eaſt and weſt and about two miles north of the village of *Paumdy* and the *Pinna* river. The ſtation is on a platform, and the center marked is as uſual.

Konakoondloo hill.—This hill is about a mile N. W. of the large hill of *Pullycondah*, and about two miles ſouth of the great road from *Gooty* to *Ballary*, a village of the ſame name ſituated at its ſouth ſide. The ſtation is on an old baſtion, marked by a ſtone and circle.

Guddakulgooda pagoda.—On the platform of the pagoda marked as uſual. The village and hill are well known, being about half the diſtance between *Gooty* and *Ballary*.

Koelacondah.—This hill is about fourteen miles north from *Gooty* in the *Chinumpully* talook, and two miles from the village of that name. On the ſummit of a large detached ſtone marked as uſual.

Gootydroog.—On the higheſt point of that celebrated droog. While obſerving the flag ſtaff was removed. It was afterwards replaced and marks the ſtation.

Ooderpeedroog.— A ſmall well known hill fort on the road from *Hundee Anantapoor* to *Ballary*. The ſtation is on the center of a ſquare platform, marked by a ſtone and circle about ten yards eaſt of a ruined pagoda.

Davurcondah.—A ſmall peaked hill with a rugged ſummit about three miles eaſt of *Hundee Anantapoor* on the great road to *Gooty*. A thin ſtone pillar to which the flag bamboo was attached, was the interſected object, while the inſtrument was there this pillar was removed, its center marked by a ſmall mill ſtone, over which it was again erected and a ſmall circular platform of ſtone and chunam built round it. The hill derives its name from a pagoda about thirty yards weſt of the ſummit.

Condapilly hill.—It is on the ſummit of a conſiderable range running nearly north and ſouth. It derives its name from a village of ſome extent about a mile N.W. of it. The place where the inſtrument ſtood is marked by a circle on the rock, and is a few feet from the ſtone pillar on the higheſt point of the hill.

Ooracondah.—This hill is on the northermoſt of the *Pencondah* range, and weſt of the village of *Chinnakatapally* on the great road between *Gooty* and *Bangalore*. On the other ſide is a village called *Nammudtella*. The ſtation is marked with a platform, a large ſtone and a circle over the center of which the inſtrument was placed.

Pole Star observations at Dodagoontah Station, and the position of its Meridian.

1805. Month.	Apparent Polar Distance.	Latitude.	Azimuth.	Angle between the Pole Star and referring Lamp.	Angle between the North Pole and referring Lamp.
	° ′ ″		° ′ ″	° ′ ″	° ′ ″
July 19	1 43 58.2		1 46 42.16	1 31 53	0 14 49.16
22	1 43 57.57		1 46 41.7	1 31 56.25	0 14 45.45
Aug. 8	1 43 54.07		1 46 38 1	1 31 51.25	0 14 46.85
12	1 43 53.05	° ′ ″	1 46 37.06	1 31 48.5	0 14 48.56
17	1 43 51.7	13 00 04	1 46 35.67	1 31 46.25	0 14 49.42
18	1 43 51.44		1 46 35.4	1 31 47.5	0 14 47.9
19	1 43 51.16		1 46 35.1	1 31 45.5	0 14 49.6
23	1 43 50.04		1 46 33.97	1 31 45.5	0 14 48.47
26	1 43 49.09		1 46 32.99	1 31 43.5	0 14 49.49
27	1 43 48.83		1 46 32.73	1 31 44.5	0 14 48.23
	Angle between the North Pole and referring Lamp,				0 14 48.31 N. E^{ly}.
	Angle between the referring Lamp and *Savendroog*,				104 4 29.68
	Angle between the North Pole and *Savendroog* station,				103 49 41.37 N. W^{ly}.

In this paper the latitude of *Dodagoontah*, which is the great station for fixing the position of the meridian line, is laid down by reducing the terrestrial arc between *Putchapolliam* and *Dodagoontah*, to degrees and minutes, taking the mean degree as given by the observations at *Putchapolliam* and *Namthabad* near *Gooty*, which is 60487.27 for latitude $13^{\circ}\ 02'\ 55''$ not differing much from the latitude of *Dodagoontah*. This gives an arc of $2^{\circ}\ 0'\ 14''.72$ which added to the arc between *Punnae* and *Putchapolliam* gives $4^{\circ}\ 50'\ 25''\ 26$, and this applied to the latitude of *Punnae*, viz. $8^{\circ}\ 9'\ 38''.39$ gives $13^{\circ}\ 00'\ 03''.65$ for the latitude of *Dodagoontah*. This latitude exceeds that determined in 1805, by $3''.74$. Therefore if this quantity be added to $13^{\circ}\ 4'\ 8''.7$, the deduced latitude of the observatory (*Asiatick* Researches, vol. 10th, page 374) we have $13^{\circ}\ 4'\ 12''.44$ the latitude of the observatory as corrected from the present operations.

Reduction of the sides of the Meridional Triangles to the Meridian of Dodagoontah, for determining the length of the terrestrial Arcs.

The length of the arc comprehended by the parallels of Dodagoontah station, and the station near Putchapolliam.

N 4

Stations at	Names of Places.	Bearings referred to the Meridian of Dodagoontah station.	Distances.	Distances on the		Distances from Dodagoontah.	
				Perpendicular.	Meridian.	Perpendicular.	Meridian.
			FEET.	FEET.	FEET.	FEET.	FEET.
Dodagoontah, ...	Deorabetta, ...	0 13 08.43 S E.	135931.8	519.6 E.	135930.3 S.	519.6 E.	135930.3 S.
Deorabetta, ...	Ponnassmalli, ...	2 11 54.36 S E.	174071 7	6677.6 E.	173947.6 S	7197.2 E.	309877.9 S.
Ponnassmalli, ...	Woorachmalli, ...	3 49 54.39 S E.	243502.4	16272.6 E.	242958.2 S.	23469.8 E.	552836.1 S.
Woorachmalli.	Putchapolliam, ...	7 53 51 52 S W.	176169.4	24206.4 W.	174498.5 S.	736.6 W.	727334.6 S.

Distances between the parallels of Dodagoontah, and the Station at Namthabad.

Stations at	Names of Places.	Bearings referred to the Meridian of Dodagoontah station.	Distances.	Distances on the Perpendicular.	Distances on the Meridian.	Distances from Dodagoontah. Perpendicular.	Distances from Dodagoontah. Meridian.
		° ′ ″	FEET.	FEET.	FEET.	FEET.	FEET.
Deorabetta,	Allasoor hill,	0 43 54.55 N. W.	194662.8	2486.3 W.	194646.9 N.	1966.7 W.	58716.6 N.
Allasoor hill,	Kulkotah hill,	4 5 43.25 N. W.	94211.8	6728.3 W.	93971.2 N.	8695 W.	152687.8 N.
Kulkotah hill,	Yerracondah,	5 43 49.55 N. E.	180883.8	18060.9 E.	179979.9 N.	9365.9 E.	332667.7 N.
Yearracondah,	Ooracondah,	7 4 21.49 N. W.	126783.3	15610.5 W.	125818.5 N.	6244.6 W.	158486.2 N.
Ooracondah,	Davurcondah,	5 32 52.09 N. E.	150503.1	14550.1 E.	149798.2 N.	8305.5 E.	608284.4 N.
Davurcondah,	Gootydroog,	0 16 40.56 N. E.	158943.1	771 E.	158941.2 N.	9076.5 E.	767225.6 N.
Gootydroog,	Namthabad,	70 43 30.21 S. W.	16471.8	15548.5 W.	5437.3 S.	6472 W.	761788.3 N.

Terristrial Arcs between the parallels of Dodagoontah station and Namthabad, ... 761788.3 feet.

Dodagoontah station and Putchapolliam, ... 727334.6

Putchapolliam station and Namthabad, ... 1489122.9

Putchapolliam station and Punnae station, ... 1029100.5

Punnae station and Namthabad, ... 2518223.4

Zenith distances of Stars, observed at *Namthabad Station*, with the corrections for precession, nutation, aberration and the semi-annual solar equation back to the beginning of the year 1805.

Observations at Namthabad.

o LEONIS.

Nearest point on the Limb, 4′ 20″ *S.*

1811. Month.	Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	′	° ′ ″	°	°
April 16	W.	4 21 9.13	109.11	4 19 20.02	86	86
20	E.	4 21 19.53	109 00	4 19 30 53	83	83
21	W.	4 21 10.38	108.95	4 19 21.43	84	84
22	E.	4 21 18.26	108.90	4 19 29.36	87	87
24	W.	4 21 8.63	108.80	4 19 19.83	91	91
25	E.	4 21 20.13	108.74	4 19 31.39	92	92
26	W.	4 21 9.63	108.68	4 19 20.95	94	93
27	E.	4 21 19.13	108.63	4 19 30.50	96	96
28	W.	4 21 9.63	108.58	4 19 21.05	94	94
29	E.	4 21 19.26	108.52	4 19 30 74	93	93
30	W.	4 21 9.63	108.47	4 19 21.16	92	92
May 2	E.	4 21 19.38	108.36	4 19 31.02	78	79
				Mean	89.2	89.2

REGULUS.

Nearest point on the Limb, 2° 15′ *S.*

1811. Month.		Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper°	Lower.
			° ′ ″	″	° ′ ″	°	°
April	18	W.	2 12 47.51	115.48	2 10 52.03	86	86
	20	E.	2 12 58.89	115.36	2 11 03.53	84	84
	21	W.	2 12 45.76	115.29	2 10 50.47	83	83
	22	E.	2 12 59.89	115.23	2 11 04.66	86	86
	23	W.	2 12 44.76	115.16	2 10 49.60	83	83
	24	E.	2 12 58.89	115.09	2 11 03.80	91	91
	25	W.	2 12 44.87	115.03	2 10 49.84	91	91
	26	E.	2 12 58.24	114.97	2 11 03.27	93	92
	27	W.	2 12 44.74	114.90	2 10 49.84	95	94
	28	E	2 12 58.87	114.83	2 11 4.04	94	94
	29	W.	2 12 46.87	114.77	2 10 52.10	93	93
	30	E.	2 12 57.62	114.71	2 11 2.91	92	92
					Mean	89.25	89.08

LEONIS.

Nearest point on the Limb, 1° 20′ *N.*

				+			
April	20	E.	1 21 29.26	126.54	1 23 35.80	80	80
	21	W.	1 21 40.26	126.45	1 23 46.71	82	82
	22	E.	1 21 28.13	126.35	1 23 34.48	85	85
	23	W.	1 21 40.13	126.26	1 23 46.39	82	81
	24	E.	1 21 28.28	126.16	1 23 34.44	89	89
	25	W.	1 21 43.13	126.07	1 23 49.20	88	88
	26	E	1 21 30.13	125.98	1 23 36.11	91	91
	27	W.	1 21 40.13	125.88	1 23 46.01	93	93
	28	E.	1 21 29.63	125.79	1 23 35.42	93	93
	29	W.	1 21 40.51	125.70	1 23 46.21	90	90
	30	E.	1 21 29.13	125.60	1 23 34.73	90	90
May	4	W.	1 21 38.76	125.23	1 23 43.99	90	90
					Mean	87.75	87.67

β LEONIS.

Nearest point on the Limb, 0° 30′ *N.*

1811. Month.		Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
			° ′ ″	″ +	° ′ ″	°	°
April	18	W.	0 31 42.13	129.88	0 33 52.01	86	86
	20	E.	0 31 33.76	129.68	0 33 43.44	79	79
	21	W.	0 31 45.51	129.58	0 33 55.09	82	81
	22	E.	0 31 33.63	129.47	0 33 43.10	84	84
	23	W.	0 31 47.26	129.38	0 33 56.64	81	81
	24	E.	0 31 31.38	129.28	0 33 40.66	87	87
	25	W.	0 31 46.01	129.18	0 33 55.19	88	88
	26	E.	0 31 33.03	129.07	0 33 42.10	90	90
	27	W.	0 31 46.26	128.98	0 33 55.24	92	92
	28	E.	0 31 35.13	128.88	0 33 44.01	92	92
	29	W.	0 31 46.51	128.77	0 33 55.28	90	90
	30	E.	0 31 33.13	128.66	0 33 41.79	90	90
					Mean	86.75	86.67

ε VIRGINIS.

Nearest point on the Limb, 3° 5′ *S.*

				—			
April	25	W.	3 7 9.13	124.85	3 5 4.28	87	86
	26	E.	3 7 23.39	124.75	3 5 18.64	90	90
	27	W.	3 7 12.13	124.65	3 5 7.48	90	90
	29	E.	3 7 20.26	124.44	3 5 15.82	88	88
	30	W.	3 7 13.01	124.34	3 5 8.67	88	88
May	3	E.	3 7 20.76	124.01	3 5 16.75	82	82
					Mean	87.5	87.33

δ SERPENTIS.

Nearest point on the Limb, 3° 55′ *S.*

1811. Month.		Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
			° ′ ″	— ′	° ′ ″	°	°
May	1	E.	3 55 15.13	77.56	3 53 57.57	81	81
	3	W.	3 55 6.5	77.29	3 53 49.21	81	81
	4	E.	3 55 14	77.15	3 53 56.85	79	79
	5	W.	3 55 4	77.01	3 53 46.99	81	81
	7	E.	3 55 15.13	76.74	3 53 58.39	84	84
	9	W.	3 55 4.75	76.46	3 53 48.29	86	86
	15	E.	3 55 11.63	75.61	3 53 56.02	85	85
					Mean	82.13	82.13

γ SERPENTIS.

Nearest point on the Limb, 1° 10′ *N.*

				+			
May	1	E.	1 11 10.63	67.83	1 12 18.46	81	81
	3	W.	1 11 17.51	67.51	1 12 25.02	81	81
	4	E.	1 11 11.88	67.35	1 12 19.23	78	78
	5	W.	1 11 19.76	67.18	1 12 26.49	81	81
	7	E.	1 11 10.38	66.85	1 12 17.23	84	84
	8	W.	1 11 21.01	66.69	1 12 27.70	86	86
	9	E.	1 11 10.63	66.52	1 12 17.15	86	86
	15	W.	1 11 21.13	65.48	1 12 26.61	84	84
					Mean	82.63	82.63

æ HERCULIS.

Nearest point on the Limb, 0° 30′ *S.*

1811. Month.		Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Low er.
			° ′ ″	— ′	° ′ ″	°	°
April	26	E.	0 29 5.37	27.69	0 28 37.68	83	83
	27	W.	0 28 55.4	27.55	0 28 27.85	83	83
	28	E.	0 29 3.87	27.40	0 28 36.47	83	83
	30	W.	0 28 57	27.09	0 28 29.91	82	82
May	1	E.	0 29 3.87	26.94	0 28 36.93	80	80
	2	W.	0 28 55.75	26.79	0 28 28.96	75	76
	3	E.	0 29 5	26.64	0 28 38.36	80	79
	4	W.	0 28 57.87	26.47	0 28 31.40	79	78
	5	E.	0 29 5	26.31	0 28 38.69	81	81
	7	W.	0 28 55.12	25.98	0 28 29.14	83	83
	8	E.	0 29 4.5	25.82	0 28 38.68	84	83
	9	W.	0 28 54.12	25.65	0 28 28.47	83	83
					Mean	81.33	81.17

æ OPHIUCHI.

Nearest point on the Limb, 2° 25′ *S.*

April	25	W.	2 23 18.37	18.55	2 22 59.82	82	81
	26	E.	2 23 30.87	18.42	2 23 12.45	83	83
	27	W.	2 23 21.99	18.28	2 23 3.71	83	83
	28	E.	2 23 33.87	18.14	2 23 15.73	83	83
	30	W.	2 23 22.74	17.86	2 23 4.88	82	82
May	1	E.	2 23 32.24	17.71	2 23 14.53	80	80
	2	W.	2 23 20.74	17.57	2 23 3.17	75	76
	3	E.	2 23 31.37	17.41	2 23 13.96	79	79
	4	W.	2 23 20.37	17.27	2 23 3.10	79	79
	5	E.	2 23 31.12	17.11	2 23 14.01	81	81
	7	W.	2 23 20.74	16.80	2 23 3.94	83	83
	8	E.	2 23 29.37	16.63	2 23 12.74	83	83
					Mean	81.09	81.09

ζ AQUILÆ.

Nearest point on the Limb, 1° 30′ *S.*

1811. Month.	Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	″ +	° ′ ″	°	°
May 10	W.	1 30 15.5	31.48	1 30 46.98	82	82
14	E.	1 30 24.38	32.16	1 30 56.54	77	77
15	W.	1 30 16	32.30	1 30 48.30	82	82
				Mean	80.37	78.03

γ AQUILÆ.

Nearest point on the Limb, 4° 55′ *S.*

				+			
May	1	E.	4 56 9.13	52.44	4 57 1.57	78	83
	2	W.	4 55 58.63	52.57	4 56 51.20	76	76
	4	E.	4 56 8.63	52.86	4 57 1.49	77	77
	5	W.	4 56 2.63	53.00	4 56 55.63	80	80
	7	E.	4 56 9.00	53.29	4 57 2.29	80	80
	10	W.	4 55 59.13	53.75	4 56 52.88	80	80
	11	E.	4 56 8.63	53.92	4 57 2.55	81	80
	12	W.	4 55 59.63	54.07	4 56 53.70	84	83
	15	E.	4 56 7.13	54.56	4 57 1.69	81	81
					Mean	79.67	80

ATAIR.

Nearest point on the Limb, 6° 45′ *S.*

				+			
May	5	W.	6 42 57.24	58.02	6 43 55.26	80	80
	7	E.	6 43 10.12	58.31	6 44 8.43	80	80
	8	W.	6 42 57.74	58.46	6 43 56.20	80	80
	9	E.	6 43 6.24	58.61	6 44 4.85	80	80
	10	W.	6 42 54.87	58.76	6 43 53.63	79	79
	11	E.	6 43 6.99	58.91	6 44 5.90	81	80
	12	W.	6 42 54.25	59.08	6 43 53.33	84	83
	15	E.	6 43 5.37	59.56	6 44 4.93	81	81
					Mean	80.63	80.37

β DELPHINI.

Nearest point on the Limb, 1° 10′ *S.*

1811. Month.	Face.	Observed Zenith distance.	Correction.	Correct Zenith distance.	Thermometers. Upper.	Lower.
		° ′ ″	″ +	° ′ ″	°	°
May 9	E.	1 9 11.37	74.12	1 10 25.49	79	79
10	W.	1 9 1.87	74.27	1 10 16.14	79	79
12	E.	1 9 14	74.59	1 10 28.59	83	82
11	W.	1 9 4.62	74.91	1 10 19.53	77	77
15	E.	1 9 10.37	75.09	1 10 25.46	80	80
				Mean	79.6	79.4

MEANS of the zenith distances, taken on the right and left Arcs corrected for refraction, equation of the sectorial tube, and the mean run of the micrometer.

Zenith distances at Namthabad.

o LEONIS.

1811. Month.	Left Arc.	1811. Month.	Right Arc.	MEAN.	
	° ′ ″		° ′ ″		
April 20	4 19 30.53	April 18	4 19 20.02	Mean,	4 19 25.67
22	4 19 29.36	21	4 19 21.43	Refraction, &c.	+ 4.24
25	4 19 31.39	24	4 19 19.83		
27	4 19 30.50	26	4 19 20.95	Zenith distance,	4 19 29.91
29	4 19 30.74	28	4 19 21.05		
May 2	4 19 31.02	30	4 19 21.16		
Mean	4 19 30.58	Mean	4 19 20.74		

REGULUS.

1811. Month.	Left Arc. ° ′ ″	1811. Month.	Right Arc. ° ′ ″	MEAN. ° ′ ″
April 20	2 11 3.53	April 18	2 10 52.03	Mean, ... 2 10 57.18
22	2 11 4.66	21	2 10 50.47	Refraction, &c. &c. ... + 1.98
24	2 11 3.80	23	2 10 49.60	
26	2 11 3.27	25	2 10 49.84	Zenith distance, ... 2 10 59.16
28	2 11 4.04	27	2 10 49.84	
30	2 11 2.91	29	2 10 52.10	
Mean	2 11 3.70	Mean	2 10 50.65	

β LEONIS.

April 21	1 23 46.71	April 20	1 23 35.80	Mean, ... 1 23 40.79
23	1 23 46.39	22	1 23 34.48	Refraction, &c. ..... + 1.29
25	1 23 49.20	24	1 23 34.44	
27	1 23 46.01	26	1 23 36.11	Zenith distance, ... 1 23.42.08
29	1 23 46.21	28	1 23 35.42	
May 4	1 23 43.99	30	1 23 34.73	
	1 23 46.42	Mean	1 23 35.17	

β LEONIS.

April 18	0 33 52.01	April 20	0 33 43.44	Mean, ... 0 33 48.72
21	0 33 55.09	22	0 33 43.10	Refraction, &c. ..... + 0.45
23	0 33 56.64	24	0 33 40.66	
25	0 33 55.19	26	0 33 42.10	Zenith distance, ... 0 33 49.17
27	0 33 55.24	28	0 33 44.01	
29	0 33 55.28	30	0 33 41.79	
Mean	0 33 54.91	Mean	0 33 42.52	

ε VIRGINIS.

1811. Month.	Left Arc.	1811. Month.	Right Arc.	MEAN.	
	° ′ ″		° ′ ″		° ′ ″
April 26.	3 5 18.64	April 25	3 5 4 28	Mean, ...	3 5 11.94
29	3 5 15.82	27	3 5 7.48	Refraction, &c.	+ 2.93
May 3	3 5 16.75	30	3 5 8.67		
				Zenith distance, ...	3 5 14.87
Mean	3 5 17.07	Mean	3 5 6.81		

δ SERPENTIS.

May 1	3 53 57.57	May 3	3 53 49.21	Mean, ...	3 53 52 69
4	3 53 56 85	5	3 53 46.99	Refraction, &c.	+ 3.89
7	3 53 58.39	9	3 53 48.29		
15	3 53 56.02			Zenith distance,....	3 53 56 58
Mean	3 53 57.21	Mean	3 53 48 16		

γ SERPENTIS.

May 3	1 12 25.04	May 1	1 12 18.46	Mean, ...	1 12 22.29
5	1 12 26.94	4	1 12 19.23	Refraction, &c.	+ 1.12
8	1 12 27.70	7	1 12 17.23		
15	1 12 26.61	9	1 12 17.15	Zenith distance, ...	1 12 23.41
Mean	1 12 26.57	Mean	1 12 18.02		

α HERCULIS.

April 26	0 28 37.68	April 27	0 28 27.85	Mean, ...	0 28 33 55
28	0 28 36.47	30	0 28 29.91	Refraction, &c.	+ 0.54
May 1	0 28 36.93	May 2	0 28 28.96		
3	0 28 38.36	4	0 28 31.40	Zenith distance, ...	0 28 34.09
5	0 28 38.69	7	0 28 29.14		
8	0 28 38.68	9	0 28 28.17		
Mean	0 28 37.80	Mean	0 28 29.29		

α OPHIUCHI.

1811. Month.	Left Arc.	1811. Month.	Right Arc.	MEAN.	
	° ′ ″		° ′ ″		° ′ ″
April 26	2 23 12.45	April 25	2 22 59.82	Mean, ...	2 23 85 0
28	2 23 15.73	27	2 23 3.71	Refraction, &c.	+ 2.49
May 1	2 23 14.53	30	2 23 4.88		
3	2 23 13.96	May 2	2 23 3.17	Zenith distance, ...	2 23 10.99
5	2 23 14.10	4	2 23 3.10		
8	2 23 12.74	7	2 23 3.49		
Mean	2 23 13.90	Mean	2 23 3.10		

ζ AQUILÆ.

May 14	1 30 56.54	May 10	1 30 46.98	Mean, ...	1 30 52.09
		15	1 30 48.30	Refraction, &c.	+ 1.53
Mean	1 30 56.54	Mean	1 30 47 64	Zenith distance, ...	1 30 53.62

γ AQUILÆ.

May 1	4 57 1.57	May 2	4 56 51.20	Mean, ...	4 56 57.63
4	4 57 1.49	5	4 56 55.63	Refraction, &c.	+ 4.91
7	4 57 2.29	10	4 56 59.88		
11	4 57 2.55	12	4 56 53.70	Zenith distance, ...	4 57 2.54
15	4 57 1.69				
Mean	4 57 1.92	Mean	4 56 53.35		

ATAIR.

May 7	6 44 3.43	May 5	6 43 55.26	Mean, ...	6 44 00.32
9	6 44 4.85	8	6 43 56.20	Refraction, &c.	+ 6.87
10	6 44 5.90	11	6 43 53.63		
12	6 44 4.93	15	6 43 53.33	Zenith distance, ...	6 44 7.19
Mean	6 44 6.03	Mean	6 43 54.60		

β DELPHINI.

May 9	1 10 25.49	May 10	1 10 16.14	Mean, ...	1 10 22 18
12	1 10 28.59	14	1 10 19.53	Refraction, &c.	+ 1.22
15	1 10 25.46				
Mean	1 10 26.52		1 10 17 84	Zenith distance, ...	1 10 23.40

AMPLITUDE

Of the Arc between *Punnae* and *Namthabad*.

STARS.	Zenith distances at Punnae.	Zenith distances at Namthabad.	AMPLITUDE.
	° ′ ″	° ′ ″	° ′ ″
o Leonis,.....	2 36 52.07 N.	4 19 29.91 S.	6 56 21.98
Regulus,.....	4 45 24.06 N.	2 10 59.16 S.	6 56 23.22
ϑ Leonis,.....	8 20 3.44 N.	1 23 42.08 N.	6 56 21.36
β Leonis,.....	7 30 11.59 N.	0 33 49.17 N.	6 56 22.42
ε Virginis,.....	3 51 5.95 N.	3 5 14.87 S.	6 56 20.82
δ Serpentis,.....	3 2 25.36 N.	3 53 56.58 S.	6 56 21.94
ν Serpentis,.....	8 8 46.97 N.	1 12 23.41 N.	6 56 23.56
α Herculis,.....	6 27 48.35 N.	0 28 34.09 S.	6 56 22.44
α Ophuichi,.....	4 33 11.86 N.	2 23 10.99 S.	6 56 22.85
ζ Aquilæ,.....	5 25 29.25 N.	1 30 53.62 S.	6 56 22.87
ν Aquilæ,.....	1 55 19.77 N.	4 57 2.54 S.	6 56 22.31
Atair,.....	0 12 14.69 N.	6 44 7.19 S.	6 56 21.88
β Delphini,.....	5 45 58.29 N.	1 10 23.40 S.	6 55 21.69
		Mean	6 56 22 25

Celeſtial Arc between the parallels of

Punnae and *Namthabad* ſtation,..... ° ′ ″ 6 56 22.25

Terreſtial Arc,..... 2518223.4 feet.

Mean length of one degree,..... 60480.42 fathoms

Latitude of the middle point,..... ° ′ ″ 11 37 49

AMPLITUDE

Of the Arc between *Putchapolliam* and *Namthabad*.

STARS.	Zenith distances at Putchapolliam.	Zenith distances at Namthabad.	AMPLITUDE.
	° ′ ″	° ′ ″	° ′ ″
o Leonis,.....	0 13 18.16 S.	4 19 29.91 S.	4 6 11.75
Regulus,.....	1 55 12.99 N.	2 10 59.16 S.	4 6 12.15
ϑ Leonis,.....	5 29 54.26 N.	1 23 42.08 N.	4 6 12.18
β Leonis,.....	4 39 59.4 N.	0 33 49.17 N.	4 6 10.23
ε Virginis,.....	1 00 55.20 N.	3 5 14.87 S.	4 6 10.07
δ Serpentis,.....	0 12 14.15 N.	3 53 56.58 S.	4 6 10.73
α Herculis,.....	3 37 38 58 N.	0 28 34.09 S.	4 6 12.67
α Ophiuchi,.....	1 43 00.69 N.	2 23 10.99 S.	4 6 11 68
ζ Aquilæ,.....	2 35 16.44 N.	1 30 53.62 S.	4 6 10.06
ν Aquilæ,.....	0 50 50.74 S.	4 57 2.54 S.	4 6 11 80
Atair,.....	2 37 54.13 S.	6 44 7.19 S.	4 6 13.06
β Delphini,.....	2 55 45.68 N.	1 10 23.40 S.	4 6 9.03
		..... Mean	4 6 11.28

Celestial Arc between the parallels of

Putchapolliam and *Namthabad*, ... ° 4 ′ 6 ″ 11.28

Terestrial Arc, ... 1489122.9 Feet.

Mean length of one degree, ... 60487.27 Fath.

Latitude of the middle point, ... ° 13 ′ 2 ″ 55

It will ſcarcely be worth while to make any deductions until my meridional operations be finiſhed, and thoſe in England extended further. I ſhall only obſerve that if the degree in latitude 11° 37′ 49″ as I have brought it out, be taken with the *Engliſh*, *French*, and *Swediſh* meaſures reſpectively, and applied to the formulæ in Art. 2 in the Appendix to my laſt paper, the ratio of the polar to the equatorial diameter of the earth will be as 1 : 1.0032183, 1 : 1,0034688, and 1 : 1.0032811, reſpectively, whoſe mean is 1 : 1. 0033227 or an ellipticity of $\frac{1}{300.96}$ nearly.

And if this mean ratio, of 1 to 0033227 be uſed with the degree in 11° 37′ 49″, and the other degrees in latitudes 9° 34′ 44″; 13° 2′ 55″ computed according to the formulæ in Art. 3 in the ſame Appendix, they will come out 60472. 6 and 60486.47 reſpectively, differing only 0.21 and 0.63 fathoms from the obſervations, and theſe differences would hold good, where the three latitudes are ſo near each other, in any hypotheſis of the Earth's figure that has reſulted from the recent meaſurements. So near a coincidence of the obſervations with the elliptic theory, I muſt own has the appearance of chance However if a ſeries of obſervations two degrees further to the northward, ſhould prove equally regular, the accuracy of the whole may be in a great meaſure relied on, and I ſhall then feel deſirous of repeating the obſervations made at *Dodagoontah* in 1805; for to all appearance no part of the country could be more favorable, and it is poſſible, that at the commencement of my obſerving with the zenith ſector, there might have been ſome overſight in uſing ſo delicate an inſtrument. I am not however aware that there was; but if the irregularity was occaſioned by the attraction of denſe matter to the northward, the matter muſt have been nearer to the place of obſervation, than I have hitherto ſuppoſed it to be.

It may be neceſſary to notice here, that in Art. 2. of the Appendix to my laſt paper, there has been an overſight in taking the mean of two computed degrees, 60465.5 and 60498, which mean is $60481\frac{3}{4}$ in place of $60485\frac{3}{4}$; or 60482 to latitude 11 6 24 which muſt therefore affect all the reſults given in that paper. But as the principal ones are computed according to the preſent meaſurement, it is unneceſſary to recompute thoſe formerly given. By uſing the mean ratio of 1 : 1.0033227, with the degree $11^{\circ}\ 37'\ 49''$, equal to 60480.42 fathoms, the degree of longitude at the equator will come out 60858.47 fathoms and the length of the equatorial diameter of the earth will be 6973866 fathoms, from whence, by proceeding as in Page 98, of this volume, the quadrantal Arc of the elliptic Meridian will be had, equal to 5468170.8 fathoms, or 3937082976 inches, which divided by 10.000000, will give 39.37083 *Engliſh* inches for the meaſure of the *French* metre meaſured at the temperature of 62° which differs only $\frac{1}{5882}$th part of an inch from that meaſured by the *French* mathematicians at 32° and reduced to the ſame temperature.

Latitudes and Longitudes

Of the great stations, and some principal places as deduced from the Meridional Arc.

NAMES OF PLACES.	Latitudes.	Longitudes from Madras Observatory W.	Longitudes from Greenwich E.
	° ′ ″	° ′ ″	° ′ ″
* Hallagamalli,	11 0 52	2 48 54	77 29 36
* Yaëlmatoor hill,	11 12 16	2 30 12	77 48 18
Eerode, *(S. W. angle of the Fort,)*	11 20 27	2 31 36	77 46 54
* Thittamalli,	11 20 49	2 53 49	77 24 41
Bhavany Pagoda,	11 25 45	2 34 19	77 44 11
* Woorachmalli,	11 28 37	2 33 43	77 41 47
Sankerrydroog,	11 28 51	2 23 41	77 54 49
Sattimungalum Pagoda,	11 30 17	3 00 38	77 17 52
* Kumbetarine hill,	11 35 31	2 58 57	77 19 33
Salem, *(S. W. angle of the Fort,)*	11 39 9	2 5 49	78 12 41
* Paulamalli,	11 41 39	2 31	77 47 30
Womooloor, highest cavalier,	11 44 8	2 12 48	78 5 42
Cauverypoorum,	11 54 43	2 29 36	77 48 54
Darampoory,	12 3 48	2 5 5	77 13 25
Pennagra,	12 7 45	2 20 58	77 57 32
Allambaddy,	12 8 35	2 30 25	77 18 5
* Ponnassmalli,	12 8 47	2 36 27	77 42 3
* Bundhully hill,	12 12 16	2 55 2	77 23 28
Sattiagul,	12 14 38	3 6 32	77 11 58
Mallavilly,	12 23	3 11 54	77 6 36
Gopauldroog,	12 29 52	2 57 31	77 20 59
Ryacottah, *(Flag Staff,)*	12 31 16	2 12 54	78 5 36
Denkanicottah,	12 31 53	2 27 53	77 50 37
Kistnagherry,	12 32 15	2 2 9	78 16 21
Anchittydroog, *(Muntapum,)*	12 35 23	2 21 45	77 56 45
* Deorabetta,	12 37 32	2 37 35	77 40 55
Annicul Fort,	12 42 33	2 33 31	77 44 59
Oossoor hill and Pagodah,	12 43 34	2 21 52	77 53 38
* Bonnairgottah,	12 48 43	2 40 41	77 37 49
Anniculdroog,	12 49 36	3 2 51	77 15 39
* Savendroog,	12 55 10	2 57 40	77 20 50
Bangalore Palace,	12 57 34	2 40 45	77 37 45
* Dodagoontah,	13 0 4	2 37 40	77 40 50
* Muntapum center,	13 0 45	2 40 13	77 38 17
Goonicul,	13 1 33	3 13 34	77 4 56
* Tirtapully hill,	13 2 25	2 21 56	77 56 34
Oosscottah Mosque,	13 4 21	2 28 13	77 50 17
Byrandroog,	13 5 41	3 4 47	77 13 43
Colar Fort, *(Pagoda,)*	13 8 20	2 6 49	78 11 41

NAMES OF PLACES.	Latitudes.	Longitudes from Madras Observatory W.	Longitudes from Greenwich E.
	° ′ ″	° ′ ″	° ′ ″
* Allasoor hill,	13 9 42	2 38	77 40 30
Shevagunga Pagoda,	13 10 9	3 1 51	77 16 39
Deonelly,	13 4 59	2 32 38	77 45 52
B. Ballapoor Eedgah,	13 18 24	2 43 13	77 35 17
* Cheetkul hill,	13 19 16	2 58 52	77 19 38
* Rymandroog,	13 21 17	2 14 37	78 3 53
* Nundydroog,	13 22 12.5	2 34 1	77 44 29
* Devaroydroog,	13 22 25	3 2 28	77 16 2
* Kulkotah hill,	13 25 14	2 39 9	77 39 21
Macklydroog,	13 25 58	2 45 4	77 33 26
Minchiculdroog,	13 27 27	3 3 16	77 15 14
* Baelippee hill,	13 39 7	2 58 28	77 20 2
Mudgherrydroog,	13 39 7	3 3 11	77 15 19
Goodeebundah,	13 40 34	2 33 3	77 45 27
Busmungydroog,	13 44 24	3 12 57	77 5 33
Serah, (*Flag Staff*,)	13 44 39	3 20 29	76 58 1
Meddagashiedroog,	13 49 54	3 3 34	77 14 56
Kodicondah,	13 49 49	2 28 24	77 50 6
* Yerracondah,	13 54 59	2 36 5	77 42 25
Muddukserah,	13 56 41	2 59	77 19 30
Pencondah, *remarkable tree*,	14 4 13	2 40 2	77 38 28
* Paughurdroog,	14 6 19	2 58 34	77 19 56
Kaummundroog,	14 14 59	2 58 44	77 19 46
* Ooracondah,	14 15 51	2 38 44	77 39 46
Durmahveram Palace,	14 17 49	2 27 34	77 50 56
Kunnaganpully Pagoda,	14 26 52	2 44 8	77 34 22
* Condapilly hill,	14 31 57	2 50 59	77 27 31
Hundee Anantapoor,	14 40 59	2 38 39	77 39 51
* Ooderpeedroog,	14 49 59	2 54 31	77 23 59
* S. end of the base, (*Eeranapilly*,)	15 0 59	2 36 24	77 42 6
* N. end of the base, (*Namthabad*,)	15 5 53	2 38 43	77 39 47
* Namthabad station,	15 6 00.6	2 38 46	77 39 44
* Konakoondloo hill,	15 6 39	2 53 3	77 25 27
* Gootydroog,	15 6 54	2 36 7	77 42 23
* Guddaculgooda,	15 7 19	3 00 51	77 17 39
* Paumdy hill,	14 57 54	2 40 15	77 38 15
* Koelacondah,	15 19 21	2 38 39	77 39 51

Note. All places marked with the asterisk (*) are great stations.

Elevations and Depressions,

Contained Arcs, and Terrestrial Refractions, together with the heights above the level of the Sea, of the principal stations.

Stations at	Stations observed.	Apparent Elevations and Depressions.	Contained Arcs.	Refraction.	Elevations above the Sea.	
					Stations.	Heights.
		° ′ ″	′ ″			FEET.
Yerraconda̲h,....	Tirtapully,.....	0 16 19 D.	25 4	1/24	Tirtapully,.....	3182.9
Tirtapully,.....	Yerracondah,....	0 6 39 D.				
Tirtapully,.....	Bonnairgottah,...	0 7 16 D.	22 49	1/24	Bonnairgottah, ..	3305.1
Bonnairgottah, ..	Tirtapully,.....	0 13 20 D.				
Bonnairgottah, ..	S. end of the base,	0 25 38 D.	7 11	1/40	S. end of the base,	3023.6
S. end of the base,	Bonnairgottah, ..	0 18 49 E.				
Bonnairgottah, ..	Dodagoontah,....	0 18 10 D.	11 40	1/17	Dodagoontah, ...	3037.9
Bonnairgottah, ..	Deorabetta,.....	0 0 0	11 35	1/16	Deorabetta, ...	3108
Deorabetta,.....	Bonnairgottah,...	0 10 6 D.				
Savendroog,.....	Bundhully,.....	0 15 41 D.	42 59	1/17	Bundhully.....	4254.5
Bundhully,.....	Savendroog,.....	0 22 17 D.				
Bundhully,.....	Kumbetarine, ...	0 3 26 E.	36 56	1/18	Kumbetarine, ...	5548.6
Kumbetarine, ...	Bundhully,.....	0 36 23 D.				
Deorabettah, ...	Ponnassmalli,....	0 17 18 E.	28 47	1/17	Ponnassmalli, ...	4928.8
Ponnassmalli,....	Deorabettah, ...	0 42 45 D.				
Ponnassmalli,....	Paulamalli,.....	0 16 46 D.	27 40	1/9	Paulamalli, ...	4958.8
Paulamalli,.....	Ponnassmalli,....	0 13 1 D.				
Paulamalli.....	Woorachmalli,...	2 34 47 D.	13 18	1/22	Woorachmalli,...	1172
Woorachmalli,...	Paulamalli,.....	2 22 42 E.				
Woorachmalli,...	Shenuimalli,.....	0 0 6 D.	20 7	1/20	Shenuimalli,.....	1788.6
Shenuimalli,.....	Woorachmalli,...	0 17 58 D.				
Tirtapully hill,...	Allasoor hill,....	0 1 40 D.	17 16	1/35	Allasoor hill,....	3380.6
Allasoor hill,....	Tirtapully hill,...	0 14 38 D.				
Allasoor hill,....	Kulkotah hill,...	0 6 17 D.	15 34	1/28	Kulkotah hill,...	3406.6
Kulkotah hill,...	Allasoor hill,....	0 8 11 D.				
Kulkotah hill,...	Yerracondah,....	0 23 45 D.	29 54	1/16	Yerracondah, ...	2848
Yerracondah,....	Kulkotah hill,...	0 2 30 D.				
Yerracondah,....	Paughurdroog,...	0 6 9 D.	24 34	1/17	Paughurdroog, ..	3052.6
Paughurdroog,...	Yerracondah,....	0 15 35 D.				
Savendroog,.....	Cheetkul hill,....	0 26 33 D.	24 7	1/17	Cheetkul hill,....	3329.3
Cheetkul hill,...	Bailippee hill,...	0 25 34 D.	19 52	1/31	Bailippee hill,...	2760.6
Bailippee hill,...	Cheetkul hill,....	0 6 59 E.				
Yerracondah,....	Ooracondah, ...	0 24 35 D.	20 57	1/8	Ooracondah, ...	2223
Ooracondah,....	Yerracondah,....	0 9 19 D.				
Ooracondah,....	Davurcondah,...	0 17 4 D.	24 53	1/8	Davurcondah,....	1876
Davurcondah,...	Ooracondah,....	0 1 23 D.				
Davurcondah,...	Gootydroog,....	0 4 27 D.	26 17	1/9	Gootydroog, ...	2171
Gootydroog,....	Davurcondah,...	0 17 16 D.				
Paughurdroog,...	Condapilly,.....	0 26 19 D.	26 35	1/7	Condapilly,.....	2282
Condapilly,.....	Paughurdroog,...	0 6 37 E.				
Condapilly,.....	Ooderpeedroog,..	0 17 0 D.	18 22	1/4	Ooderpeedroog,..	1852
Ooderpeedroog,..	Condapilly hill,..	0 9 39 E.				

Stations at	Stations observed.	Apparent Elevations and Depressions.	Contained Arcs.	Refraction.	Elevations above the Sea.	
					Stations.	Heights.
		° ′ ″	′ ″			Feet.
Ooderpeedroog,..	Guddaculgooda, .	0 3 44 D.	18 26	1/6	Guddaculgooda, .	1918
Guddaculgooda, .	Ooderpeedroog, .	0 8 25 D.				
Guddacul, ...	Paumdy hill,....	0 12 2 D.	22 10	1/7	Paumdy hill, ...	1762
Paumdy hill,....	Guddacul, ...	0 4 1 D.				
Gootydroog, ...	S. end of the base,	1 42 53 D.	5 56	1/3	S. end of the base,	1111
S. end of the base,	Gootydroog, ...	1 41 44 E.				
Paumdy hill,.....	N. end of the base,	0 37 34 D.	8 7	1/4	Nend of the base,	1253
N. end of the base,	Paumdy hill,....	0 33 38 E.				
Paumdy hill, ...	Konakoondloo,..	0 05 11 E.	15 10	1/6	Konakoondloo,..	2036
Konakoondloo, ..	Paumdy hill,....	0 15 19 D.				
Guddacul, ...	Koelacondah,...	0 6 17 D.	24 33	1/8	Koelacondah, ...	2042
Koelacondah,....	Guddacul,.....	0 11 59 D.				

IX.

Tranſlation of a Sanſcrit Inſcription on a Stone found in Bundélc'hund.

By Lieutenant W. PRICE.

To H. T. COLEBROOKE, Esq.

PRESIDENT OF THE ASIATICK SOCIETY.

SIR,

A FEW months ſince, while on duty with my corps in *Bundélc'hand*, I obſerved a ſtone, containing a *Sanſcrit* inſcription, lying at the foot of a rocky hill in the vicinity of the town of *Mow*, about ten miles diſtant from *Chatterpur*. As it appeared to me, on a curſory inſpection, to compromiſe a genealogy of princes that might tend to illuſtrate ſome doubtful points in *Indian* hiſtory, and, on this account, to merit preſervation, I cauſed it to be removed with the intention of examining

it at a future period. I have latly ſucceeded in decyphering the greateſt part of the inſcription, and now beg leave to preſent the monument to the *Aſiatick* Society, and to lay before them a correct tranſcript of the original, in the modern *Dévanâgarí* character, with a literal tranſlation.

THE ſtone meaſure 3 feet 6 inches in height, 4 feet 7 inches in width, and about 6½ inches in thickneſs. The natives were accuſtomed to ſharpen their knives and *talwars* upon it: from this and other cauſe, it is much mutilated; conſiderable portions of the inſcription are illegible; and of the laſt line, in particular, which probably contained the date, not a letter can be traced. The character does not materially vary from the current *Dévanâgarí*, excepting ſome few letters, which are formed in a very unuſual manner, and approach nearer to thoſe uſed in the *Dek'hid*, than to any others with which I am acquainted.

I REGRET my inability to offer any opinion regarding the antiquity of this memorial: and the oldeſt reſidents of *Mow* could afford me no information, farther than, it had lain where I diſcovered it, during their recollection, and that of their parents. In a metaphyſical and theological drama, entitled *Prabód'ha Chandródaya*, or the riſe of the moon of intellect, CÍRTTIVARMA is introduced by the author as the king before whom it was firſt repreſented; but I will not pretend to determine whether he is the ſame with the prince of that name mentioned in the inſcription: and indeed if they could be indentified, the circumſtance would lead to no ſatiſfactory concluſion, the age of the palp being equally involved in doubt.

I HAVE only further to obſerve, that ſome paſſages of the original are very obſcure; from the context being effaced, and admit of various

interpretations. In thefe inftances, I noted down the different fenfes in which they might be rendered, and felected that reading which appeared to be the moft eligible and confiftent: and where any doubt attaches to a particular term, I have ufually fpecified it in the notes which accompany the tranflation.

I remain,

SIR,

Your obedient Servant,

WILLIAM PRICE,

Lieut. Regt.
Bengal Nat. Inf.

CALCUTTA,
1ft September 1813.

——————————: ओक — ङ्कदवदपिवपुर्द्दिव्यमव्यक्त
घङ्गमायाजालैर्यमितभुवनोयेकहेुर्विमुक्तै——————————
——————————————————————————
——षत्रावलीमासंशिःप्रोद्य——ीकुचकलशनटाद्वक्षहिओधस्यासर्वांना
पातुयुश्चाननविशदलि——नीयाशिलाभेवेन्यस्तामन्मथेनोन्मदसुरनवि
धि—— हेवप्रभासिः॥२॥——————————————————
——नामनरेन्द्रः॥——अखिलवृवंयःकान्यकुब्जनरेन्द्रंसमरभुविविजित्य
प्रापसाम्राज्यमुच्चैः॥३॥ दर्प्पैकखडनदोर्द्दण्डद्विषद्खडनपण्डितः॥ ग
खडदेवोऽभवत्तस्माच्चतुरम्भावनीश्वरः॥४॥ तस्मादशेषनरपतिमौलियुवि
आन्तकान्तपदकमलः॥ श्रीविद्याधरदेवः————वासवोजज्ञे
॥५॥ अजनिविजयपालःस्फारकीर्त्याविशालःशुभचरितपवित्रस्तस्यरा

ज्ञःसुपत्रः ॥ क्षपितनिखिलदुष्टःप्रीणिताशेषशिष्टःहतकलि — —
— : क्षोणि — — — — — : ॥ ६ ॥ — — त्रयमनिपण्यकीर्त्तिस्तनयोऽस्या
जनिकीर्त्तिवर्म्मदेवः ॥ — — न तःकलि — — र्ं — दंड — प — ॥ धर्म्मइ —
होवतीर्ण्णः ॥ ७ ॥ जिग्येयेनारि — — — — लसममरिभिःषड्रिरेवान्तर
ङ्गैःसार्द्धंधर्म्मेणनीत्यानुदिनमधिकंवृद्धिमङ्गानिसप्त ॥ उच्छिन्नःकण्ट
को ो जगतिकलिमलंन — ॥ रेणसाकं ॥ संचारितावाजलधिपरिस
रंस्कारकीर्त्त्यारदेवः ॥ ८ ॥ — — — — — — विक्रमदरप्रोन्निद्रितारिः
सदाश्री — — — — वर्म्मदेवनृपतिस्तस्यात्मजोभूत्प्रभुः ॥ धैरेयःअतशा
लिनांगुणवतांबन्धुःकलानांनिधिःसद्वृत्तस्यचसद्मकल्पविटपीनिः — —
— व्यायिनाम् ॥ ९ ॥ येमाच्छिद्यारिलक्ष्मीमखिलकुलजनेयच्छतोचैर्नि
रस्तासानद्दाद्दःख — — — — — — — — — श्रियोकिचयस्य ॥ राज्ञांसे
वागतानांकनकमणिमयोङ्गासिनेष्यसाम्यादन्येषांचाश्रितानांसदसिकि
मपिनाभूद्विशेषोपलम्भः ॥ १० ॥ अ — — तव्यनयशौर्य्यनिवासभू
मिस्तस्याजनिष्टनयोजयवर्म्मदेवः ॥ यस्यप्रतापतपनाभ्युदयेनभूपादीपा
इव — — — — : — — रानरेजुः ॥ ११ ॥ श्रीसल्लक्षणवर्म्मक्षोणीनाथस्य
सोदरोऽवरजः ॥ जयपृथ्वीवर्म्मनृपकुलराज्यधुरांदधौधुर्यः १२ ॥
अशिक्षेप्रज्ञेयोभृशमविरतिः पात्रनिवहेजिघृक्षान्याय्यैर्यैर्विधिवदथतीय
वितरणम् ॥ परारक्षाभूतेष्वपिचविनयादानपरतावितेनेयेनेत्थंहतचरित
मुच्चैरिहकला ॥ १३ ॥ अजनिमदनवर्म्मभूमिपालस्त्रिभुवनविश्रुतविक्रमो
ऽथतस्मात् ॥ भुजबलमवलोक्ययस्यमेनेऽद्भुतबलसीमकथाजनैरमिथ्या ॥
॥ १४ ॥ द्राग्विद्राव्येवचेद्यःस्मरभरजितोयत्नान्नापिहिंस्यंकामंहाहा

वृत्यागमयनिसततंत्रासनःकाश्मिराजः ॥ येनोद्धृत्यंदधानःसवनघटिसमुन्मू
लितोमालवेशस्तन्वन्तोयत्रभक्तिंपरमवनिभुजःस्वास्थ्यमन्येचभेजुः ॥ १५ ॥
कृष्टायांवेगवल्गत्तुरगखुरपुटैर्वैरिकण्ठावमुक्तैःसिक्तायांरक्ततोयैःसमरभुवि
भृशंतेनशुभ्रांशुगौरम् ॥ मुक्तावीजंयदुच्चैरिपुकरिशिरसांकोत्तिवल्लीततोऽ
भूत्त्यागांभःप्रसेकात्क्रमलभवस्भामण्डपंव्यानशेसा ॥ १६ ॥ अथनृपतीना
मेषांयेराज्यधुरंधरामहामात्याः ॥ अभवन्विशुद्धचरितास्तद्वंशःकीर्त्यतेऽधुनावन्द्यः ॥ १७ ॥ स्रष्टुर्विश्वसृजःसमस्तभुवनैर्योमाननीयोङ्गिरास्तद्वंशे
भगवानजायतमुनिर्विद्यानिधिर्गौतमः ॥ द्राग्मीमांसकदूषणाप्रकटितेभा
सेशणेशम्भुनारोपाद्वादविधौनिजेपटतलेयेनाक्षिसद्दर्शितम् ॥ १८ ॥ न्याय
दर्शनविकासनदक्षःसोऽक्षपादइहकस्यनवन्द्यः ॥ प्रत्यतिष्टपदपास्यकुत
कीनीश्वरस्यमहिमानिश्चयंयः ॥ १९ ॥ तस्योदयतपःप्रसादवसतेर्गोत्रेविवृद्धे
क्रमात्पुण्यैकायतनंगुणौघसदनंजज्ञेप्रभासःसुधीः ॥ अभ्युद्दामसरस्वतीविल
सितेनोद्भासितंसादराःप्राभासंकुतिनःसुतीर्थमिवयंद्रष्टुंययुःश्रेयसे ॥ २० ॥
सर्वोपधाशुद्धिमतान्धुरीणोधंगेनगंडेनचभूभृतायः ॥ नयप्रयोगेगहनेसद
क्षःपरीक्ष्यचक्रेऽखिलमंत्रिमुख्यः ॥ २१ ॥ सुदृढतरबद्धमूलःसमेधितस्त
— — — सेकेन ॥ राज्यतरुरभवदनयोस्त्रिवर्गफलदःसदानृपयोः ॥ २२ ॥
बुद्ध्याश्रुतेनबलनाधिषणायनेन — — — नपोज्वलयशोभृतदिग्वितानः ॥
आजौविपक्षनिवहैरवि — — — तस्मादजायतकृतीशिवनामनामा ॥
॥ २३ ॥ अभिष्टोतुंशक्यंकथमिवगुणास्तस्यसुमतेर्यपक्षःसद्वृत्तःसचिवप —
— — — महितं ॥ क्रमाद्राज्यंविद्याधरनरपतेर्नीयकरदीक्षताशेषोर्वी
शंव्यधितभुविसर्वातिशयितम् ॥ २४ ॥ विशुद्धाद्बुध्यार्थैर्विधुरिवजनेनसु

भगोमहीपालस्तस्मादभवद्भिरामोज्ज्वलगुणः ॥ गिरंसत्येनस्तांमतिमखि
लकाव्यैः सफलितैर्येड्यापूर्त्ताभ्यांश्रियमपिहतार्थेत्वमनयत् ॥ २५ ॥ अवि
कलद्रुरुकायेधुरांभरंविजयपालनराधिपतेर्दधत् ॥ सनिरवद्यनयान्वित
विक्रमःसुसचिवेषुबभूवनिदर्शनम् ॥ २६ ॥ ——— सङ्गोगनित्योद्भा
सिवपुःकृती ॥ जगद्भरक्षमोजज्ञेऽनन्तोऽनन्तगुणस्ततः ॥ २७ ॥ अभूद्भूरि
गुणाधारोयस्ययोगेश्वरोऽनुजः ॥ सरामस्येवसौमित्रिः ——— धनव्रतः
॥ २८ ॥ अथुचैरुदितोदितंकुलमिदंब्राह्मण्यमुज्ज्वलंवेदस्याध्ययनंश्रुतंच
विमलंश्रीःशिष्टताकारिणी ॥ शौर्य्यंदुर्विषहंरणेषुसततंसर्वत्रवाक्सूनृताऽ
नन्तस्यास्यमहात्मनःअभमतेःकिंकिन्नलोकोत्तमम् ॥ २९ ॥ मंत्रीमंत्राधिका
रेसुमहतिहृदयंगूढविश्रम्भकृत्येनित्यंहस्त्य —— णारिपुषु ज —— वलाव्य
क्त —— गोप्ता ॥ निर्जेताशात्रवाणां —— ——— सर्ववीरैकधु
र्यैःकार्य्यैकस्मिन्नसोऽभूदभिमतसचिवःकीर्त्तिवर्म्मेश्वरस्य ॥ ३० ॥ युक्तश्चे
त्यादिवेगुणैरभिजनप्रज्ञापुरुषकारादिभिर्नैनास्यान्ततदास्फुटन्नृपतिनाका
धिरूढावोन्नतिः ॥ तस्मिन्नेतृवरेऽनुशासति —— यं —— कीर्त्तिवर्म्मप्रभुःकीर्त्यो
र्जितैःश्रियाचञ्जि —— धर्मात्मजा ——— ॥ ३१ ॥ ——— ———
वह्निधूमनवहैरयंमभ्रंलिहैरभ्रांनिभृतामशेषशिखिनांनृत्तक्रियाहेतु
भिः ॥ ——— श्रितलो —— पिमघवायज्ञांशभ —— धर्म्मस्तस्यगुणोत्तरेहि
गणयस्य ——— महान् ॥ ३२ ॥ त्रासर्वानाममहार्हवंशजातपुण्यचरित
महनोया ॥ अनसूयाऽत्रिमुनेरिव ——————— ॥ ३३ ॥
द्वितीयापिचतस्याभूद्भार्य्यासत्कुलसंभवा ॥ क्षमाशीलार्ज ———
——— ॥ ३४ ॥ ——————————मनघं ॥ वत्सनामसु

मौधिष्ठितमभ्युन्नतंसुनेत्रमिव ॥ ३५ ॥ — स्वच्छमतिर्बभ्रुद्धचरितःसौ
जन्यरत्नाकरोवि — — हरश्चशौर्यगरिमब्राह्मण्य — — — ॥ —
— — नाधरोगुणनिधिःसाधुप्रियोवामनःप्रद्युम्नश्च — — — — — —
— — — — — ॥ ३६ ॥ — — — — विभुनातिगुणा — रायात्स
ल्लक्षणक्षितिभुजाचपरीक्ष्यभावान् ॥ सर्वेऽमुनान्य — — — — रंनियुक्ताः
कार्येषुसज्ञशुचिशूरजनोचितेषु ॥ ३७ ॥ अथसल्लक्षणवर्म्मा — — —
— — पुनः ॥ अन्तर्वेदीविषये — — — — — ॥ ३८ ॥ — — — — — — —
— — — — — — शौर्यैर्द्रेकविनिर्जितानिजविभोःपादावनम्रीकृताः ॥ कृत्वा
कंटकशोधनंजनपदेऽप्यस्यप्रजानांभयंताभ्यः संविदधेच वृद्धिरसमाकोश
स्यदंडस्यच ॥ ३९ ॥ हित्वादेहंत्रि — — — — भांनुकन्याजलान्तःस्राध्वे
ऽनन्ते — — — — — रिमब्रह्मसायुज्यमाप्ते ॥ शास्तारीणामिनिसजयवर्म्मा
वनीन्द्रेणयत्नादात्माभक्त्यैप्रथितमतिनाप्रातिहार्येनियुक्तः ॥ ४० ॥ मौलःसर्व्व
शजन्माशुचिरमलमतिःशास्त्रविद्वृष्टकर्म्मावाग्मोदक्षःप्रगल्भःकरितुरग
रथारोहविज्ञःकृतास्त्रः ॥ — — — ऽनुरागप्रभृतिगुणयुतश्चे — — नुभा
व्यश्रीपृथ्वीवर्म्मनाम्नातदनुनृपतिनामंत्रिमुख्यश्चचक्रे ॥ ४१ ॥ सर्वैरंगैःसमृ
द्धंव्यधितनिपुणधीस्तस्यराज्ञोथराज्यंसाचिव्येपि — — — मदन
क्षोणिपालस्यसोयम् ॥ षाड्गुण्यादिप्रयोगैःसमयसमुचितैःप्रह्वभावंनरेन्द्रा
न्नीत्वासर्वान्क्रमेणव्यतनुतवसुधैश्वर्य्यमेकान्त — ॥ ४२ ॥ — — — —
— क्षमोपिविविधैर्यकोगुणैरपिश्रीमान्नोद्धतिमान्नादाधरइतिव्रतेजनोयं
सदा ॥ गाम्भीर्येणपयोनिधिंह — — — — — — — — प्यसौवुद्ध्याधःकृत
वान्गुरुश्चतदियंकिन्नाकृतिभूयसी ॥ ४३ ॥ कलत्रंसन्त्यैश्रुतमपिदाचा
रविधयेम ॥ — — वैवेदावसुकललोको — — — ॥ — — — — —

प्रवणमनतस्तस्यचरितैःकलिस्तंप्रत्यस्तंगतइवसमेनेखलुजनैः ॥ ४४ ॥ पुत्राः
श्रीधरविद्याधराद्योयद्गुणैर्जगज्जयिनः ॥ तस्याभूवन्ससतोधुरिस्थितःसर्व
पुत्रवताम् ॥ ४५ ॥ इष्टापूर्तैप्रचुरसुकृतारम्भमित्यादृतेनप्रासादोऽयं ——
——नु युतस्तेननिर्माप्यतेस्म ॥ प्रत्य——————————यशो
ऽस्मि——ः सोयंवस्तुहिमहतांपुण्यकर्म्मोपयोगि ॥ ४६ ॥ किञ्चान्यथैवि
शुद्धैर्वसुभिरतिमहान्कारितस्तेनयत्नाद्देवग्रामस्यसीम्निप्रचुरपृथुशिलाब
न्धर———— ॥ कूलेऽभेद्यं ततस्योपलमयरचनाऽप——————
——————————॥ ४७ ॥——————————ग्रप्र
देशे ॥ घटिताभ्यकटङ्ककेनव——रणःकारितइ नु गौरनीरः ॥ ४८ ॥
केडीनामद्विज——शासनग्रा——————॥ धनेशकृतिनाजनोप——

TRANSLATION.

1. * ——————————————————————————————
——————————————————————————————

2. ——————————————————————————————
——————————————————————————————

3. ——————————————————————————— the lord of

* This, and the following ſtanza, compriſe an invocation to VISHNU: they have not been completely decyphered, and it is therefore unneceſſary to inſert a tranſlation of thoſe portions, which, being legible, appear in the copy of the original.

men* ſo named; who, having overcome the king of *Cányacúbja*,† chief amongſt all, in battle, obtained exalted ſovereignty.

4. FROM him ſprang GANDÁ DÉVA, ſkilful in puniſhing his enemies, whoſe arms were two ſtaffs to cruſh their pride, and who was monarch of the four quarters of the earth.

. . . . . .

5. FROM him was produced the fortunate VIDYÁD'HARA DÉVA, whoſe beautiful lotus-foot reſted on the heads of all kings . . . . . .

6. OF that prince was born the warlike VIJAYA PÁLA, a duteous ſon, eminent from wide-ſpread fame, and purified by virtuous deeds; by whom all the wicked were exterminated; by whom all the good were rendered happy . . . . . .

7. HIS ſon was CÍRTTI VARMA DÉVA, of good renown, ... as if virtue had deſcended in a human form; who vanquiſhed . . . . . through the aid of his ſix allies;‡ and, by juſtice, daily promoted the ſeven requiſites of regal adminiſtration§. This prince, extracting the thorns of the world, and removing the impurities of the *Cali* age, was famed unto the ſea ſhore.

* The name of this prince is not legible in the inſcription: but from the 21ſt verſe, I judge D'HA'NGA muſt be here mentioned.

† Vulgarly called *Cannouge*: JAYACHANDRA, the celebrated *Hindu* ſovereign of *India*, held his ſeat of empire there at the time of the *Muſſelman* invaſion, when his government was ſubverted.

‡ The original word is '*antarangaih*,' which I have tranſlated in it's moſt probable ſenſe. The term will, however, admit of other interpretations.

§ They are thus enumerated in the *Amera cóſha*: 1ſt. the king or lord; 2d. his counſellor; 3d. a friend or ally; 4th. treaſure; 5th. territory; 6th. a ſtrong hold; 7th. an army.

9. His ſon was the fortunate . . . . .* Varma déva, a king and ruler . . . . . whoſe foes from a dread of his proweſs never ſlumbered; who was at the head of thoſe verſed in the ſacred ſciences, a friend of the good, a treaſure of the mechanic arts, an abode
10. of moral conduct, and the all-productive tree of the poor: who, having taken vaſt riches from his enemies, diſtributed them amongſt his ſubjects . . . . . moreover, in whoſe aſſembly there was no difference whatever to be perceived between the tributary princes and his other dependants, from the ſimilarity of their glittering ornaments of gold and jewels.

11. Jaya varma déva was born his ſon, the reſidence of virtue and power, from the riſing of whoſe ſun of majeſty, other kings, like lamps, ſhone not . . . . . .

12. The fortunate Sallacshana varma was the uterine and younger brother of this lord of the earth: afterwards, the prince Prit'hví varma, equal to the taſk, ſuſtained the burden of the hereditary government.

13. Averse from the vicious, having a great eſteem for the ſociety of fit perſons, deſirous of taking lawful wealth, and then beſtowing it according to form at a ſacred ſpot, carefully protecting all ſentient beings, and receiving wholly with humility, he thus greatly benefited his intereſt in this life, by practiſing virtuous deeds.

14. From him was born Madana varma,† the protector of the

* Four letters which compoſe his name are here effaced.

† In whoſe reign it would appear this memorial was compoſed.

earth, whoſe vaſt power is celebrated throughout the three worlds*: the ſtory of the extent of his extraordinary might is credited by thoſe who have witneſſed the ſtrength of his arms†. From whoſe name even, the king of *Chédi*,‡ vanquiſhed in the fierce fight, ever quickly flees; and the prince of *Cáśi*,§ through dread, by his conciliatory conduct always paſſes his time in undiſturbed tranquillity: by whom the miſbehaving lord of *Málava*‖ was in the ſpace of an hour exterminated; and at whoſe court, other monarchs, by an increaſe of confidence, obtain peace.

16. The field of battle being ploughed by the trampling of the hoofs of his horſes impetuouſly charging, irrigated with the blood guſhing from the throats of his enemies, ſown with pearls, bright as the pale-beamed luminary, from the heads of the elephants¶ of his foes, yielded glory, the creeping plant, which, being ſprinkled with the water of libation,** overſpread the aſſembly-houſe of Him†† ſprung from the lotus.

17. The venerable lineage of the miniſters of theſe princes, the ſupporters of the weight of government, and of upright conduct, is now to be detailed.

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* Heaven, earth, and hell.

† It is here to be underſtood that he was a prince of great athletic accompliſhments.

‡ The ſame, I believe, with Chandail (as the name is written in Major Rennell's Atlas), S.E. of the province of *Bundélc'hand*.

§ *Benares*. The original term, '*Cáśi rája*,' may however be aſſumed as the proper name of ſome other chief; for it is not an unuſual one.

‖ S.W. of *Bundélc'hand*.

¶ The *Hindus* imagine that the fineſt pearls are to be found in the heads of elephants.

** Solemn gifts are ratified by pouring water into the hands of the perſon receiving them.

†† Brahma, who ſprang from the lotus which aroſe from the navel of Vishnu.

18. The deſcendant of the Creator of the univerſe* was Angiras, worthy the eſteem of the whole world: in his line was born the divine ſage Gautama,† a treaſure of ſcience, an opponent of the followers of the *Mimánſa* ſyſtem,‡ who from anger in diſputation ſhewed an eye in the ſole of his foot,§ as Śambhu‖ diſplays it on his forehead.

19. Whoſe praiſe does not Acshapáda merit in this world, who, quick in expounding the *Nyáya Sáſtra*, having confuted wicked doctrine, proved the omnipotence of Iswara?

20. In the increaſe of the race of him reſting in the tranquillity of devout auſterity was born the wiſe Prab'hása, the ſole abode of virtue, and the reſidence of a multitude of excellent qualities; who was enlightened by the embraces of exalted Sarasvatí,¶ and whom pious

21. men viſited as a holy place for their moral good. That ſkilful one, at the head of thoſe who are pure from tried fealty, having been examined, was appointed chief of all the miniſters for conducting abſtruſe politics by the monarchs D'hanga, and Gańd'a déva.

22. The tree of loyalty, whoſe roots were firmly fixt, being watered with . . . . . grew up, and ever produced to theſe two princes the fruit of the three human purſuits.**

23. From him was born the righteous Śivanáma†† equal to D'hiś'a-

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* Brahma. According to the *Hindu* mythology, Angiras was his great-grandſon.

† Author of the *Nyáya* or ſyſtem of logic, the doctrines of which are ſaid to correſpond with thoſe of Aristotle.

‡ Founded by Vyása, and generally ſupported by his pupil Jaimini. Their ſeveral ſyſtems are diſtinguiſhed by the titles of *Púrva* and *Uttara*, or firſt and ſecond *Mimánſa*.

§ He is hence named Acshapáda. The legend is, however, differently related by other writers.

‖ Śiva.

¶ The *Hindu* goddeſs of wiſdom.

** *D'harma*, *Cáma* and *Art'ha*; or duty, love, and wealth.

†† Miniſter of *Vidyád'hara*.

NA'YA * in understanding, and knowledge of the numerous *S'rutas*;† who filled surrounding countries with his glorious fame . . . . . by the assemblage of his foes in battle.

24. How can the qualities of this just one be sufficiently applauded? . . .‡ an upright, exalted counsellor . . . . . he gradually so improved the government of the prince VIDYÁD'HARA, that all the sovereigns of the world were rendered tributary, and it became supreme on earth.

25. FROM him sprung MAHÍPÁLA, grateful to the eyes of mankind, as the moon produced from the pure sea of milk;§ beautiful, of eloquent speech, who fulfilled the purport of his word by truth, that of his understanding by all beneficial acts, and the intent of his wealth by sacrifices, and deeds of pious liberality.¶

26. UNTROUBLED, sustaining the weighty burden of the important affairs of the prince VIJAYAPÁLA, he, whose bravery was united to irreproachable morals, became regarded as the object of comparison among virtuous ministers.

27. AFTER him was born the learned ANANTA, of infinite excellence, capable of supporting the weight of the world; whose body was always resplendent from virtuous enjoyment . . . .

* VRÍHASPATI, preceptor of the Gods.

† The *S'ástras*.

‡ The original here exhibits '*yacapa*' which conveys no meaning: and the second syllable, moreover, is inaccurate with respect to the metre of the verse.

§ The moon was produced at the churning of the ocean. The legend is well known.

¶ Such as, digging ponds or wells, making gardens, erecting temples, &c.

28. His younger brother was Yogéswara, the ſeat of numerous qualities, as the ſon* of Sumitrá, of Ráma . . . .

29. What ſuperiority over other men is not recorded of that righteous, magnanimous Ananta? His anceſtry had been repeatedly termed pre-eminent; he was of the illuſtrious *Bráhmen* tribe; he peruſed the *Véda*, and pure *S'ruta;* his proſperity imparted good; his proweſs was ever irreſiſtible in battle, and his ſpeech pleaſing but ſincere.

30. In what affair was he, the faithful miniſter of Círtti varma, not employed? His counſellor in juſt and important politics; his intelligence in ſecret and confidential matters . . . . the conqueror of foes . . . . the ſole chief of heroes.

31. If he poſſeſſed the qualities of the firmament, if his underſtanding was characteriſtic of his race, and he was a ruler with appropriate duties, ſtill his eminence was inferior to that of his prince. This chief continuing to give counſel, the monarch Círtti varma . . . . by his fame, conduct, and wealth.†

32. . . . . . from the dancing of all the peacocks, who miſtook for clouds, the volumes of ſmoke‡ ſweeping them . . . . . Indra, a portion of the ſacrifice . . his moral virtue was reckoned abſtractedly from his other qualities . . . . . .

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* Lacshman'a, younger brother of Ráma.

† The original verſe is very obſcure; and I am not certain it is correctly tranſlated.

‡ Ariſing from his ſacrifices: peacocks are ſaid to dance from joy during cloudy weather. See the *Mégha Dúta* with tranſlation.

33. . . . . ASARVÁ* by name, ſprung from an illuſtrious family, venerable from her virtuous conduct, as ANASÚYA, of the ſage ATRI † . . . . . .

34. HIS ſecond wife was born of noble parentage; well behaved, patient, and diſcreet . . . . . .

35. . . . . VATSA‡ by name, ſinleſs, like the dignified SUNÉTRA ſeated in the aſſembly of the gods . . . of a pure mind, correct demeanour, a ſea of nobility§ . . . . . heroic, ſteady in his courſe, of the *Bráhman* claſs . . . . . a treaſure of excellence, a friend of the good. VA'MANA and PRADYUMNA,‖ . . . . . their inclinations having been aſcertained, they were all employed by the ſovereign ruler SALLACSHAN'A¶ in offices ſuitable to wiſe, juſt, and valiant men.

38. NOW, SALLACSHAN'A VARMA . . . . . again in the country of the *Antarvéd* ** . . . . . .

39. . . . . were utterly defeated by the impetuoſity of his bravery, and obliged to proſtrate themſelves at the feet of his maſter. Having cleared the country

* Who it would appear was the firſt wife of the miniſter ANANTA.

† ANASU'YA', wife of ATRI, is celebrated for her conjugal affection.

‡ ANANTA's ſon, perhaps, by his firſt or ſecond wife.

§ INDRA, chief of the deities, is here probably intended: I do not, however, recollect having before met with him under this title.

‖ The younger brothers, poſſibly, of VATSA.

¶ I know not how to reconcile the apparent irregularity of this mention of SALLACSHAN'A before JAYA VARMA, otherwiſe than by ſuppoſing their father, who may have borne this name, is here alluded to.

** The *Dóáb*, or country between the *Ganges* and *Jumna* rivers.

of thorns, and diſſipated the fears of the people, he governed them with an increaſe of wealth and power.

40. . . . . having abandoned his body to the waters of the daughter of the ſun,* the meritorious ANANTA became incorporated with the ſupreme. Hence the . . . . . of the chaſtiſer of his foes was employed in the guardianſhip† by the chieftain JAYA VARMA, who devoted his ſoul to faith.‡

41. OF a reſpectable origin, ſprung from a virtuous family, ſpotleſs, poſſeſſing a clear intellect, verſed in the ſacred ſciences, eloquent, ſagacious, prudent, acquainted with the management of elephants, horſes, and chariots; § ſkilled in archery . . . . . mingled with affection, and other qualities. On being tried, he was afterwards appointed prime miniſter by the auſpicious monarch PRĬT'HVÍ VARMA.

42. THAT wiſe one bleſſed the government of his prince with all the requiſites of royalty; and was afterwards . . . . in the miniſtry of MADANA, the protector of the earth. Having reduced all kings, by a well-timed application of the ſix expedients of defence,‖ he gradually extended his ſupremacy over the earth.

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* From the context being effaced, it remains uncertain in what manner his body was abandoned to the river *Jumna*; who is the daughter of the ſun, according to mythology.

† The original term *Prátihárica*, which has been tranſlated 'guardianſhip,' generally ſignifies the office of warden, formerly, perhaps, a reſpectable appointment in the ſervice of a king. Another ſenſe in which it is uſed is here wholly inapplicable.

‡ Meaning, probably, that he abdicated the government, and led a religious life.

§ Theſe were formerly eſteemed high accompliſhments amongſt the *Hindus*.

‖ i. e. Pacification, war, a progreſs or a march, a halt, or the maintaining of a poſt, a double reſource or a ſtratagem, and recourſe to protection.

43. . . . . able likewiſe, poſſeſſing a multitude of excellencies, illuſtrious, of whom people are accuſtomed to ſay "this is truly GADÁD'HARA!"* Who humbled the ſea by his profundity, and . . . . . even, by his underſtanding: is not therefore ſuch fame ſolid?

44. HIS wife is for the procreation of offſpring;† his knowledge of the *Sáſtras*, for the due performance of religious duties; ‡ and of the *Védas*, for . . . . his wealth is for the benefit of all men . . . . . from the virtues of that benevolent one, it is believed by the people that the *Cali* § age has paſſed away.

45. HIS ſons SRÍD'HARA, VIDYÁD'HARA, and the reſt, from their abilities have become conquerors of the world: hence he is eſteemed the head of family-men.

46. SACRIFICES, and acts of pious munificence, are the foundation of many good deeds: this temple, therefore, was erected, together with . . . . by that revered one . . . . . the wealth of the great ought certainly to be employed in acts of piety.

47. HE, moreover, with his lawful riches, cauſed a vaſt . . . . ‖

* GADA'D'HARA is a title of VISHN'U; and it probably was the name of a ſon of the miniſter VATSA, to whom this, and the ſubſequent ſtanza, appear to relate.

† i. e. not for ſenſual enjoyment.

‡ i. e. not for the purpoſe of diſputing the doctrines they contain.

§ The preſent ſinful age.

‖ A mound of conſiderable extent, compoſed of large ſtones, regularly piled on each other, and placed ſo as to form ſteps down to the margin of an extenſive lake, terminates at the ſpot where the monument was diſcovered. It evinces great labor, and is, I imagine, referred to either in this, or the ſubſequent verſe. I do not, however, recollect having obſerved any where in the vicinity, the leaſt veſtige of the temple, mentioned in the foregoing ſtanza; and, as to the other public acts of the miniſter, which appear to be recorded in this part of the inſcription, I can offer no conjecture.

to be carefully made with many large ſtones, on the boundary of the village of *Védu*:* and on the banks of the expanſe . . . . . ornaments entirely of ſtone, not liable to be broken.

48. . . . . in a place cauſed to be made with a heap of hewn ſtones . . . . . whoſe water is limpid.

49. A *Bráhman'a* named CÉDI† . . . . . by the ſkilful D'HANÉSA‡ . . . . . .

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* I made particular enquiries after this village, when on the ſpot, but they were unſucceſsful. The town of *Mow* may have formerly borne this name.

† The poet, probably, by whom the inſcription was compoſed.

‡ The artiſt, perhaps, by whom it was cut.

X.

A Journey to Lake Mánaſaróvara in Ún-dés, a Province of little Tibet.

By WILLIAM MOORCROFT, Esq.

INTRODUCTORY NOTE BY THE

PRESIDENT.

I HAVE much gratification in being enabled to lay before the Society, an extract from the journal of our colleague, Mr. Moorcroft, on a journey to explore that part of little *Tibet* in *Chineſe Tartary*, where the ſhawl goat is paſtured; and to viſit the celebrated lake *Mánaſaróvara* or *Mapang*, in which the *Ganges* was long ſuppoſed to take its ſource.

Undertaken from motives of publick zeal, to open to *Great Britain* means of obtaining the materials of the fineſt woollen fabric, the arduous and perilous enterprize, in which Mr. Moorcroft accompanied by Captain Hearsay engaged, and which was proſecuted by them with indefatigable perſeverance and admirable intrepidity, undiſmayed by the difficulties of the way and the dangers with which the jealouſy

of the *Nepaleſe* beſet them on their return, and undeterred by hardſhips and privations, and in Mr. MOORCROFT's inſtance by frequent illneſs, has in the reſult not only accompliſhed the primary object which was in view, but has brought an intereſting acceſſion of knowledge of a country never before explored: and has aſcertained the exiſtence, and approximately determined the ſituation of *Mánaſaróvara*, verifying at the ſame time the fact that it gives origin neither to the *Ganges*, nor to any other of the rivers reputed to flow from it. Mr. MOORCROFT, as will be ſeen, found reaſon to believe that the lake has no outlet. His ſtay, however, was too ſhort to allow of his making a complete circuit of it: and adverting to the difficulty of conceiving the evaporation of the lake's ſurface in ſo cold a climate to be equivalent to the influx of water in the ſeaſon of thaw from the ſurrounding mountains, it may be conjectured, that, although no river run from it, nor any outlet appear at the level at which it was ſeen by Mr. MOORCROFT, it may have ſome drain of its ſuperfluous waters, when more ſwoln, and at its greateſt elevation, and may then perhaps communicate with *Rávan* lake, (in which the *Setlej* takes its ſource) conformably with the oral information received by our travellers.

THE journal of the entire route from their departure from the *Britiſh* frontier in *Rohilkhand*, to their return, being more copious than would conſiſt with the limits of the volume of our reſearches, I have uſed the liberty of ſelection, which Mr. MOORCROFT has liberally allowed, and confined the extract of the journal to that part of the route which is wholly novel; at the ſame time curtailing the narrative, though with regret for the unavoidable excluſion of many intereſting paſſages. It is proper, however, to obſerve, that no other freedom has been uſed; and that the narrator's own words are ſcrupulouſly retained.

JOURNAL.

May 26th.—At *Jóshí-Mat'h* we left the road to *Bhadrínát'h*, which croſſes the *Daulí* a little more than a cós above the town. At the junction of the *Viſhnu-Gangá* with the *Daulí*, both rivers loſe their names; and the united ſtreams form the *Alacanandá*, the courſe of which has been before mentioned. As the road to *Jóshí-Mat'h* is known by the ſurveys of the gentlemen deputed by Colonel Colebrooke, I have not been very particular in deſcribing it:* but, as the road to *Nití* and onwards is new ground to *Europeans*, I ſhall follow it with more exactneſs.

The principal part of the minutes of our route is taken from the note book of Mr. Hearsay, who carried the compaſs and brought up the rear accompanied by Harkh Dev, and who engaged on ſetting out, to execute this part. Harkh Dev Pandit was directed to ſtride the whole of the road at paces equal to 4 feet each.†

Our road lay along the left bank of the *Daulí*, but generally at the diſtance of at leaſt a cós. The road was pleaſant but the heat was greater than might have been expected, ſeeing that the ſummits of the mountains very near us were covered with ſnow.

The road was frequently croſſed by ſmall ſtreams of water, of which ſeveral iſſue from ſtone conduits now out of repair. We ſaw people ſowing the Lál Ság or Amaranthus Gangeticus, a vegetable apparently much uſed by the mountaineers.

* For the ſame reaſon it is omitted in this abridgment. C.

† The *Pandit's* meaſure of the road would probably have been more correct, had he been directed to ſtep his uſual and natural paces, the length of which might have been eaſily determined with preciſion by a ſmall trial. C.

Wheat was nearly ready to cut, and lands under the plough. The ears of the wheat particularly long and bearded.

About a cós before we reached the ground for encampment we met our carriers returning, who ſaid that they had executed their taſk, but had received neither victuals nor money. It appears to me that the *Chaudrí* of *Jóſhí Mat'h*, who received our advances and undertook to ſupply the people, will keep the whole money for his own uſe and preſs the unfortunate villagers to carry our baggage.

Some mountains near us, whoſe tops were covered with ſnow when we firſt came, were in the evening nearly bare.

At half paſt eleven reached the town of *Baragaon;* and not findiug good ſhade went on higher, above three quarters of a mile, without being much more ſucceſsful.

The cultivated lands, in the middle of which is the village of *Baragaon*, run half way up the hill, where the foreſt region begins with ſmall trees, becoming thicker and higher as it ascends; and the very ſummit is fringed with pines and the majeſtic and fine overtopping cedar.*

27th.—In the afternoon the *Negí* came to ſay that on the following morning, he would have people to take our baggage to *Tapóban*, a village about three cós diſtant, from whence we ſhould proceed onwards the following day.

* Pinus Deodár and Longifolia.

28th.—Resume our journey, leaving our ground at 6h 30′ therm: ſunriſe 58°. Paſs by a *Sanga* over the *Daulí*, and at 3696 paces reach our ground, a little below the almoſt deſerted village of *Tapóban*, placed on the brow of a hill ſurmounted by woods of pine, cedar and cypreſs.* A conſiderable ſtream falls into the *Daulí* below the village; and by the ſide of this is a ſmall rivulet of tepid water.—This current mixes with the cold ſtream before it reaches the *Daulí*, and iſſues from ſome rough ground in the face of a rock. The heat of the water ſeemed to be very agreeable to tadpoles, which had deſerted the colder ſtream to take refuge in this.

I obſerved a common plant ſomething reſembling butcher's broom, which was ſaid to be the *Setbaruá*, from which the mountaineers make a paper that is ſold at *Sirinagar* and *Almora*, and from thence finds its way into *Hindúſtan* although not in large quantity.—The bankers employ it for their bills of exchange or *Húndís* in preference to any other kind, as the ink does not ſink further into its ſubſtance, than is neceſſary to retain the writing, as it does not imbibe water readily, and relatively to its thickneſs is much ſtronger than any other kind of paper. As connected with paper, I muſt here obſerve, that the layers of the bark of birch are uſed by the natives to write upon and they bear both ink and the ſtroke of the pencil very well. The leaves are called *Bhoj-patr*. The bark of the birch is uſed at *Lac'hnau* for covering the wires of húka-ſnakes.

29th.—Settle to give Jowar Sinh 26 rupees in full of all taxes and demands to be made upon us until we reach the frontier; for which he gave a receipt on birch paper: having previouſly put aſide a fee of five rupees for the part he bore in the tranſaction. As our carriers came in a

* Probably a ſpecies of pine, as well as that which Mr. Moorcroft denominates cedar. C.

very ſtraggling manner from the villages whence they had been preſſed, we could not leave the ground till 8. At 6816 paces reach a hut taken poſſeſſion of by our ſervants. This is computed to be ſeven cós from *Tapóban*.

AFTER having reached the top of the firſt mountain, Mr. HEARSAY, who had gone before me, killed a very thin yellow ſnake, about 18 inches in length. I found it had the poiſonous fang, but it is aſſerted that ſnakes and all other venomous reptiles are very ſcarce in this part of the country. However, on taking up the carpet on which I had ſlept, a black ſcorpion came from under it.

A WARM ſpring, which we paſſed early in this day's march, iſſues from the rock on the right of the road in a ſtream of about five inches acroſs and three deep, and threw up a ſmall cloud of ſteam. At its eſcape the heat was ſo great that the finger could not bear being dipped in it more than 2 or 3 ſeconds. The thermometer having been carried forwards, we were prevented from aſcertaining the temperature: however no inſects were in it or about it, and ſome plants which had fallen into it near the middle of the current were killed and ſeemed parboiled. The pebbles in its bed, and the vegetable ſubſtances which were immerſed in it, were covered with a yellow coat, and thoſe which had been taken out and become dry were likewiſe coated with a white earthy ſubſtance having little taſte: however the water itſelf was ſlightly auſtere, and I apprehend contained iron without any other mixture. The tepid ſtream at *Tapóban* which is much lower and not half a mile diſtant probably proceeds from the ſame ſource with this, and is cooled in its progreſs to the place at which it eſcapes below. I ſaw no appearance of volcano in this or any other mountain which I have yet met with; but many abound with minerals; and pyrites is found in great abundance.

Close to this place the road was broken by a recent ſlip, and we had to paſs upon the crumbling ſurface. The road this day was in many parts very fatiguing. In one place a ſlip of earth had laid bare a large ſurface of rock, which had been formerly covered by the road; and as it ſloped to the river with a ſharp deſcent, it required every exertion and care to guard againſt a ſlip of about a hundred feet into a current, which daſhed with great force amongſt fragments of marble, which in two or three points actually formed a bridge acroſs the ſtream.—In another part we were obliged to climb up the face of a rock nearly perpendicular, and on which, irregularities for the toe to hang upon, were at a moſt inconvenient diſtance. My left foot having ſlipped off one of them, I lay for a few ſeconds upon the poiſe, but a ſnatch at a clump of graſs, which on being ſeized, luckily did not give way, and a ſudden ſpring, brought me to a comparatively ſafe ſpot, with the loſs of ſome ſkin from my knees and elbows, and ſome rents in my trowſers and ſleeves.—Sometimes points of rock projected to the edge of the river, and theſe were turned by rude ſtaircaſes made of wood and ſtone.—Retiring angles were paſſed by inclined planes formed by a tree being laid on points of ſtone on each ſide of the angle, and looſe ſtones were thrown from the wood to the rock. For a moment the eye could not quit the road and ſuffer the feet to proceed, without riſk of accidents; and yet a trifling expenſe would render the road in general paſſable, although it would always be liable to be injured by the falling of the rocks above.

When we had reached the cuſtom houſe on the middle of the mountain immediately beyond a *Sanga* by which we croſſed the *Rauni*, we found one of our ſircars who was detained by three men and as many women as pledge for the payment of duties on the paſſage

of our baggage. The receipt written upon a ſlip of birch bark was no ſooner beheld by the moſt riotous of the men than he ceaſed to attempt any further moleſtation, although it was clear that he had not read its contents.—As however one fellow was ſtill a little impertinent, my friend inſiſted upon his relieving a carrier from his load, which he actually took part of the way up the hill; and then ſlipping from under the load ſlid down a face of rock, and though old, ſkipped away from point to point of a rough road with the agility of a deer. As many loads were left behind, it was deemed prudent to take the third man along with us as an hoſtage for their ſafe paſſage. As he went along, he told us that the *Chaudrí Calyán*, had farmed the cuſtoms of this place for 500 rupees a year; and that the woman, who was ſo clamorous, was one of his wives, of whom he had ſeventeen. The other two women were her ſlaves.

To a poor woman, who had had much difficulty in carrying her burthen over a very rough road, I gave a *Timáſhá*, which in a few minutes was taken away from her by a man whom I ſuppoſed to be her huſband. On learning that he was no relation, I got it from him, ſent him about his buſineſs, and returned the coin to the woman; but when ſhe departed, I had the mortification of obſerving him at a conſiderable diſtance ſtart from a place of concealment and again force the money from her. This man was a *Zemíndar* of the village in which the poor woman lived, and though he had been obliged by the *Négí* to carry a load, he ſtill exerciſed his petty tyranny over one more defenceleſs than himſelf.

The gratification of the calls of hunger ſeems to be the firſt object amongſt the inhabitants of a country, which, if under a well regulated government, would be capable of exporting a ſurplus of

proviſions. At *Tapóban*, a ſtout young fellow offered himſelf to be my ſlave for life if I would only feed him. Although I wanted not his ſervices, and did not much like his appearance, yet his appeal was too forcible to be reſiſted; and I therefore engaged to give him food for his ſervices.

30th. Obliged to halt for the purpoſe of collecting carriers; which was difficult, as the villages in this part of the country are ſmall and diſtant from each other.

31ſt. As this day my companion and myſelf ſeparated, and he had along with him the compaſs, and the young Pandit who meaſured the road, I ſhall make extracts from his notes of the route, and afterwards notice my deviation from it. 'At 1381 paces; Tops 'of mountains covered with ſnow in every direction. At 2297, 'croſs a rivulet which comes from E.—Snowy mountains in that 'direction quite cloſe. At 2437, commence aſcending the moſt 'tremendous place I ever ſaw. At 2783, deſcend to bed of *Dauli* 'river, most thankful that I am once more ſafe—was obliged to take off 'ſhoes and ſtockings. At 7610, reach our halting place. Ten hours upon 'the march. The coolies moſtly women arrived at the ſame time. The '*Dauli* much reduced in breadth; but the curren very ſtrong: with a 'ſmall exception, its general courſe has been to the S. W.'

I left our ground at 40 minutes paſt 5.—From the bridges acroſs the *Dauli*, having been ſwept away laſt year, and not reinſtated, a new road has been made by the goat-herds along the ſides and over the tops of the mountains which overlook the river. This has been firſt worked into a track by the goats, and in the worſt places ſtrengthened by fragments of ſtones thrown in heaps ſomewhat imitating rude flights of ſteps. The

path in various places, formed by pieces of ſtone which jut out, overhangs the edge of the water and ſeldom retires ſo far from it as to give a chance of the traveller eſcaping from rolling down to the river, ſhould he have the misfortune to make a falſe ſtep; and the footing was very inſecure from ſmall ſtones being mixed with much looſe earth.—Juſt on attaining the ſummit I met a large flock of goats loaded, and was glad to find a ſecure corner until the whole had paſſed. I obſerved, that goats when laden climb up places however apparently difficult without heſitation; but they do not like to go down ſteep declivities: for whether they deſcend ſtraight down or ſideways, the load urges them forward quicker than they like, and as there is no belly-band, it frequently tumbles off, and is the cauſe of the animal being carried down the ſteep ſides of hills and loſt.—Goats, caſt a look of inquiry at ſtrangers and paſs on leiſurely; but ſheep generally ſtop, and, after one has either been driven onwards or gone of his own accord, the reſt follow with precipitancy, and frequently loſe their loads by their hurry.

Crossing this mountain took up an hour and a quarter. Having mounted a height, which though ſhort, was ſteep and rugged, I was ſomewhat confounded by the ſight of a ſteep and bare ſlope of ſtone about 100 feet deep running to the bed of the river without any path, and with a ſurface ſo ſmooth as to excite a doubt whether I could reach the bottom in any other way than by ſliding, which would have been too rapid to be ſafe: the more eſpecially as the ſtop muſt have taken place amongſt ſtones in the bed of the river. By taking off my ſtockings, preſſing the ſpike of my ſtaff into little dips in the ſtone, and catching at a friendly tuft of graſs which occaſionally preſented itſelf near one edge, I got to the baſe nearly at the ſame time with the old Pandit, whoſe

activity would have more ſurpriſed me had I not known that he had been bred in the mountains of *Kamaon*. Juſt as we had congratulated ourſelves on our eſcape, we ſaw two other paths, one higher up and another lower down under a ledge of the rock, which ſaved the reſt of our party, ſave two of the Pandit's hill people, from the dangers of this road.

Soon after deſcending the ſlope, I overtook a woman who had been preſſed by the *Négí* to carry a load. She ſaid that her meaſure of miſery was full, and that ſhe was reſolved to emigrate into *Jawár*, where oppreſſion was not ſo grievous as here.

Seeing our carriers who had ſtarted about three-quarters of an hour before me, ſupporting themſelves on the ledge of a rock, which overhung the river at a great height, by clinging with their hands to the ſtones on the face of the mountain, and that at length they actually ſtopped, I was induced to make the experiment of going round by a winding path, under an idea that I ſhould effect it in nearly as little time as would be ſpent in paſſing over the broken path of rock. Mr. Hearsay coming after me, and finding that the carriers preferred the ſhort, but more dangerous road, to the long one, reſolved to attempt it; and aſſuredly I ſhould have done the ſame, had I known the length and roughneſs of that which I actually took. Mr. Hearsay and a large portion of the carriers went over the rock without accident: but at one point the courage of my khánſamàn failed; for, on miſſing footing with one leg, he ſhrieked violently and ſunk down almoſt ſenſeleſs upon a point of ſtone with one leg hanging down over the abyſs, calling out that he was loſt. Mr. Hearsay was at hand and aſſiſted him moſt opportunely, along with the Pandit—One woman carried four burthens at different times for her leſs courageous companions; and a

bearer was alſo of ſome uſe; but at length became ſo alarmed as only to be capable of proceeding by being ſteadied by an end of his turban being tied round his waiſt, and the other end ſecured by the young Pandit as he proceeded in front.

The horrors of this road were very great, and ought ſo to have been to juſtify paſſing by ſuch a road as that which I followed. For it coſt me the labour of two hours to attain the top of the firſt mountain which I had to ſcale, and although the path conſiſted of lines of zig zag not more than 10 or 12 feet in length, at angles ſo ſharp, that in a length of 24 feet, nor more than 10 feet were gained in actual aſcent, yet even this progreſs was not made except by clinging with the hands to ſhrubs, roots of trees, clumps of graſs and clods of earth; and ſometimes from the obliquity of the path, required me to creep on hands and knees to prevent ſlipping. Near the ſummit of the mountain, the path divided; and a mountaineer, whom we met, as we thought opportunely, at this point, adviſed the lower one; though from the accounts of porters and ſervants who took the upper one, the latter was eaſier but a little longer.

In deſcending the mountain a grand view opened from the S. E. conſiſting of a viſta formed by two ſides of mountains compoſing a glen, down which ran a large ſtream.—One ſlope was enriched by a foreſt which reached to the clouds; the other covered by ſcanty paſturage for about 400 yards; when it was overhung by a ſteep face of barren rock of immenſe height, and the upper part of the vale was ſhut up by a peak of ſtill higher mountain, the baſe of which was ſprinkled with cypreſs, and the top whitened with ſnow.

After a tedious march of two hours more, through a foreſt of

cedars and cypreſs,* of which many would have been large enough for main-maſts of firſt rates, I came to a *Sanga* acroſs the ſtream which ran down the valley. From this point I aſcended the hill ſurmounted by the bare ſheet of rock, by a goat path, and had to croſs an avalanche which was ſcarcely ſettled; every now and then a piece of ſtone rolling down its face and bringing with it currents of earth. The path was narrow, occaſionally going over a ſurface a little rounded, which in ſome ſlight degree maſked the tremendous declivity below, and ſometimes ſkirting its very verge. At one ſpot, on a ledge of rock, the old Pandit heſitated and retired into a hollow. However, having the advance, he ſummoned up courage, and paſſed the cauſe of his fears; this was formed by an angular piece of rock having ſlipped out of the ledge or cornice on which we were walking; and a piece of ſtone, which juſt, and only juſt, reſted with both ends on the oppoſite edges of the gap, ſhewed a precipice of a depth ſufficient to alarm the anxiety of a perſon who had not been much accuſtomed to the mountainous paths of this country. After clambering over fragments of ſtone which had fallen from the heights, we came to a point of rock, whence we had a complete view of the declivity over which we had to paſs; and this part was to me more difficult than any other, however I reached the bottom of the hill without injury. I learnt that I had gone 4 cós, and had not made above half a mile of head way. From the fatigue of this detour, I was ſo enfeebled as to be under the neceſſity of halting five or ſix times in aſcending a ſteep mountain, and obliged to creep on my hands and knees for a great diſtance, not having ſufficient confidence in my legs. My knees tottered, and I was frequently attacked with ſuch a violent pain in the right knee, as for a ſecond or two almoſt deprived me of the uſe of the limb.

* Pine; ſee a note above.

I much ſuſpect that I had loſt my road. In creeping along I certainly made a wrong choice, as I found myſelf at once upon the brink of a precipice, on the very angle of a rock which overhung it, and a ſlit in the ſtone ſhewed me my danger at the very moment I was about to place my hand upon a fragment which the weight would probably have diſlodged, and carried me along with it; at this moment the recollection of the danger produces an involuntary ſhiver.—After ſome time I got into a tolerably good path, and found my companion, and the greateſt part of the party, waiting my arrival by the ſide of a cool ſtream of excellent water.

The latter part of our march was not good: but this road, although almoſt every where elſe it would have been deemed impoſſible except for goats, was good in compariſon with that which conſtituted the labour of the morning.—This has certainly been the moſt ſevere day's work we have had; and yet I compute the actual diſtance, including the 4 cós of detour, cannot have exceeding 13 cós.

The ordinary road is not particularly difficult or dangerous; and all the riſk of life which I have mentioned, inconvenience to the inhabitants of the country, and impediment to commerce, are created for want of Sangas which might be made for 100 rupees: but the preſent government does nothing to ameliorate the ſtate of the country or to increaſe the happineſs of its ſubjects in theſe diſtricts.

June 1ſt.—Commenced our march at 7-30. At 2345 paces the river becomes a ſucceſſion of rapids, and has its channel diminiſhed to about 20 yards in breadth. At 3407 paces we paſs two caves,

a ſmall and a large one. The *Dauli* about eighteen yards broad. At 10,971 paces come to ſome cedars* and halt. The *Dauli* much reduced.

At our place of encampment, a black ſcorpion was brought, and was ſaid to be harmleſs: however, on pulling off his ſting and preſſing it, a large drop of a thin milk coloured fluid eſcaped from its point.

On the top of a high mountain thinly ſprinkled with worm-wood, dwarf cypreſſes,* and a kind of furze, blocks of marble and hard ſtones were ſcattered about in every direction, which ſeemed to contain minerals; and I am much deceived, if I did not ſee ſome veins of ſilver† in ſtrata of quartz. I had no inſtruments to break ſtones with, nor did I ſee any ſmall fragments which I could with convenience place in my girdle. I was obliged therefore rather to leave this point unſettled, than to expoſe myſelf to the ſuſpicion of coming into the country in ſearch of precious metals. The ſurfaces of many of the hardeſt ſtones, on this ſide of the *Paie-kundé*, are ſtudded with ſmall red cryſtals, which project; at firſt view, one is diſpoſed to take them for garnets; but they are not tranſparent. They are ſo firmly imbedded in the ſubſtance of the ſtone which ſerves as matrix to them, that they cannot be raiſed by any common inſtrument in a perfect ſtate, ſo that I could not count their faces.

The ſcenery of this day has always been wild and in ſome places moſt impoſingly majeſtic; eſpecially from the ſide of the mountain where we halted. On every ſide the view is bounded by ſummits

* Pines.

† Perhaps Mica. C.

of mountains peaked, rounded, broken into aſcending and deſcending lines, with abrupt, ragged dips and a few ſoft hollow ſweeps, but all covered with ſnow. The declivities in ſome parts thickly covered with cedars and cypreſſes,* in others thinly ſprinkled, and in others diverſified by bare patches of rock or ſand. The baſe of two lines of mountains is waſhed by the *Dauli*, which runs with great rapidity and noiſe about 400 feet below our encampment in a ſpace only juſt large enough to receive the water which it now rolls along the channel. One ſlope of the hill immediately before us has been broken from top to bottom by a ſlip which has only lately happened. In its courſe it has overwhelmed large trees, of which ſome have been hurried into the river, others lay acroſs its bed half buried in rubbiſh; and others, thrown down, hang by their roots with their heads towards the baſe of the mountain. The devaſtation, committed by large ſlips, is ſometimes very great, and they frequently happen; for I have this inſtant heard a tremendous craſh at a diſtance produced by a fall of rock, and was awakened by another at a moment that I had loſt all ſenſe of fatigue under the ſhade of a large maſs of ſtone.

When the ſtructure of the expoſed faces of mountains has not been entirely broken, I have remarked, that the general direction of the component layers has been to the E. of N. with an inclination towards the horizon about the angle of 45.

We pitched in an open ſpace between two ranges of high rocks. At the foot were ſome large cedars.* I meaſured one at ſix feet from the ground, twenty-two feet in circumference.

* See note above.

This evening the report ran, that a carrier had fallen off the firſt Sankho in this day's march, into the river, with his load, and was drowned.

June 2d.—March at ſix with the ſame coolies. In one place the river is covered by maſſes of rock, under which the current ruſhes with great violence. At 350 paces we croſs to the left bank of the river over a Sankho, conſiſting of three parts, in conſequence of two blocks of ſtone having fallen into the ſtream and formed three channels. It was in good order and thirty paces in length. At 4680 paces croſs a broad large brook, in which there are large beds of frozen ſnow, with a ſtream of water running beneath them; and immediately on the right bank of which is the village of *Malárí*.

The road of to-day has exhibited much variety; and a ſhort account of its features will convey a general idea of thoſe of this country. At firſt we paſſed over heaps of fragments of rocks; afterwards over beds of pebbles; then aſcended a mountain partly by a path worn in the earth by frequent treading, and partly formed by the ſurface of rocks and by ſtairs; where the road on the face of the rock ſhelved much to the river, a few looſe ſtones were laid upon it cloſe to its edge; and ſometimes earth was thrown amongſt them, or a few pine branches were placed along it and loaded with ſtones: this ſerved as a kind of defence or parapet: but, as they were never higher than a foot from the level of the ſhelf, they would only ſtop a ſlip of the foot. Where niches were broken out of the rock in the line of the path, and formed gaps over the precipice, if only of ſmall extent, a piece of wood was laid acroſs the wideſt part, and ſlabs of ſuch ſtone as was at hand laid from it to the rock, either ſupported by a ledge, or if the face of the rock chanced to be ſmooth, on another ſpar of wood.—Where the

gap was very wide, the trunk of a large tree was put acroſs; the upper ſide being cut a little flat, or elſe having notches hewn in it as ſtepping places; an open ſpace being left between it and the wall. Commonly theſe trees or Sankhos over chaſms, as well as thoſe Sankhos acroſs rivers, are tolerably well guarded againſt turning, either by being weighted with large ſtones at each end or by having rude ſtone wedges driven through two holes at each extremity of the trunk or plank.—Where the chaſm is too long for a tree, a heap of flattiſh ſtones is placed in the neareſt part which affords room for the baſe of a flight of ſteps, conſtructed ſometimes of ſtones wholly, ſometimes of ſtones ſupported in front by logs of wood: but no railing is to be met with any where; and, from the general looſeneſs of the mode of building, theſe roads are ſubject ſoon to get out of order; but, if the ſtones be large and the baſe flat, this kind of ſtair laſts longer than might be expected, as the paſſengers walk with care. Slips from the hills do moſt miſchief to them, and their courſe being almoſt always at the foot or on the ſide of mountains expoſes them to conſtant injury in ſome part of their extent. To-day I had juſt croſſed the ſlope of a ſlip that had happened laſt night; when I heard a little trickling above, which rapidly increaſed, and was cauſed by a ſhower of ſmall ſtones, of which ſome ſlid eaſily over the ſurface of the falling earth, but others, having got a little momentum by rolling over perpendicular breaks, daſhed down with ſuch force, as would have been fatal to any animal which they might have chanced to ſtrike in their fall.

As Mr. Hearsay was following the coolies, three bears, which were ſcampering up a ſteep gulley, that had been a water courſe, but was now half filled by ſand, earth and ſtones, diſplaced ſtones about 300 feet above the road. Theſe in their deſcent looſened others, and daſhed acroſs the road while the coolies were paſſing, but fortunately ſtruck

no one, except one of my bearers upon the leg, and he was more alarmed than hurt.

The view of the village of *Malári* from the top of the hill, where it comes in ſight at a diſtance of about a mile, is pleaſing, and would give a good effect on canvas. It is placed in the eaſtern angle of a triangular plain about a mile on each face, and bounded on two ſides by ſtreams, and on the other by ſteep hills, covered up to their ſummits with a bed of ſnow, thin on the projecting parts and deep in the ravines. The ſouthern ſtream is half choaked by banks of frozen ſnow, through which a mountain current, formed by ſpring water and melted ſnow, forces its way, undermining the maſſes of congealed ſnow, which now impede its progreſs; but which in two months will be diſſolved and carried into the *Dauli* that runs with impetuoſity from the north to the weſt.

The extremely neat ſtate of the land recently ſown principally with Chéná*, and ſeparated into fields by recently piled ſtone fences and living hedges, would do credit to any country; but the proportion of cultivated to uncultivated land in this country at preſent is almoſt as a drop of water to a large river.

The village of *Málári* conſiſts of about 20 houſes built of rough ſtones, cemented with clay and mixed with much wood. Many are of one ſtory, but more of two, and ſome even of three ſtories. The lower range is generally given to the cattle. Circular ſtones, with holes through the middle of them, are hung by ropes to the projecting ends of the beams at the gables, to prevent the roof being injured by guſts of wind which are here frequent and violent. The upper ſtory

* Panicum Miliaceum.

projects generally beyond the lower one, in consequence of its being furnished with a wooden verandah, which commonly runs along both sides, and is made of fir plank in strong pannels, ornamented with flowers and figures of *Hindu* deities, amongst which GANÉSA is most frequently represented. There is no lock, bolt, or latch to the doors, but in one door-post a square hole is cut, through which a rope is past, that ties a dog to it who guards the entry with fidelity. His collar is of wood like a yoke collar, and a stick is tied to it, and likewise to the rope which holds him to the door.

MÁLANÍ is inhabited by a class of people who call themselves *Rajpút*, but appear to pay little attention to cast. The poorer class of inhabitants of the frontier eat raw meat with a little pepper and salt as seasoning; which we had an opportunity of seeing; for, the leg of a goat being thrown away in consequence of being tainted, the coolies instantly seized it, and made apparently a savoury meal from it. Both men and women are rather of low stature, but not ill made, and have something of the *Tartar* countenance mixed with that of the *Hindu*.

THEY dress in coarse woollen cloth made from the fleece of their own sheep, and of those of *Bután*. The women alone weave, sitting on the ground, and are very industrious and expert. In five days, with a very simple apparatus, a woman will weave a piece of cloth about 18 inches broad and 15 cubits long. This is called a *Pankhí*. Some of them are flat, but others are twilled and very strong. They are worn without being bleached or dyed. The proportion of females seems much greater than the males. This may be accounted for by part of the male population being taken by the *Nepalese* for their army, and by another part being engaged in going from the upper to the lower hilly district, to sell salt and bring back grain. The dress of both men and women is

generally over-run with lice; and their perſons are with few exceptions diſguſtingly filthy. The inſide of the houſe is no leſs filthy than the dreſs of the inhabitants; and as no other articles of furniture are to be ſeen in them than benches and cooking utenſils, one might be led at firſt ſight to believe, that the inhabitants laboured under the preſſure of the ſevereſt poverty; but this is not the caſe, as is ſhewn by the ornaments of the women; and it is probable, that they avoid making a diſplay of wealth, leſt it ſhould be taken from them by the *Gorkhiahs;* to which may be added the circumſtance of their inhabiting this country only from about the 24th of May till the 23d September, when they migrate to the villages of *Tapóban, Baragaon,* and other places to the N. E. of *Jóſhi-Math.* Theſe people, from living half a year in one country and the remainder in another, are called *Dóbáſás,* and alſo *Marchás;* which latter appellation gives a whimſical affinity in ſituation and name to the former inhabitants of the borders of *England* and *Scotland.* They carry on a conſiderable trade between the inhabitants of the *Úndés* and thoſe of the lower parts of the hills. From the former they procure borax and ſalt, which they either carry to the frontier of the Company's poſſeſſions or ſell to the inhabitants of the hills, and take back to *Bután* grain in exchange. This commerce produces a profit to the *Marchás* of at leaſt a hundred per cent on the grain, and about 150 or 200 on the ſalt: but can only be carried on during the ſix months of the year when they reſide on the *Bután* frontier: and as they load goats and ſheep with the merchandize, theſe feed themſelves wherever they ſtop; and, as great flocks are driven by two or three people, the tranſport is attended with little real coſt to the *Marchás.* But the commerce of the preſent day is ſaid to be a mere trifle in compariſon with the traffic of former times. The goats uſed for this buſineſs are of the breed of this country, migrate regularly twice a year, are ſhort legged, of a ſtrong compact form, and travel about 5 cós a day over the moſt rugged and difficult roads that can be imagined.

The principal articles of the food of the moſt wealthy conſiſt in the morning of boiled rice and goats fleſh, and at night of cakes made of wheat flour beaten with water and ſeaſoned with ſalt and clarified butter; as alſo of curds and freſh milk of ſheep and goats. But wheat flour is ſcarcely ever taſted by the poor, who live upon the coarſeſt and moſt common kinds of grain; and, when they can get it, eat fleſh raw as has been before obſerved. Wheat is not raiſed in this diſtrict, but grows to a good height near *Joſhi-Math*. The following grains are raiſed here:

1ſt. Chuá or Marcha; reſembling the Amaranthus Gangeticus, or Lál Ság of the *Hindus;* uſed here both freſh, and in its ſeed when reduced to flour.

2d. Manruá or Manrwé: Cynoſurus Coracanus.

3d. Phaphei —This looks a little like *French* wheat.

4th. Coarſe red rice.

5th. Ana Jau.—I have not ſeen this growing, but the grain unſhelled looks like barley. Shelled, like a poor kind of wheat.

6th. Barley.

7th. Chání or Chéná. Panicum Miliaceum.

8th. Kangné. Panicum Italicum.

9th. Jangorá.

Slaves are much employed; and are bought from the *Gorkhials*. In the evening my ſakir harcárah, with a real ſakir, arrived with intelligence, that one of the women carriers, who had followed the circuitous track I had taken on the 31ſt, being much fatigued, went to the river to drink, and placed herſelf on a large ſtone, which ſlipping, cauſed her to fall into the water. The rapidity of the current was ſuch as to hurry her out of her depth and ſhe was drowned. This matter affected me conſiderably. On inquiry I found ſhe was without a family.

June 3d.—Leave *Malári* at 9 A. M. At 6165 paces, reach our encampment. The quantity of common and lemon thyme near watercourſes was very great, but none of it had been cropped by ſheep; I alſo ſaw baſil, ſavory, mint, and other potherbs, with ſedums of ſeveral kinds; and I likewiſe met with ſome gooſeberry buſhes.

June 4th.—After breakfaſting in a cave, at the foot of which run a clear rill down a deep and broad rivulet half choked with a body of frozen ſnow, we left our ground at $7\frac{1}{4}$ A. M. After proceeding 5145 paces, arrive at the village of *Niti*. In the latter part of this day's march I found my rate of breathing quickened beyond its natural ſtandard in proportion to the difficulty of aſcent, and was obliged frequently to ſtop in order that the action of the heart might become leſs violent. My companion has been aware of occaſional oppreſſion in breathing for the laſt three days; but I did not experience any till this day. The very wretched appearance of the 14 or 16 houſes, which compoſe the town, give no favorable expectation of the ſupplies we ſhould here meet with.

June 5th.—The ſituation of *Niti* is in itſelf pretty enough, being at the foot of a ſmall ſweep of hills which defend it from the N. and W. A gorge, between the Weſtern hills and thoſe to the South, give entrance to the *Niti* river; and the valley is ſhut up, about a mile to the E. by an aſcent covered with birch trees and leading to many gorges and ridges of a high mountain topped with ſnow. Down the ſide of the mountain, immediately in face of the town and extending from top to bottom, winds the track of a recent avalanche looking like a new made turn pike road. In front of the town, and between it and the river, are a few flats, which deſcend by ſteps, and have lately been ploughed. The town, following the line of the baſe of the rocks, was originally

built in a creſcent, but many of the houſes have been deſerted and unroofed, and now ſerve only as night ſtable for cattle.

We ſent a meſſage to the *Sehána* * importing that we ſhould be glad to ſee him. The meeting took place at our tent; and the *Sehána*, whoſe name was Arjun, began by ſtating that this was a road which pilgrims to *Mánſarowar* ſeldom came; that we were armed; that we had many people; that report ſaid we were either *Gorkhalís* or *Firingís* come with deſigns inimical to the *Undés;* and that meaſures had been taken accordingly. We endeavoured to remove theſe unfavorable impreſſions; and after much converſation the old man ſeemed ſatisfied. We wrote a letter in *Hinduſtáni* to the *Déba*, informing him that for pious and humane purpoſes we wiſhed to viſit the lake of *Mánſarówar;* that for defraying our expenſes we had brought certain articles from our country for ſale; that we had for our own defence certain arms which we were willing to leave in his keeping during our ſtay in the *Undés.* On urging to the *Sehána* the neceſſity of our ſpeedy departure, he obſerved that the ſnow was not yet ſufficiently melted; that the communication was never attempted before the *Sancránt* or entering of the ſun into the next ſign; and that this would happen in fifteen days; when they would accompany us, in caſe the anſwer of the *Déba* ſhould be favourable to our intentions. The argument of the road not being open was falſified by the appearance of the *Unias;* but it was thought beſt to wait an anſwer from the *Déba.*

From the 5th to the 9th, the thermometer at ſun-riſe has been generally at 46°, but in the middle of the day about 72°. The nights have commonly been clear and ſerene, but there have been a few ſlight ſhowers of rain in two of them. About nine it becomes pleaſantly

* The head man of a village is called *Shána, Sehána,* or *Seyáná.*

warm; at noon it is ſultry; about three the heat generally and ſuddenly ſubſides, and the tops of the higheſt mountains are enveloped in clouds, which depoſit their contents on them in the form of ſnow and in very gentle ſhowers of rain in the valley of *Niti*. The changes in the temperature of the atmoſphere are very ſudden and ſevere.* In the morning the ſummits of the higheſt mountains are wholly con-

* On a ſubſequent day Mr. Moorcroft obſerves "*June* 12*th*.—The temperature of the air varies much in the courſe of the day and night. At ſun-riſe, the thermometer is from 40° to 50°; in the middle of the day, from 70° to 80°. At eight in the morning the ſun overtops the hills which ſurround the little valley of *Niti*, and blazes with a fierceneſs of which we were the more ſenſible from the cold of the morning. About three the heat falls off moſt rapidly. I have never before experienced ſo ſudden a tranſition from heat to cold, and contrariwiſe. At night I am only comfortably warm with almoſt all the bed clothes I can muſter. At ſun-riſe a thick coarſe woollen *Hinduſtani Chapkal* or wrapping gown, over ſhirt, cotton waiſtcoat and double cotton coat, is only juſt ſufficient to keep out the cold. At nine the outer coat muſt be thrown off; at ten it is deſirable to get quit of the other; and at noon the reſt of the garments are, to ſay the leaſt, incommodious from the heat. The reverſe of this progreſs becomes neceſſary from half paſt three till night. The frequent changes of the temperature produce colds and fevers both amongſt the inhabitants and ſtrangers: but, though rather active in their ſymptoms, they are neither dangerous nor of long continuance. Ordinarily from the morning till about three o'clock, there is an upper and under current in the atmoſphere. The clouds are generally white during this time; move briſkly towards the north, and change their forms with much vivacity. Their ſpeed is commonly checked as they approach the moſt lofty mountains, to which they decline, and if they do not come ſo much within their influence as to burſt upon them, they regain by degrees their former courſe. But about three the clouds became more murky, are ſtationary, envelope the ſummits of the mountains, and roll down their ſides, diſcharging their contents in the form of ſnow upon the higheſt, and in light ſhowers of rain upon the lower ones. The lower current is formed by the interruption given to the under ſtrata of the higher current by the irregular form of the land beneath, and is almoſt continually varying in direction. During ſtill nights the dew falls very heavily; but, when there is a little motion in the atmoſphere, the humidity is ſuſpended above the valley and attracted by the hills. The ſtars are very brilliant, and the north ſtar is beautifully reſplendent. A bed of clear light coloured air in the darkeſt night overhangs the ſummits of the peaks which are covered with ſnow. Once only lightning has been obſerved: but, there has been no thunder during our ſtay. Does the great height of the mountains carry off the electricity of the atmoſphere before it can be accumulated in quantity ſufficient to diſplace a body of air with the violence neceſſary to produce an exploſion? I regret that we have no means of meaſuring our actual height above the level of the ſea. All of us feel much inconvenience through it being neceſſary to breathe very frequently, even when going as ſlowly as poſſible upon an eaſy aſcent. We anticipate great fatigue from this cauſe on ſcaling the ſtupendous heights over which the road lies. The natives recommend a ſmall quantity of coarſe ſugar to be eaten whilſt we are mounting, and ſpeak highly of the power of the kind of ſpar found near the ſnow reduced to powder and mixed with water, in diminiſhing the diſtreſſingly quickened action of breathing. This ſpar they believe to be ſnow gradually melted and again condenſed and cryſtalized by continual cold, and call it *Himgal* from *Him*, ſnow; and *gal*, from *galána*, to melt.

cealed by the ſnow: about noon the ridges between the ravines are cleared, but it remains in the clefts and gorges: and from three to the following morning the mountain has a new covering. This ſucceſſive depoſition and melting go on during the warm months. But, in the cold weather, when the mountaineers are obliged to quit their habitations, and leave them to be taken poſſeſſion of by ſuch wild animals as prefer them to taking an aſylum in caverns and glens; the whole ſurface of the valleys, as well as mountains, is richly covered with ſnow, which in ſome parts melts under the influence of heat and of rain, but in others remains continually. This maſs of melted ſnow on the vaſt ranges of mountains forms the great rivers which proceed from them.

When we arrived, the *Niti* river, about ten yards broad and from two to four feet deep, ſent down a rapid ſtream of greeniſh but clear water. The two following days were very hot: the ſtream was on the 3d, at leaſt a foot deeper, and conſiderably broader; and the water is clay coloured and turbid. I have frequently obſerved, that the water mark early in the morning upon the ſtones in the river was a foot and even eighteen inches above the level of the ſtream at that time of the day, and that the river always roſe conſiderably towards the evening. This is eaſily explained by the cold of the night produced by the ſnow on the mountains ſuſpending the melting proceſs, and of courſe interrupting the ſupply until the heat of the following day quickens it again. Such a ſurface of mountainous country, in ſuch a ſtate, along with the vaſt declivity of the beds of the rivers, will afford a more ſatisfactory explanation of the real ſources of the *Ganges* than the deriving it from a lake which muſt have ſome continual ſource of ſupply itſelf.

The birch trees upon the ſides of the mountains, as well as the ſmall roſe buſhes, are juſt breaking into leaf; the furze is juſt coming into

bloſſom. The natives have ſome barley, of which a few blades appear, and they are engaged in getting into the ground the *awa-jou*, *phāphar*, and *chua*. This is, it is preſumed, their ſpring; and our rains muſt be their ſummer, as their harveſt is cut before the middle of *September*, when the people go in ſearch of a milder climate.

This morning (the 9th) I ſaw a beautiful crop of rock cryſtal ſhooting out of an expoſed layer of quartz which had formerly been a vein in a maſs of very hard ſtone. Theſe mountains, which are primordial, would, if examined by an able and careful lithologiſt, throw great light upon the natural hiſtory of the mineral kingdom; for here, at almoſt every ſtop, he might come in ſight of the ſurfaces of rock which have never been altered by the hand of man, but have alone been ſubject to the laws of compoſition and of deſtruction, induced by the operation of natural cauſes.

With the exception of grain of various kinds which is to be obtained at an exorbitant rate, little eatable is to be procured at *Niti*. The only animal food, which we have had, has been two or three lean goats. There was no want of kids or lambs: but the owners would only ſell ſuch as were ill or extremely old This country at the preſent ſeaſon gives no fruit. The inhabitants have no gardens, and the only eſculent vegetables, which we could find, were the *Bathua* (Chenopodium album,) a ſmall quantity of ſelf-ſown *phāphar* about three inches high, and ſome rhubarb, the leaves of which were only juſt ſpringing from the ground; yet, even in this early ſtate of vegetating, the flowers were thrown out on the ſides of ſhort finger-like proceſſes and yielded a ſweet ſmell. The vital principle ſeems to be moſt rapidly called into action amongſt the vegetables of this climate to compenſate for the long period during which they remain in a torpid ſtate.

Our diet was certainly of a very frugal kind, and would not have been conſidered luxurious even in the cell of an anchorite: but our beverage was water of ſo excellent a quality as to make up for the ſcantineſs and uniformity of it. We had been promiſed by the Pandit, that we ſhould have an opportunity of ſeeing and probably of killing ſome *Barals*. The firſt part was verified; for they made their appearance amongſt the furze buſhes, almoſt immediately above our heads, and at the foot of the bare rocks; but never came within gun ſhot. Although we were told that the richer *Marchás* ſometime ate animal food, I believe that this occurs very ſeldom. They are much ſubject to fevers from derangement of the inteſtines brought on from vegetable diet little ſeaſoned; and ſeveral have the *Gegha* or *Goitre*.

13th.—This day two *Úniyas* arrived at *Níti* with a letter to the *Sháná*, which neither they nor he could decypher. However a meeting was held upon the ſubſtance of the meſſage, which they brought, by the head perſons of the principal villages in this neighbourhood. The letter was ſuppoſed to be a formal rejection of our deſire to enter the country. This concluſion was drawn from the refuſal of the *Déba* to accept our preſent, and from the verbal notification to us of the deceaſe of the *Lama* and of large bodies of troops having been detached to all the paſſes leading from the mountains into the *Undés*, to prevent the entrance of any white people, or perſons wearing white clothes, into the country, until after the election of another *Lama*. This meſſage was of courſe very diſagreeable to us: however we were reſolved not to return without having made every effort in our power to ſucceed in our original project. The people of *Níti* confeſſed, that they were alarmed at the reports which had been circulated reſpecting us, previouſly to our arrival: but, that on ſeeing more of us, they had ſent a *Fúniá* or *Vakíl* to the *Déba* of *Dábá*, ſtat-

ing that they believed we were men of character really intending to go to *Mánsarówar*, having merchandize to diſpoſe of, and not harbouring any evil deſign againſt the general welfare of the country. We knew, that the *Vakil* had been diſpatched two days ſubſequently to the departure of the firſt two *Úniyas*. But we placed little dependence upon the impreſſion he would make. The commencement of his miſſion certainly took off much from the accuſtomed dignity of his poſt; for, in attempting to ride upon a bullock, he with difficulty mounted in conſequence of being very drunk, and fell off four times before he was able to reach the top of the mountain.

16th.—ANOTHER great meeting took place. The *Úniyas* inſiſted upon our not being permitted to paſs; and the *Seyánás* of *Níti* and *Gomaſalé*, ARJUN and GUJAR MALL, were decidedly againſt us, eſpecially the latter. HARDEB was ſent back with money to the brother of NATHU, a relation of RAMKISHEN *Seyana* of *Malári*, who had ſhewn an inclination to aſſiſt us, to bring bullocks immediately, that we might attempt proceeding by the road of *Kieulang*, and we laid in ten days proviſion for all our men, in order that we might not loſe any time at *Malári* in collecting it. RAMKISHEN acquainted us with the opinion of the council, ſaid he would haſten all our operations at *Malári*; and HARDEB was ordered to bring a *Jowári* (who had made an offer to us of conducting us in three days from *Malári* into the *Úndés*) with promiſes of ſafe conduct to *Níti* and back, and of reward for his ſervices. Hopes were entertained, that in ſome way we ſhould ſtill ſucceed by perſuaſive means with the people of *Níti*. However, we thought it right to take all ſuch meaſures, as might appear likely to gain our point without loſs of time.

ANOTHER meeting was appointed two days afterwards at *Gomſale*.

In the courſe of this morning two perſons had come from *Negí* BHAWANÍ SINH, with a letter requeſting the loan of one hundred and one rupees to be repaid either in carriage of articles, in proviſion, or in ſpecie, with intereſt at 2 per cent per menſem, and a bond for the amount, along with a ſtatement of the prices at which we ſhould receive proviſions. He ſaid, that he underſtood we were delayed, and adviſed our getting on quickly.

IN the evening AMER SINGH, the ſon of the *Seyana* ARJUN, declared to the Pandit, that, if we would place confidence in him, he would take our baggage to the frontier, would make an arrangement with the *Déba* by becoming ſurety for us, and would go with us to *Manſarówar*, after which he would ſettle in *Jówar*, as he was apprehenſive, that the *Negí* would have recourſe to ſome harſh meaſures with him, in conſequence of his quarrelling with JOWAHAR SINGH, and cauſing his ſervant to be beaten. He ſaid if the council at *Gomſalé* were friendly, it would be well; if not, he had five bullocks, and would ſee what was to be done in reſpect to the further number required. His father was convinced, that we were perſons to be depended upon, and was privy to the tranſaction. As it ſeemed on many accounts preferable to take the *Dábá* road, the old Pandit on our part went to the father and ſon in the night, to take their oaths for the performance of their covenant. The next day HARDEB returned with an account of NATHUS's brother having repented of his declaration, of RAMKISHEN's ſlackneſs, and of his not being able to purchaſe any bullocks although at double their value. It has been agitated whether the *Seyanas*, altogether, ſhall become ſureties for us: but as yet this motion has been negatived. Once it was propoſed, that we ſhould leave our property at *Nití*, and go on with clothes and proviſion alone. This was of courſe rejected by us as ridiculous. It was then ſubmitted,

whether we would allow them to take it and ſell it whilſt we ſhould ſtay for the proceeds.—This was rejected likewiſe, and we declared our determination to march alone if they would not aſſiſt us with cattle.

THE *Fúnéa* arrived on the 19th, and by him it appeared clearly that it depended ſolely upon the people of this country to give us an introduction; for the *Déba* ſaid he hoped the *Nití Marchas* would not give us carriage, obſerving "if they have not conveyance for their baggage and proviſion, they cannot come; but if provided with carriage, as there are no troops hereabouts, there is no method of preventing their entry into the country." The *Fúnéa* alſo hinted, that a moderate preſent to the *Déba* would overcome all difficulties.

22d.—AMER SINGH ſays that we ſhall certainly break ground to-morrow; but as yet we ſee no preparation, ſave amongſt ourſelves.

23d.—STILL difficulties are ſtarted againſt our proceeding, until there ſhall be a general conſent of the heads of villages, to enter into a ſecurity for our good conduct with the *Déba* of *Dábá*. We have had no ſmall degree of difficulty in cauſing ARJUN to fix terms for the hire of his cattle. At length we have fixed, that each bullock ſhall carry the accuſtomed loads of two men and not exceed five rupees. Underſtanding that all the people concerned in our affairs were drinking at ARJUN's houſe, we made a bottle of brandy into a kind of punch, well ſweetened, and ſent it in hopes that its influence might be beneficial to our cauſe; in the opinion of the party it had only the fault of being too limited in quality.

24th.—WE were diſturbed during laſt night by the ſhoutings of men

and almoſt continual barking of dogs. Two large bears had broken into a ſheep and goat-pen, and carried off one of the goats.

We roſe at a very early hour to prepare our baggage for loading, as nine bullocks had been brought to *Niti* the night before, but after being ready for two hours without Amer Singh or any of his people coming, we ſent word that we wiſhed to proceed. This brought old Arjun, who deſired us to delay our journey three days longer when every thing ſhould be ready. His reaſoning was very unſatisfactory, and we urged him to fulfil his contract. In conſequence of our remonſtrances, he promiſed that we ſhould begin our march to-day even if Gujar would not conſent, although he was particularly anxious to obtain his concurrence to the meaſure. After waiting another hour, Gujar made his appearance and made many objections to our journey. He, Gujar, received a preſent of ten rupees, but I had reaſon to believe that he expected more. Arjun had five, and we had friends amongſt the women, in conſequence of medicines given to them, as alſo of ſilver rings and other trifles, which I had diſtributed. After a delay of two hours more we took our leave of *Niti;* my companion and myſelf then mounted on a *chounr* bullock.* We were told that the firſt march was to reach *Gútang*, a place five cós diſtant, where we were to halt two days. This compromiſe we were really happy to make, for it was evident that it was the intention of the people to detain us at *Niti* as long as poſſible, for objects of their own.

Left *Niti* at 11h. 20′. After travelling a mile, the people would not go any further, ſaying they were not prepared to proceed to *Gútang*, and that they would be with us the following day. They wiſhed to ſolemnize the anniverſary of the death of one of the villagers which hap-

* The Yak of Tartary. Bos grunniens.

pened by accident twelve months ago, and their march to *But'hant (Bootan)* at the ſame time; and, notwithſtanding their promiſe, it was underſtood, that they would take up two days in this feſtival.

Our encampment was on the ſlope of a hill ſituate between the foot of high mouldering mountains and the river *Dauli* not farther than a mile in direct diſtance from *Niti*.—However, we had made a ſtart, and were in a better poſture for defence in caſe of any attack being made upon us than at *Niti*, for in front of us there was a deep rivulet, on our right looking towards *Niti* whence only we had any thing to apprehend, was the river *Dauli*, and, on the left flank, mountains which could not be turned without immenſe difficulty.

25th. Rain fell during the night, and, as the cattle had been turned looſe to graze the preceding day, I reſolved to go towards the rocks. We had heard the call of birds which we took to be pheaſants. I was three hours in reaching the baſe of the line of rocks which ſeemed not quite three miles from our encampment; and though I climbed as ſlowly as poſſible, I was obliged to ſtop every five or ſix paces to take breath; and the perſons who accompanied me were affected in the ſame manner. In reſpect to game my ſearch was unſucceſsful, but I met with many plants, amongſt others were two kinds of rhubarb.—One I took for the Rheum palmatum, the other was much ſmaller. I cut up the roots of many large plants. The leaves in ſeveral inſtances ſprung from a little ſound bark, which ſurrounded a large portion that was rotten. Thoſe, which were hard, were detached from the ſound part of the bark near the ſurface of the ground: but theſe ſhrunk much in drying, and had but little of the rhubarb taſte, colour, or ſmell, whilſt the ſound fragments of the root of the preceding year were marbled like the cut ſurface of a nutmeg: ſome were yellow, and had the

peculiar qualities of the rhubarb, with a very large proportion of a bright colouring matter which ſtained the finger of a gold tint: but I preſume, that the beſt time for taking up the roots is in *September*. If the quality of this root ſhould be found to equal that of the *Levant*, the quantity procurable here at an eaſy rate would be very great.

We have learnt, that the carouſals of laſt night were kept up ſo long as to have prevented the partakers from undertaking any kind of buſineſs.

26th. Early this morning I went up the mountains. The aſcent was very laborious from the great difficulty of breathing which we all experienced; yeſterday, out of five people, two only were able to go as far as I did: to-day only one out of four could keep company with me; and he requeſted me to return, as the cold made him ſuffer much. The wind blew freſh up the mountain in the line of direction which I was taking: but I found, that I could not take above five or ſix ſteps ſtraight forwards without ſtopping to take breath; I therefore aſcended by zigzags of eight or ten paces, which afforded the opportunity of having a ſide wind in each oblique line. After a toilſome aſcent of five hours, I reached a ſmall flat of table land, which, if alone, would have been conſidered as of great height; but was of minor importance in the preſence of rocks of ſuch ſtupendous loftineſs, as thoſe which hid their ſummits in the clouds. This was covered with a dark green carpet formed by a ſhort narrow leaved graſs of a ſpringy nature, and enamelled with ſmall blue polyanthuſes in tufts, with anemones and ranunculuſes, but not with any of remarkable brillancy of colour: after collecting all the varieties within my reach, I prolonged my march, following the track of a *chounr* bullock up the hill. I was obliged to continue my oblique march; but, on turning my back to

the wind, felt a ſudden fulneſs in my head accompanied by giddineſs; and fearing apoplexy, I threw myſelf on the ground with precipitation. After a ſhort time the gaſping for breath became leſs frequent, the action of the head was leſs violent, and I quitted the turf; but although I walked as leiſurely as poſſible, I was twice again attacked with the ſame ſymptoms, and thought it moſt prudent to deſiſt ascending any higher. The imperious neceſſity for ſtopping to breathe at every four or five ſteps was only felt whilſt ascending; when the impetuous action of the heart was reduced by remaining quiet in one place, no difficulty in breathing was perceived, nor was it felt in deſcending, even in a run where this was practicable; but ſeveral times at our encampment, when about to fall aſleep, I have been interrupted by the ſame ſenſation. Although not particularly aware of any remarkable degree of heat or of cold, yet I found my hands, neck and face very red, and the ſkin ſore, and blood had burſt from my lips: a circumſtance which I do not recollect to have happened to me before.

27th.—HEARING nothing from the *Niti* people, a meſſenger was diſpatched to learn the cauſe of their not coming. He went off about ten in the morning, and ſaid that he found all the inhabitants faſt aſleep from the effects of intoxication. Men, women and children were lying in one promiſcuous heap upon the floor—with difficulty he awoke two people, who ſtated that ARJUN would be with us in the evening, and that we ſhould aſſuredly march the following morning. They had killed ſeveral goats, and burnt the entrails, and ſome other parts on an altar, but had feaſted on the remainder. When a perſon dies, it is cuſtomary to invite all the relations and friends of the deceaſed to a ſupper and dance. The night is ſpent in feaſting and drinking at the expence of the property of the deceaſed; and not unfrequently, the revelry is attended with bloodſhed, as was the caſe laſt night, three perſons having been wounded with ſwords.

In the evening ARJUN came, and promiſed that we ſhould ſtart in the morning; but deſired to have a bond of indemnity againſt any miſchief that might be done by any of our party in *Úndés*. This was complied with, we promiſing to pay five times the amount of any damage done.

June 28th.—THERMOMETER 51½, depart at 7 A. M. At 3605 paces croſs melting ſnow. At 5917 came to our halting ground on the bank of the river. This is called *Gútang nacli*. Here we found the goats and ſheep belonging to the *Marchas* of *Ghomſáli*, *Pharkia* and *Níti*, who are going to *Bootan* with grain. Two P. M. thermometer in tent 74°. In the evening AMER SINGH and GUJAR's ſon arrived. Rain continued great part of the night.

29th.—THERMOMETER 50°, morning cloudy and rainy. Leave our ground at ſix A. M. At 1560 paces the *Dauli* is joined by the *Hiwangal*, which riſes from the *Nar Naráyan* mountain of *Bhadra Náth*, and is a conſiderable ſtream. The joint ſtream is about twenty-five yards broad. Proceed over blocks of ſtone along the left bank of the *Dauli*, which hurries down its bed a great body of ſnow water. At 2370 paces a bed of ſnow forms an arch, under which the river runs, this bed was about forty yards long and ten thick. At 2680 paces arrive at another, over the edge of which we proceed. At 3109 paces reach another, which like the former paſſes over the river. At 3580 paces croſs on a *Sankho* to the right bank; river about ſixteen feet broad but rapid; aſcend a difficult hill. At 4630 paces reach its ſummit. This is the road for the early part of the ſeaſon; at a later period the beſt road is along the right bank of the river. The ſtream is about 700 feet below the top of the aſcent juſt mentioned. At 7350 paces croſs a broad water courſe called *Pátarpáni*, proceeding from the

mountains, and carrying a conſiderable body of water, due E. into the *Dauli* about a mile diſtant. On the other ſide of the river another water-courſe coming from the E. by S. empties itſelf into the great ſtream.

We had been obliged to comply with the extravagant terms of the *Niti* people at the rate of fourteen *Timáſhás* * for every load, and a bullock was rated at two loads, that is twenty-five *Timáſhás*; we wiſhed, that there ſhould be a ſtated weight: but this they would not comply with, and a cow was entered as being equal to a bullock. This proved unuſed to carry burthens, as ſhe three times threw off her load; at length diſengaging herſelf from what ſhe carried, ſhe ran away, and I was obliged to diſmount and put her load on my bullock. The *Niti* people had propoſed to carry flour for us to *Dábá* at a moderate price on goats, but we could not bring them to ſpecific terms before we ſtarted, and were obliged to keep this matter open, notwithſtanding this renders us ſtill more liable to be impoſed upon. To-day they inſiſted that three goats were equal to the hire of one man; and although this rate is higher than the abſolute value of the goats, we were obliged to ſubmit to the impoſition. At *Niti* our *Bareli* rupees were current in payment for five *Timáſhás*; at this place the carriers will only conſider them equal to four; this circumſtance explains one reaſon of the delay in ſettling the rate of hire.

June 30th.—Thermometer 46° at ſun-riſe. It has rained great part of the night, and the ſummits of the neighbouring mountains are ſprinkled with ſnow. Yeſterday the firſt part of our march was through a narrow gulley giving courſe to the *Dauli*, the bed of which was

* The ſilver coin of *Súnagar* and *Látakh*; which ſhould weigh, as the name imports, three *máſhás*, the fourth part of a rupee, but the preſent currency has been much debaſed.

formed by the union of the baſe of mountains of great height. Thoſe, which were principally compoſed of ſand-ſtone, had their feet concealed by a large ſlope of ſand and ſmall pieces of ſtone, and their ſummits were ragged and rapidly breaking down. Of this deſcription for the moſt part were thoſe on the left bank of the river, and their craggy irregular tops were far removed from the channel. Thoſe of the right bank were principally of granite of a green colour where waſhed with the water, and blue, blackiſh and brown above. The face of theſe, though by far more perpendicular than the other, and in moſt inſtances almoſt entirely ſo, ſhewed manifeſt ſigns of the deſtroying power of the weather. Some of the blocks of ſtone, which lay in the channel of the river, were of a kind of pudding ſtone, the inſulated pebbles being of a reddiſh or bluiſh colour, and the cementing material of green granite; were theſe maſſes in ſituations where they could be worked, they would furniſh moſt beautiful ſlabs, as their union is moſt intimate, and the friction of the water alone has given to many of them the ſmootheſt ſurface imaginable. At the union of the *Daulí* with the *Hiwangal*, we took leave of trees; the laſt we ſaw being birch and ſmall firs on the right bank of the *Daulí* juſt after the other ſtream had fallen into it. The character of the mountains before and on each ſide of the ſlope, on which we were encamped laſt night, is of a different nature; though bold in their forms, their outline is rounder, leſs abrupt, and the line of their ſummits more continued and agreeable.

I AWOKE at a very early hour and was immediately ſeized with difficulty of breathing and great oppreſſion about the heart, which was removed for a few ſeconds by ſighing deeply. When on the point of falling aſleep, the ſenſe of ſuffocation came on, and the ſighing became very frequent and diſtreſſing: however, as the air became a little warm-

er, this affection somewhat subsided. Several of the people are suffering from headaches, colds, and affections of the intestines, apparently attributable to the great and sudden changes in the state of the air, as in the middle of the day; the thermometer often stood 30° higher than in the morning.

March at six—At 3021 paces, desert the *Daulí*, within two cós from its source at the foot of a mountain called the *Gangá-nóli*. At 5360 paces, commence ascending the *Ghátí* or pass which separates *Hindustán* from *Undés*. Ascent very steep and difficult. We rode upon our bullocks the whole of the ascent, which was a mile and three quarters. At 7470 paces reach the summit, where we find a heap of stones, on which is a pole with pieces of rag attached to it; and as it is customary for every caravan or even for a single traveller to add his mite, we ordered a bit of cloth to be suspended in our name. This custom is supposed to entail the accomplishment of the objects of the journey to every one who observes it. We pass over an extensive plain thickly covered with large stones, upon which the bullocks tread with extraordinary firmness. This plain is bounded on evey side with mountains; those behind are covered with snow without any mark of vegetation; those before are equally bare, but without snow. Distance this day about five miles and a half.

The first ascent was very steep, but not so difficult as the second, which is called the *Níti Ghátí* or pass. Here our conductor Amer Singh had some fears, that our progress might be impeded by some guards from *Dúbá*, and whilst ascending, called to the Pendit, who had got the start of him, to examine whether there were any watchmen on the summit.—He appeared not a little gratified on learning that there were not any. The height of this pass is so great and long, that a very

ſmall body of reſolute men on the top might defend it almoſt againſt a large army, merely by rolling down ſtones.

We found the ſun hot about eleven, when we began to climb; but it was ſtated that about three it became ſo cold that it would be ſcarcely poſſible to ſupport it; however I conceive this to be an exaggeration. In ſome parts of the ſtoney plain, the ſnow lay in maſſes, over which the bullocks trod without heſitation; and in others, it was melting. Part of this gently ran over the ſurface into ravines, and part ſoaked into the ground, and probably broke out in ſprings at diſtant places. Between the *Níti Ghátí* and the northern face of a hill adjoining a ſtream called the *Jandú*, there was not the ſmalleſt trace of vegetation.—The diſtance was about one half cós; but juſt on the brow of the hill declining to the river, were ſome buſhes of furze and green mounds formed by a kind of moſs, which is remarkably cloſe and firm.—The ſtoney plain was of great breadth and was interſected by deep and broad ravines, which took off the melting ſnows.—Theſe ravines all ran towards the North and Eaſt, and are the ſources of various ſtreams which joining in their courſe, give uſe to the *Setlij*. The laſt range of hills had been repreſented as not ſo high as many in *Garwal*. However from the view which I have had of them, it appears to me that they are higher; and the general difficulty of breathing experienced by us in paſſing them comes in confirmation of this opinion.

We encamped on ſome flat ground on the bank of the *Jandú*, a river which receives the *Sheku*, and another branch from the northern face of the great *Himalaya* range. It was extremely hot when we arrived; and as there was no natural ſhelter, I laid myſelf on the ground under a thick blanket. Though oppreſſed with deſire for ſleep, I found it impoſſible to indulge the inclination, in conſequence of op-

preſſion in breathing, the moment I was dropping aſleep; and deep ſighing only proved a temporary relief. At three o'clock the wind became very violent, but abated in the morning a little before ſun-riſe. Two *Úniyas*, going to *Níti* with ſalt, here met AMER SINGH, and ſtarted, as he ſaid, many objections to our proceeding. He thought it prudent, that they ſhould return with us, leſt they might ſpread ſome report that might be prejudicial to us.

July 1ſt.—THERMOMETER at ſun-riſe 41; march at 5, 35 A. M. At 3205 paces reach the ſummit where there is a heap of ſtones. Here we found the two *Úniyas*, one of whom was buſied in lighting a fire, into which the other threw ſome incenſe, which he had previouſly bruiſed on a ſtone. He then leiſurely walked round the pile of ſtones, in the midſt of which was a ſtatue having a piece of cloth tied to it, and whilſt walking, uttered a long prayer. To the Eaſt was the ſacred mountain near the lake of *Mánſaróvar*, tipped with ſnow, and called *Cailás* or *Mahadeó ka Ling*.* Turning his face towards this mountain, and after raiſing his hands with the palms joined above his head, then touching his forehead, he ſuddenly placed them on the ground, and going on his knees preſſed his forehead to the ground. This raiſing the hands, and proſtration of the body and head, was repeated ſeven times; the other *Úniya*, leſs devout perhaps, contented himſelf with three ſalutations and a ſhort prayer.

CAME to a large plain divided into ſeveral portions by broad ravines, and having ſeveral broad but not high hills on it. The only marks of vegetation upon it are low buſhes of the furze, which may be called Tatarian, and ſmall mounds of the compact moſs before mentioned, with here and there a ſmall tuft of a thin ſilky graſs juſt ſpringing up.

* There are two mountains of this latter name: one near *Gangotri*; the other at *Cailás*.

Patches of ſnow ſtill upon the ground, and ſplaſhes of water in which the feet ſunk conſiderably; although I give our *Niti* friends credit for detaining us as long as poſſible, I nevertheleſs think we ſhould have found ſome difficulty in paſſing theſe plains ten days ago, from their then ſwampy ſtate. At 5400 paces, leave ſome ſnow in a hollow cloſe to the left. At 5840 paces, come to another heap of ſtones, and deſcend rapidly along a ridge between a water-courſe, now dry, to the right, and one to the left, having a ſtream running down its bed. At 6000 paces deſcend. At 6965 paces, encamp on the left bank of the *Chaſtu* river, the ſource of which bears S. 70 W. and ſprings from the northern baſe of the great *Himalaya* ridge. The bed of the *Chagla* river is about the ſixth of a mile broad, pebbly and fleet, with ſeveral ſmall but rapid currents running down it. The rivers to the South of the great *Himalaya* ridge are narrow, from the ſides of the hills being very ſteep and their baſes forming a narrow angle with little valley. Thoſe which riſe on the northern baſe of the ſame ridge have broad flat channels, the water draining into them more ſlowly from the table-land, and the more gradual and gentle ſlopes of the hills.

A HUNTER, whom we have long employed unſucceſsfully, this evening brought in a female *Baral*. It was about the height of a hog deer,* (Cervus porcinus) with its legs and feet much like the ſheep, and ſome ſimilarity in the head, but the ears were thinner and narrower. It had eight teeth and two horns which curved lightly backwards. Its hair was very hard, and on the neck cloſe to the ſkin grew ſome fine wool. Its general colour was aſh or grey, but it had its ſhins and tail darker than the reſt, and under the belly it was nearly white. It had four ſtomachs and a gall bladder; a veſicular tænia was in the meſentery, but I broke it in endeavouring to extract it. Were it not fanciful to ſuppoſe a

* Seems to be Ovis Ammon. C.

chain in the works of nature, I ſhould ſay that this animal was the link between the deer and the ſheep.

In croſſing the plains I have ſeen no inſects ſave a few ſmall yellow butterflies; no reptiles but a little active lizard of a dun tint; no game, and no birds ſave the red *Túti*, larks and linnets: but at our encampment there were ravens of a large ſize with a loud caw, an immenſely large eagle on the wing, and a blue pigeon with lighter plumage than that common in *Hindúſtan*. I conceive that no trip would be more inſtructive to the phyſiological Botaniſt than one acroſs the mountains which ſeparate *Hindúſtan* from *Tatary*, as plants of the ſame kind vary in their ſize, tints and ſtrength, according to the difference of their ſituations. Some time I thought that I was mistaken, but having ſeen the habitudes of many flowers differ extraordinarily in different places, and as the difference between thoſe on the ſummits of gigantic mountains, and at the bottom of profound glens was preſented very frequently to my eye with intermediate ſhades in intermediate places, as to elevation within a ſhort ſpace, I was enabled to recogniſe their identity of family after a little time without difficulty. At ſun-ſet high wind aroſe. Thermometer 54°.

July 2d.—Thermometer 5, A. M. 44; wind ſubſided during the night. The general direction of the rivers which we now meet with is E. by N. although they riſe from S. 70 W. As the cattle had ſtrayed, we were delayed until half paſt eight. At 5168 paces the mountain, along which we have come this moment, ends parallel to the left one. At 6845 paces arrive at our encamping ground, which is bad, as there is only one ſmall ſpring from which the water is taken by a ſmall ladle as faſt as the hole fills, and this is very ſlowly. Here we found a ſquare tent of black blankets pitched with four poles at

the corner, and belonging to ſome *Úniyas* who had come from *Dábá* to graze their goats. As the water was not in ſufficient quantity for the ſupply of the *Úniyas* and the *Níti* people, another well was dug, which gave what was required for cooking; but that for drinking was brought nearly three cós. An *Úniya* woman, wife to one of the goatherds, very good naturedly filled the water veſſels of thoſe perſons who came to the little well, and did not take up her own part till the different candidates for water received the quantity which they aſked for. She had rather a pleaſing countenance, was of middle ſtature, and about thirty-five years old. There was much of curioſity in her looks at ſeeing us, but nothing of fear or impertinence. Her dreſs was woollen, and of the ſame form with that of the men. Her boots were likewiſe woollen, and much diverſified by patches of various hues. Her hair, which was of a deep black, was plaited in treſſes from the forehead down to below her waiſt, where the plaits to the number of fifty, after each being terminated by a cowrie ſhell were aſſembled in a band of leather which was tipped with a taſſel of red worſted thread: her head lappet, if I may ſo name it, was of leather and extended from the forehead down the back to the waiſt, but in the latter part gradually ended in a point. At the forehead it was bordered with ſilver, and from this rim hung ſeven rows of coral beads, each row conſiſting of five, which were terminated by ſeven ſilver *Timáſhás* that played upon the forehead. The crown of the lappet was ſtudded with ſmall pearls diſtributed in ſeven rows, and the lower part was decorated with green ſtones ſomething like turquoiſes but marbled, with coral beads, and many bands of ſilver and of a yellow metal, probably gold, about a finger's breadth. A ſtiff band of leather ſomething like a ſoldier's collar was placed looſely round her neck, and ornamented with five rows of coral beads. The collar was

ſecured with a button and claſp of ſilver. In her left ear was a coral bead ſet in ſilver, and in her right were two ſmaller beads in the ſame material. On her right thumb ſhe wore a ſquare gold ring with characters engraved on the table.

On quiting the ſpring in the way to our encampment, we ſaw ſome of the *Bampo Marchas* ſitting by their loads, with a dead ſheep lying on the ground in its fleece, but having the entrails taken out; on a diſh lay ſome of the inteſtines cut in lengths like black puddings, and I was led by this to enquire what they were and how made; and from the intimation which I received, was a little ſurpriſed to find the borderers of *Bootan*, well acquainted with the art of making black puddings. The carcaſe of the ſheep was afterwards, I underſtood roasted whole, by being frequently turned in a fire of furze roots.

This day we were treated with ſome chops from our *Baral*, and we found the fleſh juicy, tender and high flavoured. There was a *Bootan* prieſt ſitting with ſome ſhepherds from the neighbourhood, cheapening ſmall wooden bowls turned out of knots of horſe cheſnut. They are very durable, the knotty ſtructure preventing them from either breaking or warping. In the evening there were ſome peals of diſtant thunder, and an appearance of much rain; however we eſcaped with a few drops, the maſs being attracted by the hills to the north. The *Úniyas* had dogs with their flocks, which were fierce and much diſpoſed to attack ſtrangers.

July 3d.—Thermometer at 5,—58°. Marched at 5,—10, as our conductors were anxious to reach *Dábá* at an early hour. Road leading over a dry gravelly plain, much cracked, and with little vegetation, except here and there ſome low buſhes of furze, ſmall tufts of a

ſilky graſs ſpringing out of this cleft, and a woolley plant like that commonly called "everlaſting," perhaps a kind of dittany. A ſnowy peak in front The road lies over a plain of great length but not of above ſeven cós in breadth, and conſiſting of many levels or ſteps broken by deep ravines, the edges of ſome of which are as level as if executed by art. On the ſouth, the plain is bounded by the laſt *Himálaya* ridge juſt tipped with ſnow in ſtripes like foot paths, extending along the windings of the ridges: on the north, by the *Cailás* mountains, the ſummits of which are marked more diſtinctly with ſnow, and the baſes of which deſcend to the level of the plain by eaſy ſlopes and diminiſhing ſwells, forming a ſucceſſion of ſteps ſeparated from each other in the length of the plain by breaſt-works of broken ground. Behind, the mountains ſeem to meet in an angle near *Mahádéva ka Ling;* but the plain ſeems to expand before us till it is ſhut in by ſtupendous mountains, whoſe ſides, as well as craggy ſummits, are apparently very thickly covered with ſnow. To the left or rather to the S. W. are the mountains of *Baſchar.* At the diſtance of about two miles, a little to the W. of N. is a moſt extraordinary face of broken ground. This repreſents pyramids in ſome places joining their tops but ſeparate at their baſes, in others, ſeparate at their tops but cluſtered at their foundations: buttreſſes of various proportions and forms; and no unapt reſemblances to ruined caſtles and fortifications in piles above each other.

The town of *Dábá* is perched upon the top of a rock, which juts out towards the river with an irregular declivity, and is ſurmounted by the higheſt eminence in the whole line which defends it from the N. W. At 5306 paces the river cloſe below, and a few cultivated fields, which are the firſt we have ſeen in this country: encamp near a rivulet in the town.

It was conſidered proper that AMER SINGH ſhould announce our arrival to the *Déba*, and enquire when we might wait upon him. It ſeems, that there are three perſonages of importance here, the *Lama*, the *Wazér* and the *Déba*, who is properly the head zemindar. The *Wazér* was abſent on buſineſs towards *Mánſarovar*, and his ſon officiated for him.—AMER SINGH reported, that the *Déba* and *Wazér's* ſon were very angry with him for having afforded us carriage, as without this aſſiſtance we could not have come on; and he had more reaſon to be diſpleaſed, as he had ſent two meſſengers to forbid our entering *Undés*.—AMER SINGH made excuſes; ſaying they had delayed from time to time furniſhing bullocks under the expectation of our being wearied and giving up the idea of proceeding; but that, ſo far from this producing the effect which he expected, we threatened to make him advance not only the expence of our ſtay at *Nití* which was conſiderable from the number of people we had with us, but alſo to pay the charges of the whole of a journey which by his not forwarding us was likely to end in diſappointment. But the *Déba* ſtill remained diſpleaſed.

IN the evening there was a conſultation betwixt the *Wazer's* ſon, the *Déba* and the *Lama*, at which were preſent AMER SINGH, the old pundit, a ſircar and a *jouar* man It was ſtated by the *Déba's* people that it was neceſſary to report the matter to the military chief who reſided at the court of *Gortope*, a place about two days journey diſtant, and who exerciſed a general governing power over the country.

July 4th.—THERMOMETER 54°—AMER SINGH ſent word, that the council was ready to receive our viſit; and we ſet out towards the government houſe, which was about a hundred yards diſtant, accompanied by a few ſervants. The houſe on the outſide was not of

a very impoſing aſpect, though built of ſtone. Over the door a large dog was tied, which eyed us with attention, but did not attempt to moleſt us. We paſſed through ſeveral paſſages and ſmall anti-chambers full of people, into a low room of about 18 feet ſquare, in the middle of which was a ſmall carpet for us to ſit on. Immediately in front of us on a ledge raiſed about a foot, ſat two young men, one of whom was repreſented as the *Wazér's* ſon and the other as the *Déba*, each upon their cuſhions; on their right, and forming the upper end of another line of perſons extending from one ſide of the room to the other, the *Lama* was ſeated upon a leather cuſhion, next to him a prieſt, and then an interpreter; The *Seyánas* of *Nití* formed an oppoſite line; and we were ſeated in the centre of a ſquare of people, who, if not very clean, were at leaſt orderly and reſpectful in their behaviour. The young men were large in their perſons, the *Wazér's* ſon particularly ſo, and about twenty-five years of age; the *Déba* was ſomewhat older; in the features of both the *Tatar* character was obſervable, though not in any very great degree. The *Lama* was about ſixty with a ſhaven head, dark complexion, ſerious and wrinkled countenance, and features of a common caſt. The prieſt beſide him was ſtill darker, more ugly, and more greaſy in his clothes, reclining partly on the floor, and partly on the ledge on the upper part of the room; near to the *Déba* was a young woman of pleaſing face, wife to the *Déba* and daughter to the *Wazér*, with a pretty child in her arms, and the left returning line from the *Déba* was begun, by a writer of dark countenance. The *Wazér's* ſon was dreſſed in an large looſe coat or gown of woollen ſtuff, ſtriped blue, yellow, green, and red alternately about a finger's breadth, and ſaid to be manufactured at *Guinnak* the capital of *Chineſe Tatary*. His hair was collected into one large plait which hung down his back, and he had no beard. The *Déba* had on a dark green woollen gown, and his hair was plaited in the like manner. His beard was plucked out, but he had reſerved a thin muſta-

chio on the upper lip; both the *Wazér's* ſon and the *Déba*, wore broad rings on the right thumb. Their oſtenſible uſe was for defending the thumb in drawing the ſtring of the bow: but it ſerved very convenient alſo for trimming their tobacco pipes, which lay in readineſs beſide them.—Theſe were about eighteen inches long, in the form of the *Engliſh* pipe, but made of iron, decorated with emboſſed work and a rim of gold, and a circle of the ſame metal at the union of the bowl with the ſtem. A ſmall japanned table was before each, and on them were implements for writing with two round wooden boxes japanned, and a large red and white china tea cup.—The *Lama* had before him alſo a japanned long and low ſtand upon which was a round box.—When we entered the room, the *Déba* was correcting a letter, which he had written to the commander of *Gortope*, and which he read over, deſiring AMER SINGH to explain the ſubſtance of it to us.—He read with a diſtinct articulation, with occaſional pauſes. The language was ſoft; and the ſubſtance, as far as we could collect it, was as follows.—That AMER SING and other *Seyánas* had brought along with them two *Mahants*, and twenty-five followers, who were deſirous of proceeding on a pilgrimage to *Mánſaróvar;* that the firſt repreſentation of their being *Gorkhalís* or *Firingís*, was a miſtake: and that the arms which they had with them, were only ſufficient for their protection during ſo long and hazardous a journey as that which they had undertaken.—That the *Seyánas*, had entered into an engagement that theſe were real *Goſains*, who brought merchandize to defray their way expences, and that they would be reſponſible both in their perſons and property; that they ſhould demean themſelves peaceably and properly whilſt they ſhould remain in the country, paying for every thing they might require, and taking nothing by force; and as they had been put to much unneceſſary expence by their being delayed at *Niti*, the *Déba* truſted, that the chief would give

orders for their being allowed to proceed without delay. The *Déba* cauſed alſo a written agreement to be drawn out on the part of AMER SINGH, binding himſelf to the truth of the above depoſition in the name of the ſeveral *Seyánas*, and to which he affixed his ſeal. The letter was forwarded to the chief of *Gortope* after the conſent of the *Lama* had been received.

IT was ſtated that the *Lama* had never before left his college on matters of buſineſs; and we were to conſider this as a great compliment paid to us. Between the *Lama* and the *Wazér's* ſon was an empty place which was ſuppoſed ordinarily to be filled by the *Wazér*; and before this was laid down our preſent at our firſt coming into the chamber: enquiries were made whether we would drink tea or eat parched meal, which we declined on the ſcore of having juſt riſen from our repaſt, but which we could not accept in our character of *Hindus*, theſe people having no caſt; a large braſs diſh half filled with butter and wheat flour was placed before us as ſome return for our preſent, and we took our leave.

YESTERDAY a perſon came to us from the *Déba* to enquire after our health. He looked about my ſmall tent with much curioſity, and obſerved that my friend's half boots were like thoſe of a *Feringí*.—I had taken the precaution of having my *Engliſh* ſhoes furniſhed with long turn up toes and tags at the heels, and this not being done to the others excited his ſuſpicion.—The redneſs of my face, which from being expoſed to a hot ſun and cold wind was almoſt wholly deprived of ſkin, particularly attracted his attention. The explanation given was, that, before this pilgrimage I had been but little expoſed to the ſun which had produced the effect which he ſaw. The ſame enquiry was made by a very black prieſt who came on the part of the *Lama*, and who ſaid that

if ſuch was the influence of climate, he ſuppoſed he ſhould become white, if he were to go to the country I came from; in about two hours after our viſit was paid, the *Wazír's* ſon, the *Déba*, the interpreter, the *Déba's* wife and ſiſter came to look at our finery, and admired ſeveral things, but found all our articles vaſtly too dear; and I think in general they were right; for we had affixed prices in ſome meaſure to make up for the expences to which we had been ſubjected by impoſition and delay.—The *Déba's* wife fell in love with a ring which ſhe actually aſked for and of courſe obtained. Five "children of a larger growth," who were extremely inquiſitive, were deſirous of knowing the contents of a bundle of my clothes; they were made in the *Hindú* faſhion. The *Déba* was anxious to ſee our guns; but, from his mode of handling them, it was clear that he knew little of the uſe of fire arms. We offered our gueſts tea, which they refuſed, but they partook of ſome ſweet biſcuits, ginger-bread, and ſugar candy. After a ſtay of an hour, they left us apparently ſatisfied with the reception which they had experienced.

July 5th.—THERMOMETER at ſun-riſe 48°; the town of *Dábá*, is ſituated partly upon irregular eminences forming the ſide of a flat ravine deſcending rapidly to the river *Tiltil*, and in the bed of the ravine itſelf. Its ſituation, conſtruction and appearance are altogether unlike any thing which I have ever ſeen before. The ravine or bay is ſurrounded by heights conſiſting of ſtrata of indurated clay and thick beds of gravel. Some of theſe heights are above three hundred feet in elevation, others are leſs. They are broken into maſſes of various ſhape by the torrents of ſnow water which fall down their ſides. Some are like large buttreſſes with pointed tops; and others, though of greater height, are ſurmounted by flat ſpaces.—Their ſides are full of excavations, to ſome

of which are wooden doors; and others are merely caverns; of theſe, ſome ſerve as houſes, but the greater part as granaries or rooms in which the inhabitants depoſit their property, when they leave their houſes in the town for a warmer ſituation during the moſt ſevere ſeaſon of the year, when the ravine is nearly choked up with ſnow, ſo that *Dábá* is only to be conſidered as a ſummer reſidence. The houſes are of ſtone two ſtories high, white waſhed on the outſide below, ſurrounded with a band of red and *French* grey above, and having terraced roofs ſurrounded with parapet. The tops of the walls are decorated with lines of pieces of different coloured rags tied to ſtrings. The inſide is very filthy; the floors of little yards, which lead to them, being covered with bones of ſheep and goats, fragments of bones, and locks of wool. From the ground floor, which is raiſed, a wooden ladder leads to the terrace, which in the *Wazir's* houſe is divided into an encloſed verandah that ſerves as a chamber of audience, and into an open ſpace uſed as a promenade by all the family. The town is divided into three parts, viz. a college, the reſidence of the *Lama* and his *Gelums*, or monks; a nunnery; and the houſes of the *Wazír*, *Déba*, and the laity in general. Immediately in the centre of a ſemi-circular ſweep formed by the houſes, are temples or mauſolea of *Lamas*, with ſmaller ones attached to them. Theſe are circular at their baſe, diminiſh by ſmaller circles and terminate in a point covered by plates of copper, like umbrellas, and gilt: in the centre above theſe, ſurrounded by horns, and painted of a red colour, ſtand an irregular building with one door, and ſurmounted by a ſquare ſmaller building, tiled with braſs gilt and decorated with groteſque figures; it is the temple of *Nárávan* or the great ſpirit. The parapet of this building was adorned with maſſes of black hair, formed, I believe, of the tails of the *Chouri* cow reverſed, plaited and intermixed with pieces of ſome ſhining ſubſtance, and having on their tops iron tridents.

This morning was dedicated to a viſit to the temple, and afterwards to the *Lama* A prieſt, by order of the *Lama*, opened a locked door, on which was a ring attached to the centre of an iron emboſſed ſhield-like plate inlaid with different metals. This led to the porch of the temple lighted by an opening in the roof to the Eaſt. The ſide walls were painted al freſco on a white ground with a bold ſketch of ſome deity, with large ſtaring eyes and enveloped in a kind of glory. The doors being thrown open, we entered an apartment of about 30 feet ſquare, lighted only from the door, and from two large ſilver lamps on attached pedeſtals of the ſame metal, about 18 inches high, placed upon a low japanned ſtool in the middle of the floor. At the upper end of the temple and immediately fronting the door, was a figure of *Nárâyan* of copper gilt, in the *European* ſitting poſition, and about 20 feet high. The hands were lifted up, with the palms gently inclined forwards, as if in the act of benediction.—Theſe, with the feet, were the only parts expoſed; the reſt of the figure was draped with narrow robes of ſilk. On his right hand was a ſmaller figure of Lacshmí; and on his left, that of a *Lama* crowned with a conical cap and dreſſed in pontifical robes.—Theſe figures, alſo well executed, were likewiſe of gilt copper; a flight of ſmall benches deſcended from the feet of each of the laſt figures, on each ſide of the room, as low as the foot of the throne, having a ſpace clear before. On theſe was arranged in rows the greateſt aſſemblage of *Hindu* deities, I have yet ſeen. They were of braſs, exhibited great variety of countenance, and much better proportion of parts than I have before witneſſed. The whole of the group juſt mentioned, were placed in a receſs bounded by pillars reaching from the roof to the floor, and ſeparated from the body of the temple by a wooden ſcreen about four feet high, furniſhed with ſhelves deſcending in gradation to the floor.—On the upper range were the effigies of deceaſed *Lamas* carved in wood, with their mothers, and the principal

perſons of their houſehold; a large gilt pyramid was on one ſide of this ſcreen half concealed by a ſilk veil, and another elevated figure, ſomething like a ſceptre on the other; each on a large gilt ſtand. Lower down was a gilt cheſt; and on the floor, in the ſpace fronting the door, was a low table on which were ranged ſeveral rows of braſs, ſilver, and gilt or golden bowls containing water for the uſe of the deity; a ſmall quantity was poured into my hands, part of which I drank, the reſt waſhed with and threw over my head, as I was directed by the officiating prieſt: we had a carpet ſpread on the floor in front of the deity, and immediately under a large expanded umbrella. I had given a preſent on my firſt entrance, and afterwards added another trifle for the particular uſe of the prieſt in attendance, who deſired us to come forward, and examine more minutely the figure of the deity, and receive a portion of his ſacred veſtments conſiſting of a ſtripe of a white ſilk gauze which was put round our necks. In returning we ſaw maſks of leather in imitation of the heads of ſtags, tigers, bears, and demons, worn at the celebration of ſome great feſtival, ranged on ſhelves; and on wooden frames, piles of ſheets of writing within ſmall planks of wood, like the boards of books without backs, lying on open lattice work tables.

On leaving the temple we were deſired to turn ſome wooden cylinders ſupported on iron cylinders, in receſſes in a wall, and to go round the building ſeven times, a ceremony which it ſeems is preſcribed to thoſe who wiſh to have an audience with the *Lama* after a viſit to the temple. Whether this was mentioned merely to enhance the ſanctity of the place or the perſonage, or was really the cuſtom, I know not, but the ceremony was interrupted after one round, and ſetting the whirligigs, by a meſſage from a prieſt, that Amer Singh was wanted elſewhere. He underſtood the ſignal, and went to a ſmall door, which

when knocked at, was opened by a laughing ugly fellow, who pointed to four coils of ſhawl wool, for which a bargain was immediately ſtruck.

We were deſired to make another turn round the temple, and were afterwards led up two very ſteep flights of ſtairs towards the *Lama's* apartments. Over the firſt door hung a ſtring to which were attached ſome leaden pipes, in imitation of the iron ones uſed for ſmoking. In an open apartment, up a third flight of ſtairs, ſurrounded by a veranda, on a ſmall and thin cuſhion placed upon an old mat, the biſhop of the dioceſe was ſeated. We each made a preſent of a rupee, and three for the *Gelums*; the latter he would not touch, but ſent for the ſteward to take charge of, and ordered that they ſhould ſay prayers for us three times; after which the money ſhould be divided amongſt them. His manners were mild and conciliating. To our interpreter he ſignified that he did not approve of our deſign of building a hoſpice at *Mánſaróvar*. We ſtated, that we ſhould attend to his opinions, even if our money had been in greater plenty than it now was.

At the ſuggeſtion of Mr. H. I laid the ſtring of beads, which I uſually wore round my neck at his feet. He was ſtruck with the circumſtance, roſe, beckoned to two *Gelums* to accompany him, and after a ſhort abſence, returned with a pot of ſour milk, ſome butter in a bladder, a kind of cheeſe and a cake of ſweetmeats, which it was ſignified, was conſidered ſo good as to be thought worthy of being preſented to the deity. He alſo brought a ſtring of wooden beads, which he deſired me to accept, as a mark of friendſhip in return for mine, and which I accordingly put on; we departed highly pleaſed with the manners of the prelate. In the evening, we paid a friendly viſit to the *Wazír's* ſon.

July 6th.—THERMOMETER at ſun-riſe 46°; I had cauſed the pundit and AMER SINGH to enquire for wool, in order to purchaſe a quantity and forward it to *Níti*, and have this day the mortification to find, that the people dare not ſell any until we ſhall have received permiſſion to buy from *Ghertope*. This is cauſed by ſtrict injunctions to all the owners of flocks not to ſell any ſhawl wool except to the *Caſhmírians* or their agents, in conſequence of a repreſentation having been made to the Government, that the *Jouaree* merchants had bought ſome laſt year, and that the *Caſhmírians* would ſuffer, if any of this kind of wool were to paſs into other hands.

DURING the period that the *Úndés* was governed by *Rajas* of the *Rájeput* caſt of *Súrajbans*, and ſubſequently that it paſſed under the dominion of the *Chineſe*, the independent *Tatars* of *Ladák* were extremely troubleſome to the inhabitants by their frequent inroads, and only ceaſed their depredations in conſequence of this country being given in *Jagír* to the *Dela Lama*. The ſacredneſs of this perſonage, who is the head of the religion of the *Tatars*, cauſed them to deſiſt from their incurſions, and probably, would have the ſame influence in the event of any alteration in the current of trade: but to this, it is likely, that they would make great reſiſtance.

July 7th.—THERMOMETER 42°; The *Wazír* made us a viſit and ſtaid nearly an hour. I obſerve, that the prieſthood and the immediate officers of Government are in eaſy circumſtances, as alſo are the goatherds, but the reſt of the population are plunged in the moſt abject poverty and literally clothed in rags.

July 8th.—THERMOMETER 46°, at noon in a tent 73°. We have heard, that an anſwer is arrived from *Ghertope*. In the evening, I went

to enquire the determination of the Government upon our affairs, and was informed that in the following morning the letter ſhould be read to us.

July 9th. RAINED.—Thermometer at ſun-riſe 50°. It being paſt eleven, and not hearing any intimation of our preſence being deſired, I proceeded to the Government houſe, and found the Council ſitting, aſſiſted by a number of people whom I had not ſeen before. I addreſſed myſelf to the Council; and as we had been informed, that a letter had arrived from *Ghertope*, I begged to learn the ſentiments of the Governor in reſpect to us, and their final determination upon them. The *Wazír* ſaid, in reply, that the Governor of *Ghertope* had ſignified to him, that inteiligence had been conveyed to him about three years ago, that ſome *Europeans* were about to come into the country; and, whether we were the perſons alluded to or not, he wiſhed to ſee us, and the goods we had brought, of which he requeſted an exact inventory to be forwarded to him, and prohibited any ſale till he ſhould have inſpected them. I told them, that, although we had ſuffered much from delays, yet that out of reſpect for the authority of Government, we were ready to go to *Ghertope* or even to *Laſſa*, ſhould it be required of us, as we had no other than honeſt intentions; but as we were ordered to go by the Government, it was but reaſonable, that we ſhould be furniſhed with carriages. After much altercation, it was agreed, that cattle were to be ready in three days; and that as many as could be procured ſhould be purchaſed, we taking the reſponſibility of the meaſure upon ourſelves. In an hour, the interpreter came to ſay that we ſhould have the requiſite bullocks, and we are to ſtart in three days from this date.

IN the evening we went to ſee the temple of NÁRÁYAN again, and to pay our parting viſit to the *Lama*. We found the old man in a ſmall

cell juſt large enough to allow of three people ſitting down; with a raiſed bench of brick, fronted by a railing of wood, with a little door in the centre.—Although early, he was retiring to reſt or meditation; and conſidering the wealth of the college which is reported to be very great, was a real and edifying picture of humility. He wiſhed to know very particularly if we ſhould return by *Dábá*. We anſwered certainly. He was much pleaſed with our attention, and putting out his hand to take hold of my friend's white gown, he being a little nearer than me, ſaid "I pray you let me live in your recollection as white as this cloth." There was ſomething particularly affecting in his manner and utterance, and I could not help bending over his out-ſtretched hand with emotion, as I took leave of him.

I MENTIONED, that there are a college and a nunnery. The *Gelums* or monks ſeem a happy, good humoured ſet of people, dirty, greaſy and in good eaſe. They carry on a conſiderable trade in ſheep's wool and ſalt, in exchange for wheat and barley. Of the nature of the inſtitution, I could learn little. Of the *Paraphernalia* of the temple, the reſemblance with thoſe of the *Romiſh* church was very ſtriking. The *Gelums* obſerve celibacy. There is a nunnery, the rules of which are ſaid to be ſevere. Commerce with man is puniſhed by ſolitary impriſonment and a heavy fine.

July 10th.—THERMOMETER 48°; this evening we purpoſed to mount a hill, on which formerly was a houſe belonging to the *Raja*; and there ſtill remains a temple. In our way, paſſing cloſe to the houſe of the *Wazír* we found him, the *Déba*, and ſeveral ſervants, ſhooting at a mark with bows and arrows. There was novelty in the contrivance of the target. The bull's eye was compoſed of two parts, the inner one about four inches in diameter, was of wood, convex, and pointed

black in the middle, with a circle of red on the outſide. This was placed in a roll or cuſhion of cloth which it fitted tightly. The arrows were tipped with wooden balls, ſome of which were ſolid, and others hollow, with four holes in the end, which cauſed a whiſtling ſound as the arrow flew through the air. When the arrow miſſed the target, and ſtruck againſt the butt, it fell to the ground; if it hit the ſoft ſhell of the target, it did not diſengage the bull's eye; and no arrow was accounted a ſhot, but that which diſlodged the eye from the target. When ſtruck out, the eye did not fall, but dropped a few inches lower than the circle, where it was held by a ſtring from an upper projecting rod. This is altogether not a bad contrivance, as it prevents diſputes. Theſe people pull the bow more in the *Engliſh* manner than in that of the *Chineſe*, their neighbours and maſters; but their inſtruments are very indifferent; and they are not formidable archers. They uſe alſo the ſling, but I had not an opportunity of ſeeing them exerciſe with it. Leaving the archers, we aſcended to the top of a hill about 300 feet above the level of the lower town, along a zigzag road, and through ſome winding paſſages excavated with little art in the ſtrata of gravel and indurated clay. The inſide of this temple was by no means ſo rich as that on the other ſide, and the prieſt complained of poverty. He ſaid, he felt an intereſt in our welfare, and recommended our departing without delay, as the governing people were not good, and we might, if we ſtayed long, be caught by ſevere weather, and periſh. We thanked the old man for his good advice, and left him more ſubſtantial proof of our regard, for which he was very grateful and placed round our necks ſmall ſtripes of gauze. During our ſtay, the *Gelums* began an evening Hymn, which was not unmuſical; but, in a very ſmall cell ſacred to BHAVÁNÍ, three perſons were making a noiſe not unlike the quick chirping of graſshoppers. There were ſmall ſtatues of the laſt *Súrejbans Rájá*, his ſon, daughter, prieſt, treaſurer, and other perſons of his

court. As it is the cuſtom here for a conſiderable portion of the property of every perſon who dies in affluent circumſtances, to go to the church, and as likeneſſes are ſent to the prieſts, who pray for the repoſe of their ſouls, as in the *Roman Catholick* faith, I apprehend the ſeries of figures repreſented the whole of the court; and in this idea my belief was ſtrengthened by obſerving ſome females of different age and character on a bench, immediately behind that on which the *Rájá* was ſeated. The head dreſs of two of theſe was very ſimilar to that of abbeſſes. The *Rájá*, whoſe reſemblance was here preſerved, in conſequence of the frequent inroads of the *Ladákis*, and of his father being killed by the *Tatars*, was ſent by the principal people, to requeſt the protection of the *Chineſe*, who accorded it and aſſiſted him againſt the invaders. But in an earthquake his houſe was precipitated along with himſelf and his houſehold into the plain, and the *Chineſe* afterwards availed themſelves of his death, to take this country for their own uſe, and after a certain period to give it to the *Dela Lama*.

At this laſt temple there were few muſical inſtruments; but at the great one, we ſaw ſome prodigiouſly large braſs and copper trumpets, made of tubes, which ſhut in and drew out like teleſcopes, and had ſmall mouth-pieces or pipes which were diſtinct. There were alſo drums of great ſize ſet in frames and beat upon their ſides.

There are granaries in the rock on which the ſmall temple is ſituated, in which they ſay that there are many thouſand maunds of rice for the uſe of the people generally in the event of any great exigency, and this is certainly a very prudent precaution, as ſcarcely any grain is raiſed in this country, and the inhabitants are dependant for their annual ſupply of rice and barley on the marchas of *Níti* and *Jouár*. Shortly after the period that the *Gorkhas* made an irruption into the

territories of the great *Lama*, the *Chineſe* government ordered 30,000 maunds of rice to be taken out of the magazine, which is in fact the property of the public; but how the funds are provided, I did not learn.

July 12th.—THERMOMETER 51°. The *Chouar* bullocks arrived at day-break; and having paid for their hire as well as for the food of two horſemen, who were to accompany us, into the hands of the interpreter, we ſtruck our tents and took leave of *Dábá*. At 4906 paces arrive at the ſummit of hills, ſaid to contain gold. To the right are clay hills broken down by melting ſnow into ſtrange looking projections and hollows. Scarcely the ſlighteſt appearance of vegetation, and yet a hare was ſeen upon theſe heights. At 5116 paces reach a narrow paſs, through which we go and deſcend to a ſtony plain, then enter a very deep water courſe now dry, of which the banks are perpendicular, of vaſt height, and formed of beds of gravel. I examined their ſtructure with great attention, in hopes of finding ſome traces of marine productions, but was diſappointed. At 7230 paces came to a plain ſloping to the *Satúdrá* or *Setlej*. It came from the S. W. by W. and ran N. E. receiving here the *Tiltil*; breadth 80 yards, depth $3\frac{1}{2}$ feet. The current was ſo rapid, that I could ſcarcely keep my footing. On the plain were two very beautiful poplar trees, in which were many gold-finches, which regaled me with a ſong, whilſt I ſat under the ſhade of the trees, waiting for the party, having reached the river half an hour before they arrived.

THE broken ground in the neighbourhood of *Dábá*, and which we did not loſe ſight of, until we quitted the bed of the *Tiltil*, was very extraordinary in appearance. The right bank was of great height, and the melting ſnow had cut the clay of which it was formed, into

channels, leaving intermediate ridges, which from difference of hardneſs or being acted upon by the water in different directions, was faſhioned into great diverſity of figure, in ſome places repreſenting caſtles, fortifications, houſes, and maſſes which baffle deſcription.

We have paſſed three villages to-day, all painted, and of different colours. Theſe are winter reſidences of the inhabitants of *Dábá* and *Dong*.

Just at the point when we began aſcending, the valley narrows ſuddenly to a channel only juſt ſufficient to give paſſage to the water. The hills, which are ſtated to be rich in gold, are granite of mixed colours, the red predominating, with horizontal ſtrata of quartz and ſmall fibrous veins of a white material like agate, deſcending perpendicularly: where the rock has been expoſed to the weather, its ſurface is broken into ſmall pieces, having little more coheſion than clay burnt in the ſun. This decompoſition is effected, I ſuppoſe in conſequence of the different materials of which the maſs is compoſed, not being intimately united, and water entering the fiſſures where it congeals, &c, burſts the ſtructure.

The gold here is ſeparated by waſhing, there being no fuel in the neighbourhood; or rather no wood; for from the appearance of ſome of the hills, I apprehend that they hold coal. In the bed of the *Setlej*, were many large flowering ſhrubs, which I take to be a ſpecies of the tameirſk. I have found it from three inches high to eight feet, in ſituations more or leſs favorable. The yaks and goats were very fond of the foliage. I obſerved, that the bite of the yak is quicker and nearer the ground than any other ſpecies of neat cattle I am acquainted with; a peculiarity which fits them for the ſhort and ſcanty herbage of an *Alpine* country.

We have deſcended much to the *Setlej*, notwithſtanding the mountains are high, which intervene between this river and *Dábá*, and the heat is great. In the tents, the thermometer ſtood at 96°. Diſtance come this day 7525 paces.

July 13th.—THERMOMETER at ſunriſe 56°; march at 6° 30′. This plain is ſtony, about half a mile in breadth and length, bounded partly by heights and partly by the *Setlej*. It is full of ſhallow pits made by perſons who have dug for gold duſt, and left heaps of ſtones by the ſides of the excavations. At 306 paces aſcend to another flat which has likewiſe been dug. At 1835 paces reach a ſmall flat, where there has been cultivation; caves of gold mines in the rock to the left, now deſerted. At 5975 paces reach a houſe near which are two gold mines with tunnels under the ſurface.—Heretofore the excavations were perpendicular. The earth is dug out and carried to the brook to be waſhed.—At 6182 paces arrive at the ground for encampment near the village of *Damoo*, ſituate half way up a rock on the right bank of a watercourſe, in the direction of which we travelled moſt part of this day, conſiſting of a few red houſes, and many caves, with two or three temples.

IN the evening killed ſeven hares.—There are great numbers of theſe animals. They are ſhorter in their bodies, longer in the hind legs, and ſomewhat ſmaller than thoſe in *England*.—Their fur is much finer and longer: altogether they are much paler generally. The under part of the neck is fawn colour, ſides greyiſh, belly white, and the thighs are furniſhed with thicker and longer furs than the reſt of the body, and of an aſh or lead colour mixed with grey.—When diſturbed, they fly to the mountains, but frequently ſtop and riſe on their hind legs to look at their purſuers. Their fleſh is well taſted; and they are very prolific; as in two there were eight young ones.

Some cultivated land under the grain called *ad'hi jou*, well irrigated.

July 14th.—THERMOMETER 52°; leave our ground at 5° 25. At 5780 paces much ſaline efflorescence on the ground, ſuppoſed to be ſoda, cracked under the foot like ſlightly frozen earth. The ſkeletons of two wild horſes were lying in the valley. In various parts of the road we have found many ſkulls of the male *Baral* with enormous horns.—Some have at leaſt been from 50 to 60 lbs. weight. We meet again with rhubarb which we had long loſt ſight of. At noon, thermometer inthe tent 75°: on a high hill to the right, three wild horſes ſuddenly made their appearance, probably for the purpoſe of coming to water; after looking at us for ſome time, they went off at a ſmart trot. They were too far off to afford a very clear view, but ſeemed to be about thirteen hands high, a bay colour ran along the upper part of the neck, and back and ſides were of a fawn or azure colour. Their heads appeared thick and ſhort, but well carried: their bodies round, ſhort: general ſhape compact, clean, and tail thinly furniſhed with hair.

July 15th.—AT ſun-riſe, thermometer 41°; march at 5h 40'. At 574 paces a bed of ſnow in the watercourſe. The plaſhes of water on the ſurface of the ground melted during the day, are frozen in the night. Road aſcends to 1934 paces, when we reach the level of a beautiful plain about a mile and half broad, with mountains to right and left, and narrowing to a gorge about three miles in front. Mountains on left have ſnow falling upon them. At 4800 paces reach the right ſide of the valley, which declines to the North: a ſtream ariſes from a bed of melting ſnow, direction N. 65 E. At 5240 paces a ſecond bed of ſnow. Middle of valley ſtony with two currents of water. Animals of a fawn colour about twice the ſize of a rat without tails, and having much longer

ears than rats; 2. *Marmot?** They burrow in the ground, and ſeem to aſſociate with a ſmaller ſpecies of the ſame form and general character, but of a much darker colour; perhaps younger ones only. One of this ſort was ſhot yeſterday, being taken for a young hare; which it reſembles in its mode of jumping and ſitting on its hind legs. At 5551 paces the valley narrows to 600 yards; ſurrounding hills ſaid to contain gold, which is ſometimes found in lumps of conſiderable ſize. At 9786 paces encamp; at 11 A. M. cloudy, high wind; begins to rain; afterwards hails, and this alternately with ſtrong wind till ſun-ſet, when the atmoſphere clears and the wind falls.

July 16th.—THERMOMETER at ſun-riſe 34°; our tents frozen. March at 6° 45′ along the left bank of the ſtream which we followed yeſterday, ſaw cloſe to our ground a large pair of horns attached to a ſkull, which I ſuppoſed to have belonged to the *Baral* or wild ſheep, but was ſaid by the *Úniyas* to be an animal called *Douga*. At 1905 paces large fragments of frozen ſnow fallen into the water from the rocks, almoſt choking up the channel, which is not above ſeven yards broad. The frozen ſnow or rather ice, when broken from the edge of the projecting banks under which the water flows, divides into pyramidal or conical nails, the ſmall part downwards. Red ſtones, ſomething like cinnabar of antimony, with black ſhining cryſtals, interſperſed through their ſubſtance. Large lumps of green granite glazed over, in parts with a kind of green glaſs, in the bed of the ſtream. At 2000 paces enter into a narrow defile of frozen ſnow, which the ſtream has cut through and deſerted. A ledge of about eight feet thick, is ſuſpended to the rock at each ſide, leaving a narrow paſſage beteen them, 94 paces long; at 2435 paces came to another defile of ice. At 3420 paces, rhu-

* Probably a new kind; as all the known ſpecies of Arctomys have ſhort ears or none. In other reſpects ſeems to agree with the genus.

barb plants in plenty. At 6375 paces our ſtream joins another; and the road leads to a plain, on which were two wild horſes and a prodigious number of hares. At 8025 paces reach the bed of a clear, broad, and rapid, but not deep river; plain dug in many parts for gold. Having croſſed the river, and reached our ground at 1 P. M. and 11962 paces, we encamped.—We killed this day one hare, and two grouſe, or birds of this claſs, of a fawn colour, feathered legs, broad feet, covered with a pad of horn, divided into many points, like ſhagreen, and having two long thin tail feathers. This river, which riſes near *Gongré*, goes paſt *Ghertope*, then cloſe to *Laták* or *Ladák*, and is ſaid likewiſe to proceed to *Bokhara*, where probably it falls into the *Ammoo*, *Djihon* or *Oxus*. The mountains on each ſide of this valley or plain, which is about five miles acroſs, dip much to the N. W.

July 17th.—THERMOMETER 39°. Ice or water near our encampment. Saw ſome *Brahminí* geeſe* and ſmall ſhrikes hovering over the river. At 336 paces aſcend the foot of the mount, ranging with the river, which runs about eighty yards to the left. At 1360 paces, the plain is divided into an upper ſtep about two miles broad, and a lower one, in which is the river following the middle of the lower ſtep or valley, and about a mile in breadth. Many wild horſes on the upper ſtep. At 3200 paces myriads of ſmall flies, very troubleſome. At 4205, road very uneven from hillocks and hollows. The ſurface of the ground covered with ſalt. At 5720, the various currents which divided the valley unite and form a large and clear ſtream, of conſiderable rapidity. At 6000, a very large but dry watercourſe leads to the river. At 8600, a valley opens from two to three miles broad, and covered with large pebbles. Heat very great. At 11278, come to five currents of a river, which we croſs. This river riſes from mountains covered with ſnow lying S. 75 E. and falls

* Anas Caſarca.

into that juſt mentioned. *Ghertope*, formed by ſome black tents, at a conſiderable diſtance, bears from hence N. 5 E. The intervening plain and indeed as far as the eye can reach until it is bounded by a paſs to the N. W. is covered by prodigious bodies of ſheep, goats, and yaks, amongſt which is a ſmall number of horſes. The number of cattle cannot I think be leſs than 40000. At 14000 paces reach the town, or rather aſſemblage of tents in cluſters, made of blankets ſurrounded by hair ropes fixed to ſtakes. Over the tents are variouſly coloured ſhreds of ſilk and cloth as flags.

We had only juſt pitched our tents, and arranged our baggage, when a meſſenger arrived from the *Déba* and *Wazír*, deſiring us to pay them a viſit to day, and we ſhould proceed to buſineſs the following day; the terms of the meſſage were too preſſing to admit of delay, accordingly we proceeded to the houſe of the *Déba* with our preſents. It was encloſed by a fence about four feet high, and ſurrounded by the ſame litter of bones, horns, and ſcraps of wool, that we had remarked at *Dábá*. After entering an encloſure, we ſtopped a few ſeconds at the cloſe of a ſmall yard, in the front of which were ſome matchlocks and bows and arrows, piled in a kind of guard houſe; and we were deſired to go through a low door into a room, about twenty feet long. At the oppoſite end, on a raiſed bench of earth, covered with a carpet and cuſhions, ſat an elderly man, bare-headed, and clothed in a greaſy yellow damaſk gown. This was the *Déba*. On the right hand from the *Déba* was a dark complexioned perſon, who was his younger brother; and on his right again, a rather fair young man, who was the ſon of the late *Wazír*, and now ſhared the authority of government with the *Déba*. The *Déba* had rather a ſhrewd countenance. His brother had a ſullen expreſſion, and was ill-favoured. The young *Wazír* had a pleaſing face, of the *Tatar* kind. We had cuſhions placed

on the ſide of the room, oppoſite to the young men; and our attendants with thoſe of the houſehold occupied the lower parts of the chamber. Some converſation paſſed through the medium of our interpreter, which turned upon our uſual place of dwelling, and the articles we had brought with us, of which an inventory was handed to the *Déba*, and after being looked over by him, given to the *Wazír*. The apartment was built of ſods. The roof was flat, made of branches of trees laid acroſs, covered with ſods, and having a ſquare hole near the centre, which anſwered the double purpoſe of letting in light and giving vent to ſmoke: the ſides of the room were hung with dirty yellow ſilk. On the right hand of the *Wazír* were two dogs. The *Déba* ſat at the upper end of the room on a platform of ſods two feet high, covered with an old carpet, on a cuſhion faced with *China* ſatin, Before him was a little long table, on which a box, with barley-meal, a blue and white large *China* tea-cup, a thing, like a ſmall lead tea caniſter, uſed as a ſpitting pot, and a greeniſh jaſper tea-cup, leſs than the other. This latter was frequently filled by a boy, from a large earthen tea-pot, with a pale coloured lid, apparently cold. Superſtition in eaſtern countries attaches to jaſper cups, the property of ſplitting, if poiſon be put into them; and this trait at firſt bluſh, does not ſpeak in favour of the morality of our *Tatar* friends.

Over his head, to defend him from the earth of the ſods or other annoyance, were two or three pieces of common chintz, and at the right corner was a ſmall ſquare apartment, made by a chintz curtain, in which was a light; as the *Déba* lighted his pipe from a chafing diſh of charcoal, which was on the floor, I ſuſpect him to be a worſhipper of the ſun and fire; and this ſuſpicion is ſtrengthened by the long hymns, which our attendants chanted on the road, at the firſt appearance of that luminary.

Our interview was very long; but it was eaſy to ſee that the impreſſion of our being either *Gorkhas* or *Felings*, (ſo the *Tatars* call *Europeans*) wore off either by the repreſentations of the *Deba* of *Dábá*, or by the weight of our preſents. Particular inquiry was made for pearls, and cups of cryſtal. Round the *Déba's* neck was a ſtring of beads, thick in the middle, and ſqueezed in at the ends; each bead about an inch and a half long, of a black ſubſtance reſembling elaſtic gum, and marked with a deep circular impreſſion made by a kind of ſeal. At the bottom was a ſmall oblong, rounded gold box, with a little turquoiſe ſtone in the middle of the lid. In each ear he had a long pendant, conſiſting of a large pearl, between rows of ſmall turquoiſe ſtones ſet in gold. All the three perſons mentioned had on their tail, which is twiſted from three plaits, a gold circular ornament in lieu of a roſette. This is generally larger than a crown piece, half an inch thick, with a raiſed edge defended by very beautiful fillagree work enriched with ſome decoration of the turquoiſe. This is really an elegant trifle, and with the exception of a dagger caſe, and an etui for long iron ſticks to clean the throat of their tobacco pipes, was the only real decoration betokening taſte, I have ſeen in the country.

July 18th.—This morning we diſplayed our goods as detailed in our inventory. After we returned, a *Caſhmírian Vakíl* from the *Rájá* of *Laták* ſent word, that he was ready to buy our goods, if the *Déba* did not cloſe with our terms. He ſaid, that he ſhould be glad to open a commerce with *Hindúſtan* for goods of that country in exchange for the productions of *Laták*. That place, he ſaid was about ſixty kos or ten days journey from *Ghertope*, and the ſame diſtance from *Caſhmír*. He mentioned a place called *Buſheer*, twenty days journey from *Laták*, and ten only from *Bokhara*. The road through *Cabul*, from *Dehlí* to *Bokhara*, he repreſented as very circuitous. From *Amritſir* to *Latak*

the journey was from twenty to twenty-five days, and the beſt ſeaſon for it was the hot weather or the rainy ſeaſon, but it would be preferable to go in the former, and return in the latter period. He purchaſes ſhawl wool on advances at thirty *negís* per rupee, the firſt quality ſells in *Caſhmír* at twelve *negís*, and the ſecond fifteen *negís* per rupee. The beſt wool comes from the neighbourhood of *Ouprang Kote* near *Mánaſaróvar*.

July 19th—The *Latákís* as well as the *Úniyas*, are not able to grow grain enough for their own conſumption: but are ſupplied by the inhabitants of the hills. The *Úniyas* procure their grain from the *Jouárís*, the *Marchas*, and other traders, through the paſſes as far as *Baſchar*. the *Latákís* from the *Caſhmírians*.—The ſupply of grain is highly important to the *Úniyas* as they live on barley-meal and rice, which they eat with their tea. Animal food ſeems to conſtitute only a ſmall portion of their diet.

The ſhepherds are now beginning to ſhear their ſheep and goats. *Jouárí* and *Baſchar* merchants are purchaſing ſheep wool which they manufacture into *Pankís* and blankets; and thoſe from *Laták* are collecting the ſhawl wool; I purchaſed a ſmall quantity of the latter, at the rate of twenty-five *negís* per rupee. The *Latákís* require thirty. The *Déba* hinted that he might be diſpoſed to give twenty; and this in the beginning it may be prudent to take, until a footing be eſtabliſhed. It is important to ſhew, that he will receive more advantage by dealing with our agents in future than with the *Latákís*. Theſe have ſome ſhawl goats, but not in numbers ſufficient to ſupply the *Caſhmírian* market. However, if a portion of the quantity raiſed in *Úndés*, can be diverted from the uſual line, they may be compelled to keep more goats themſelves. Still without much ſucceſs, as the cold is not ſo ſevere in the neigh-

bourhood of *Laták*, as to the eaſtward, in which direction the mountains are higher, and covered conſtantly with a larger quantity of ſnow.

July 20th.—At a little diſtance from us, and cloſe to the river, two people are engaged in preparations for making paper. They have two large bags of old paper, that has been written upon, and manufactured from the bark of the root of the *Latbarisa*, formerly mentioned. A few large flat ſtones are placed near the edge of the water, where a portion of the ſtream has been divided from the main current by a low piece of ſods. On the graſs are two frames of wood, covered on one ſide with fine cloth, and the other is open, forming a ſhallow tray. The workmen begin by dipping ſome of the old paper in the water, then beating it upon a flat ſtone with a ſmall round one, till it is reduced to a pulp. One of the trays is then placed in the broad part of the canal, leaving a ſpace for the water to run under it. The pulp is put into a geer pump with water, and worked into a paſte; it is then poured on the cloth, and as this is ſunk two or three inches in the ſtream, the water riſes through the cloth into the tray, and, mixing with the pulp, dilutes it. The impurities, which ſwim, are picked out, and the pulp agitated by the hand until it is ſuppoſed to be ſufficiently clear, when the current of water is leſſened. The workman ſees if the cloth be equally covered with pulp; and if any part look thin, he ſtirs the water with his finger immediately over another, that is too thickly covered, and raiſes a cloud of paſte which his finger leads to the thin ſpot, and by making a little eddy, the motion of which he gradually diminiſhes, the pulp is made to ſubſide. By a repetition of this ſimple proceſs, the ſheet becomes of an equal thickneſs throughout: when it is carefully raiſed out of the water and placed horizontally on the ground to dry, till the greater part of the moiſture is drained off, when it is gradually raiſed, and when nearly dry, the frame is ſet upright: when perfectly

hard, one corner of the large ſheet is raiſed from the cloth, and the whole detached by the hand. However this paper is very inferior as to evenneſs to that made in *Hinduſtan*.

July 21ſt.—At about ten o'clock we were viſited by three *Tatar* muſicians from *Latâk*, one played on the hautboy, another on drums, and the third ſung and danced. The airs were very ſimilar to thoſe of the *Scotch*; and the tones of the hautboy reſembled ſtrikingly thoſe of the bagpipe. This inſtrument had eight holes for the fingers, and one for the thumb, with two reeds, and a metal tube, with a broad flange concave upwards and convex downwards, in which the reed was inſerted.—The reeds were tied together with a piece of ſtring about two inches long, that the looſe one might be ready to be changed inſtantly. The muſicians began with an overture not unlike that of Oscar and Malvina as far as compariſon may hold between the execution from two inſtruments, and that of a full band. They then ſang the words without muſic, and ſo went on with the inſtrumental and vocal performance alternately.

The *Déba* and *Wazír* made their preſent, conſiſting of two large trays of rice, one coarſe, the other fine; three lumps of butter, ſewn in ſkins, and eight ſheep. The butter was rancid, a circumſtance which in this country does not lower its value. The exhibition of the articles of my ſmall medicine cheſt and of ſome ſurgical inſtruments appeared to give much ſatisfaction; and both the *Déba* and *Wazír* were pleaſed with a few drops of oil of peppermint on ſugar.

22d.—This morning I received a meſſage from the *Déba* to viſit him as ſoon as poſſible. He propoſed a new rate of valuation for the coin, in which our advance for wool had been made to him. This propoſal

was a groſs roguery, as we had weighed the rupees and found that one of them was equal to 4½ *Latáki Timáſhas*, and had aſcertained the goodneſs of the ſilver. He had too of his own accord offered to allow that rate. I told him, that we had placed the fulleſt confidence in his honour, and had conſidered the bargain of the day before as binding on both parties: however we were in his power, and we wiſhed him to receive the twenty-five rupees, which would have ariſen out of the tranſaction, as it at firſt ſtood, in the light of a *nazar*. I declined giving five *Sirinagar Timáſhas*, in lieu of a rupee, as I had been informed, that the *Déba* alone refuſed them, and probably through the influence of the *Latáki* merchants. During the arguments on this ſubject, the young *Wazír* ſpoke to the *Déba* ſeveral times in an under voice, held down his head, ſeemed confuſed, abaſhed and aſhamed of the trick played by the *Déba*. The latter obviouſly pleaſed with having carried his point, ſaid, that heretofore no ſhawl wool had ever been ſold except to *Latáki* merchants; that there was an order of government inflicting the loſs of his head on any man that ſhould ſell this wool to any other perſon; but that in conſequence of our having come from a great diſtance, being, as he was fully aware, perſons of conſideration, and as he was pleaſed with our conduct, he had departed from the general rule and had put us on the ſame footing with the *Látákis*: that we ſhould in future be placed on the ſame terms as they; and he would engage that no third perſon ſhould enter into competition with the two parties for this article. I expreſſed my ſatisfaction with his promiſes; and begged that he would give me a liſt of the things he might be likely to want from *Hinduſtan*, as the *Europeans* ſent many articles of great utility and beauty to that country. He ſaid, that a ſword, and large pearls of a roſe colour, pear ſhape, and free from flaws or irregularities, would be moſt acceptable. He gave me a drawing of one, which probably would be worth 2,000 rupees, and which

he valued at 3 or 400. After our commercial affairs were thus ſettled, he ſaid that we could not have permiſſion to go out of the uſual road from *Ghertope* to *Mánaſaróvar*, or to ſtay more than one or two days at that place. Thence we were to proceed to *Gangrí*, afterwards to *Hienlung*, to take up our wool, then to return to *Dábá*, and enter the territories of the *Gorkhas* by the *Níti* paſs. I anſwered that we were ready to obey, to the utmoſt of our ability, the orders which he had preſcribed; but that it had entered into our pilgrimage to viſit *Jualámuchí*, and that by the road of *Níti*, we ſhould make a round, to which our finances were unequal. He ſaid, that the heads of the *Seyánas*, who had become ſureties for us, ſhould anſwer for our leaving the country by any other road. I urged every argument, that occurred to me; but he was inflexible. He ſaid his own head would be forfeited if he gave his conſent to our returning by any other paſs; and that our lives were held by him in equal eſtimation with his own; but that the caſe was without remedy. This blow was unexpected and heavy, as it places us in the alternative, either of being expoſed to be ſtopped by the *Gorkhálís*, or of loſing the benefits of the connexion we have formed with the governor of the *Úndés*. AMER SINGH ſays that as the *Marchas* were our ſecurity here, ſo will they guarantee our paſſing by the *Baſchar* road. To effect this, he ſays it is only neceſſary to go one day along the *Níti* road when we leave *Dábá*, and then ſtriking to the Weſt with a good guide, we ſhall reach the *Baſchar* without inquiry or moleſtation; or if we diſlike this plan we may go to *Níti* and make an arrangement with the *Mana Marchas*, near *Bhadrínát'h* to give us a guide. My companion thinks it will be beſt to go as far as *Tapóban*, and there ſtriking over the great ſnowy *Tunſásí* range, gain the province of *Budan* and puſh vigorouſly for *Chilkea*. I prefer this, becauſe we can ſee our cattle ſafe to *Níti*, and make an arrangement then for paſſing our cattle and goods through the *Gorkha* territory. The old pundit

opens for *Baſchar* road; and ſays we ſhall neither be ſeen or heard of by the route which he ſhall chalk out, until we reach a country in which we ſhall not be noticed. I rather apprehend that the prohibition has been cauſed by the inquiries which the old man has been frequently making from *Baſchar* people reſpecting the ſtate of the road: but, be it as it may, it is clear to me, that if we wiſh not to furniſh to the governor of *Ghertope* a ſubſtantial reaſon for rejecting future communication with us, we muſt abide by his order in reſpect to quitting his country by the *Níti* paſs.

Mr. H. went to the *Caſhmírian*, and found that he was a *Wakíl* or agent of the *Rájá* of *Laták* for the purchaſe and ſale of wool. He ſaid that the amount of wool annually bought by the *Rájá* was between two and three lakhs, the greater part of which was reſold to the *Caſhmírian* merchants, who waited for the return of the *Wakíl* and paid for it immediately. Merchants from *Amritſir* took off the reſt. In ſpeaking of articles of merchandize which were marketable at *Laták*, he mentioned coral beads, which formerly were brought from *Dehli* and *Benáres*, and, though exceedingly dear, were reſold into *Tatary* at a great profit. But within the laſt three years their value has fallen greatly, from the great numbers which have come through *Yárkund*. Theſe have been brought by the *(Ooroos) Ruſſians*, who have long been in the habit of trading with that country, and in the courſe of the laſt three years have puſhed on a lively traffic into *Caſhmír* through agents. The *Wakíl* ſaid, that the *Ooroos* had not yet been at *Laták*; but the *Déba* of *Dába* aſſerted, that kafilahs of 5 or 600 *Ooroos* on horſeback had come to the fair of *Ghertope*. Now if this latter intelligence be true, the *Ruſſians* muſt reach *Ghertope* by another route than that of *Yárkund*. The *Wakíl* ſaid that the horſes of *Laták* were much larger than thoſe of *Úndés*, but that the beſt were bred in *Yárkund*, thirty days

journey from *Laták*, and that *Bokhara* was fifteen days journey from *Yarkund*: *Laták* is ten or twelve days journey from *Ghertope*, and the same distance from *Cashmír*, and twenty-five from *Amritsir*. Thus the road to the N. W. of the *Himálaya* from *Dilhi*, would stand thus: from *Amritsir* to *Laták* twenty-five days, *Yarkund* thirty, *Bokhara* fifteen; making a total of seventy days; a much shorter distance than that by *Cabul*, —In this route there are two days journey, in which no water is to be met with; and for thirty days there is a tract without inhabitants: but the road is safe. I must here remark, that the river, which goes from *Ghertope* to *Laták*, does not proceed to *Bokhara* as before stated; but falls into the *Attack*, or more properly speaking, is the main stream of that river. Neither is it a fact, that *Cashmír* furnishes *Laták* with grain, as was at first reported to me; the latter country having sufficient land in cultivation for producing barley and other grains, except wheat and rice, which it obtains from *Baschar*. I went this evening to the *Cashmírian's* tent, taking with me two small bottles of essence of peppermint and of volatile caustic alkali. He received me with great respect, spoke in the highest terms of the regard shown to medical characters in the West, and of the pleasure he had in our meeting, which he now regretted had not taken place before. His name was Ahmed Khan, Kazalbásh, about forty-eight years of age, and of a respectable appearance. He placed before me some fine sugar-candy and a paper of saffron. Looking glasses of large sizes were, he said, much in request in *Cashmír*. He was particularly desirous to have a lancet of the same make with one that I had given to the *Garpan*, but in this I could not indulge him. I drew him on to converse about the *Russians*, but could learn no more than what has been stated, save that a few have before been in *Cashmír*. He brought with him shawls of various kinds for sale; and said that his people, who were not come up, had some of great value in charge. No body, he said, could trade at

Latáks without the direct permiſſion of the *Rájá*. We firſt ſuppoſed, that the *Caſhmírians* came to *Úndés* for part of the wool they uſed; and learning that they did not, were diſpoſed to blame them for want of enterpriſe. However it appears that they have not been permitted to trade directly with *Úndés* by the *Latáks*.—A ſtate of warfare had long exiſted with intervening periods of peace, or rather truce between theſe two ſtates, in the reign of MAHMUD SHAH. The *Chineſe Tatars* then invaded *Latak*, whoſe inhabitants applied to the *Caſhmírians* for aſſiſtance. Theſe repreſented their ſtate to the Emperor, who ordered them to ſend ſome infantry to their aid. By their help the *Latáks* repulſed the aſſailants; and a treaty of amity was made between the conflicting parties, of which one article was that the ſhawl wool raiſed in *Úndés* ſhould be ſold to the *Latáks* alone. This has ſince been little infringed upon, except two years ago, when the *Jouári Marchas* purchaſed a ſmall quantity on account of Mr. GILLMAN of *Bareily*. The *Latáks* appriſed of the tranſaction, complained to the government of *Ghertope*, who iſſued the rigorous edict before mentioned, forbidding the ſale of any except to the *Latáks*, on pain of death to the party ſelling.

23d.—LEAVE *Ghertope*; thermometer 38° at ſun-riſe. The night has been froſty. Having taken leave of the *Déba* or *Garpan* in the afternoon, and of the *Wazír* at night, we prepared to ſtart. The *Wazír* treated us with much cordiality. He ſaid that in a very ſhort time he ſhould go to *Laſſa* to remain. In his apartment, which was a much better one than that of the *Déba*, were many trunks, and in the right hand angle was a ſmall platform with benches in front, on the top of which was a braſs image, before which a lamp was burning, and grain of various kinds was ſerved on ſalvers of wood.—On the loweſt ſtep were ſeveral plain wine glaſſes reverſed, which from their clumſineſs, I ſuppoſed, to be of *Ruſſian* manufacture. He ſhewed us the picture of the

late *Lama*, executed in ſilk, but both the form of the perſon and the countenance announced more of the female than of the other ſex. This character I have remarked to have prevailed in every portrait of the many different *Lamas* which I have ſeen, and, were it not that no mention has been made of this perſonage having been emaſculated, I really ſhould have imagined this to have happened. However, taken out of the hands of his parents in infancy, educated in the entire ſubjection of the paſſion of ſex, and kept in a ſtate of little leſs than entire confinement, with full feeding, it is not ſurpriſing, that the features of the face ſhould have little of the virile character, and that the whole contour of the body ſhould contract a feminine ſoftneſs undiſtinguiſhed by the bold variety of ſwell and fall belonging to a muſcular frame accuſtomed to exerciſe.

At 3985 paces reach two piles of ſtones, the uppermoſt of which were engraved with a character, that appears different from that in common uſe, and appropriated, I preſume, to religious purpoſes. The valley here narrows and is bounded by mountains, whoſe tops are more or leſs covered with ſnow, and it takes a winding direction to the left. At 5407 paces arrive at our ground of encampment near ſome tents, and a conſiderable herd of yaks with a flock of the fineſt ſheep I have ſeen in *Tatary*.—Pleaſed with the proſpect of having my choice from amongſt the beſt collection of cattle of every kind I had ſeen, I rambled through the whole, and made choice of ſeveral female yaks and calves as alſo of young goats, which however were not equal in quality to the yaks and ſheep.

The horſemen, whom I diſcovered too late to be intoxicated, ſaid that they had no orders to allow me to pick out of the flock; but would ſend for inſtructions on that point.

24th.—Thermometer 44°. At an early hour ordered the pundit, ſircar, and interpreter to proceed to *Ghertope*, and repreſent to the *Déba* and *Wazír* how we had been treated; as alſo to mention that the horſemen had ſaid, that as they had received only four days pay, we muſt travel day and night. We had ſcarcely determined upon this meaſure when the horſemen ſent word, that a meſſage was come from the *Déba*, importing that he would ſend another draft of each kind; and, if I did not approve of them, I might take back the articles he had purchaſed. I directed them to offer a higher price for the power of ſelection: but rather to take ſuch cattle as he ſhould offer, than on our part to break the original bargain. In the evening my meſſengers returned with eight cows, and the ſame number of calves, of which four were bulls.

July 25th.—Thermometer 41°. March at 8h 10'. The river we have left comes from N. 85°. E. The mountains in this thoroughfare for the moſt part covered with ſnow. The breadth of the valley in which the ſtream runs, is about $3\frac{1}{2}$ miles. Thermometer at 1 P. M. 82°. The road, on which we are proceeding, ſeems a great thoroughfare; many *Baſchar* and *Jouárí* merchants having paſſed to-day with loaded ſheep, goats, and yaks towards *Ghertope*.

July 26th.—Rain. Thermometer 43°. The changes of temperature in this climate are extremely ſudden. Laſt night the mountains to the right were bare; this morning they were covered with ſnow. Thermometer in tent 74°, at three P. M. rain: alternate ſun-ſhine, overcaſt ſky, wind, and thunder.

July 27th.—Thermometer 39°. At noon all our baggage being dry, commence our march. The river from this ſpot runs N. 70° W.

about $1\frac{3}{4}$ miles, and then takes a turn to S. 80° W. and joins the river along which we went to *Ghertope*. At 4460 paces croſs the river three feet deep, rapid with large ſlippery ſtones; water very clear. At 6260—13 wild horſes grazing to the left. At 7957, came to bank of river, which croſs, about $2\frac{1}{2}$ feet deep, 80 yards broad, and very rapid. At 8200, reach our ground and encamp. The valley well furniſhed with graſs—Several *Tatar* tents, and cattle grazing—Much furze on the adjacent hills. River comes from N. 75 E. and runs N. 50 W. for about $1\frac{3}{4}$ mile when it takes a turn to the S. 75 W. and forms one of the principal branches of the *Ghertope*, ſuppoſed to belong to the *Attock*—Wind very cold, raining all round. The river roſe rapidly, and the *Tatar* horſemen refuſed to croſs their horſes, in order to bring over ſome of the people who had ſtayed to conduct our goats and ſheep acroſs the river; the yaks were ſent in, who ſtemmed the current. Some clung to the tails of the animals and came over eaſily; the others, more timid, preferred retreating to ſome huts at a diſtance, where the *Tatars* gave them milk and lodging—A few drops of eſſence of pepper-mint on ſugar to the *Hindus*, and a dram of brandy to the *Muſſelmans*, with ſtrict injunctions, that they ſhould run about and not approach the fire till warm, prevented any of the perſons who had been much expoſed to the cold from ſuffering by it.

July 28th.—THERMOMETER at ſun-riſe 44°; obliged to wait until ten o'clock, before the river had ſunk ſufficiently to admit of the men and a few goats which were left, paſſing over. At 1^h 20′ march. The mountains have the particular red appearance indicating the preſence of gold; and though adorned with little verdure, are pictureſque in their forms. Croſs ſeveral ſmall rivulets which come from the left, and fall into ſeveral ponds to the right—air very cold. At 7050 paces reach a pile of ſtones covered with inſcriptions. At 8160 road croſſes ſeveral

dry watercourſes, and aſcends to the ſummit where are two ſmall heaps of ſtones, over which is a line covered with ſlips of rags, and ſupported by two ſticks. At 9460 paces croſs a rivulet formed by freſh melted ſnow. This riſes on the left and runs to the right. Reach our ground, 10066; at 5^h 20′ very cold, windy and cloudy—A ſtorm riſes in the N. W. attended with thunder and ſmall hail. Thermometer 47. Hail changes to rain, which falls ſteadily till 7 P. M.

To-day I heard a ſtrange ſharp and loud noiſe proceeding from the ſide of a hill, at the bottom of which the road ran—It ſeemed between a bark and a growl, and expreſſed much anger. For ſome time I could not make out hence it came, but, whilſt caſting my eyes on a furze buſh, an animal about the ſize of a middle-ſized dog ſprung from a hole underneath it, about fifty yards up the hill, and after ſurveying the paſſengers and repeating his yelping, retreated with precipitation into his cave, as ſoon as he ſaw me jump from the back of a *Chownr*—His general colour was a yellow-brown. His head was round with ſmall ears, his face burned light and dark-yellow and his tail long.

July 29th.—THERMOMETER 37°. At 9^h 45′ began to hail, which ſoon changed to rain, and laſted until 10^h. We began our march at 10^h. 45′. Mountains on the left covered with ſnow; many wild horſes grazing on the high Table Land. At 16652 paces reach a branch of the *Satúdrá* river which I forded here, and again at 16868, much againſt my will, as it was extremely cold: but my yak had played ſome tricks, which in my weak ſtate of health I did not think prudent to experience more than once. At 7°. 15′ reach *Miſar*, very cold and much fatigued. Thermometer 46°.

July 30th.—HALT at *Miſar*. Thermometer 44°. In the forenoon, S

yaks arrived laden with ſhawl wool and accompanied by two perſons on horſeback—one of theſe was an officer called a *Nerba*, who had received orders from the *Garpan* to ſupply the quantity for which we had made advances. The morning was hot, a circumſtance in our favour as the ſellers of wool are in the habit of wetting it under an idea as they pretend of its twiſting the cloſer, but more probably to make it weigh heavier. However, after a little delay on our part, that the wool might dry as ſoon as poſſible, we had it weighed by a pole with a weight, on the principle of the ſteel yard, which the *Garpan* had ſent with us. As more was brought than we advanced for, we agreed to take it, on the principle of encouraging the *Garpan* to give more another year. The ſurplus amounted to 88 rupees and 1 *Timáſha*; and the *Garpan* had ordered rupees alone to be received, which ſhewed that he had given directions for more to be brought than we had contracted for, in order to try whether we really meant to purchaſe, or uſed the plea merely in his preſence to maſk other deſigns—at this place we found many *Jouárí* and *Dhán* merchants, who were troubleſomely inquiſitive as to who we were, what could be our motives for coming, and why we purchaſed ſhawl wool. The ſight of ſome of our wares ſeemed to convince them, that we were what we appeared to be. I conſider this day as the epoch at which may be fixed the origin of a traffic which is likely to be extremely beneficial to the Honorable Company.

Misar has only one houſe made of bricks baked in the ſun and 5 tents of goat-herds: it is ſituated upon a riſing ground upon the left bank of a rapid ſtream forming one of the branches of the *Satúdrá* or *Setlej*. This ſtream comes from 86.5 E. and runs down a valley about $2\frac{1}{2}$ miles in breadth and near 8 in length, running S. W. After a courſe of about $\frac{1}{2}$ mile, it joins that which we forded yeſterday.

July 31ſt.--THERMOMETER 34°. Ice $\frac{3}{8}$ of an inch thick. The changes of temperature, ſo frequent and rapid in this climate, require that the quadrupeds naturally belonging to it ſhould have ſome very warm clothing, to protect them againſt their ill effects; and we find that this has been very liberally beſtowed by nature. The ſheep has a very thick and heavy fleece; the goat has at the root of his long ſhaggy hair a very fine fur interſperſed generally; the cow has a material of the ſame kind, not much inferior in warmth and ſoftneſs, which I apprehend might prove a ſubſtitute for beaver; the hare has her fur of peculiar length and thickneſs; and even the dog has a coat of fur added to his uſual covering of hair--The wild horſe *(Equus Quagga*)*, the wild aſs *(Goorkhen, Onagre)*, and I believe the mule, the offspring of theſe animals,† are found in abundance on the mountains of *Tatary*; but whether they have any thing of the fur kind I cannot ſay; but that animal, which is here called the *Baral*,‡ and which ſeems to have many characters of reſemblance to the deer as well as to the ſheep, has certainly at the bottom of the brittle hair of the former the moſt beautiful brown fur I ever ſaw.

THIS morning the *Nerba* came to take leave of us, and as his behaviour had been uniformly attentive, I was deſirous of ſhewing him that we were ſenſible of it, and accordingly gave him a double bladed knife and my ſword. The latter was in fact no great gift, as it was bought at *Najibábád* for three rupees, and was intended ſolely for the journey. He was however highly pleaſed with the compliment. His name was THAR-CHAND; and he ſaid, that he was in the ſuite of the *Wazír*, and ſhould accompany him to *Laſſa*. He wore a pendant in one ear,

* Probably *Equus Caballus*, which inhabits in the natural ſtate, the deſerts of great *Tartary*. C.

† *Equus Hemionus*; which much reſembles the mule. C.

‡ *Ovis Ammon*? C.

in which, along with rows of ſmall turquoiſes, the never failing ornament of this part, was a large irregular pearl, ſuch as are in high requeſt in this country, on account of their ſize. Theſe I underſtand are brought to *Calcutta*, in conſiderable numbers during the rainy ſeaſon, from the *Lackadive* iſlands, and ſold at a very eaſy rate. The *Nerba's* outer garment was woollen, of green, red, blue, and yellow narrow ſtripes manufactured at *Guinak*, under this were four other garments; and both men and women conſtantly load themſelves with ſeveral veſts to prevent ſuffering from the cold.

On the back of this habit, and on the right ſhoulder were ſewed the ſaw, adze, chiſſel, rule, and all the inſignia of Free Maſonry in iron; the ſymbols of a fraternity, of which he ſaid he was a member. I purchaſed from him ſome gold duſt at the rate of 40 *Sirínagar Timáſhas* for the *Fitauk* of 7 *Maſhas*. The *Nerba* appeared to have gold duſt to the amount of about 5000 rupees; and it was underſtood, that every perſon, willing to become an adventurer in the gold mines, pays to the chief of the diſtrict one *Fitauk* as an entrance fee, and all lumps above a certain weight. This occupation is more profitable here, than in moſt other places; as though the gold digger works only three months, he expects that the reſult of his labour ſhould k ep him the whole of the year. Leave *Miſar* at ten A. M. having loaded our wool upon the yaks which brought it, and for the hire of which the *Nerba* would receive no gratification; the firſt inſtance of diſintereſtedneſs I have witneſſed in this country. At 4500 paces enter *Tírtápúrí*. At 4525, paſs ſeveral piles of ſtones inſcribed as is uſual, and ſome figures carved in ſtone and painted. Reach the ſummit of the height at 4575 paces and encamp.

Tírtápúrí is the reſidence of a *Lama* and ſeveral *Gelums*, who live in ſeparate houſes made of rough ſtones, and follow a paſtoral life.

It is perched upon the top of an eminence, about 200 feet higher than the plain, and has Table Land running from it eaſtward. Steep, craggy, lime ſtone rocks in a ſtate of decompoſition immediately overhang it, threatening ſome of the houſes with deſtruction at no diſtant period. Inſulated pillars, which have reſiſted the influence of the weather longer than the ſofter portions of ſtone by which they were ſurrounded, ſeem upon the very point of falling; but apparently give no alarm to the inhabitants.—Still higher, and loſing their heads in the clouds, are pointed mountains, which from their brilliant whiteneſs, appear to conſiſt of chalk, covered here and there with a layer of yellow ochre. Immediately at the foot of the rock, on which the buildings ſtand, runs a very rapid ſtream, which is ſaid to proceed from a lake at the foot of the *Himálaya*, called *Ráwan hrád*, and to conſtitute the principal branch of the *Satúdrá*.

To the Weſt of the town, and about a quarter of a mile diſtant, are the hot ſprings, forming one of the moſt extraordinary phænomena, I have ever witneſſed. From two mouths, about 6 inches in diameter, iſſue two ſtreams, bubbling about 4 inches higher than the level of the ſtony ſubſtance whence they eſcape. The water is very clear, and ſo hot, that the hand cannot bear to be put into it for an inſtant; and a large volume of ſmoak curls round them conſtantly. They burſt forth from a table of calcareous ſtone nearly half a mile diameter, and raiſed in moſt places ten or twelve feet above the plain on which it ſtands. This has been formed by the depoſit from the water of the ſprings whilſt cooling. Immediately ſurrounding the ſprings, the ſtone is as white as the pureſt ſtucco. The water flowing over a ſurface nearly horizontal, as it eſcapes from the vents, forms ſhallow baſins of different ſize and ſhape. The edges of all theſe baſins are curiouſly marked with indentations and projections, like the tops of muſhrooms and fleurs-de-lis, formed

by calcareous matter prevented from uniting in one uniform line by the continual but gentle undulation of the water entering into and eſcaping from the ſeveral baſins which are emptied by ſmall and ſucceſſive falls into the ſurrounding plain. By degrees, however, the fringed edge becomes ſolid, and contracting the baſin, of which the hollow fills likewiſe, the water takes a new courſe and makes new reſervoirs which in their turn become ſolid. Although the water appear perfectly tranſparent, the calcareous earth, which it depoſits, is of different colours; in the firſt inſtance, near the mouth, it is delicately white without a ſtain; at a little diſtance it aſſumes a pale ſtraw tint; and further on, a deep ſaffron hue: in a ſecond the depoſit has a roſy hue, which, as it recedes from the ſource, becomes of a deeper red. Theſe various colours are depoſited in the ſtrata, which hardening, retain the tinges they received when ſoft; and, give riſe to variouſly ſtratified and veined ſtone and marble. The whirls, twiſts, knots, and waves, which ſome of the fractured edges exhibit, are whimſically curious, and ſhew all the changes which the ſtony matter undergoes, from ſoft tufa to hard marble; I obſerved that the marble is generally formed in the middle of the depth of the maſs, riſing up with nearly a perpendicular front of the height beforementioned: the table muſt have been the work of ages. The calcareous matter, which is ſo largely diſſolved and ſuſpended by the water whilſt hot, is probably furniſhed by the chalky mountains above *Tírtápúrí*, but the origin of the heat, I have no clue to diſcover. The water muſt be moſt ſtrangely ſituated, for two ſtreams ſo inconſiderable to throw down ſuch a prodigious quantity of earth; and the ſurface where quiet is alſo covered with a thin cruſt of ſemi-tranſparent matter like that which riſes on ſuperſaturated lime water.

At this place, I left the wool which I had obtained at *Miſar*. The

Lama was abſent when I took the liberty of depoſiting the wool in the verandah of the temple of one of the deities: therefore it remains to be ſeen, ſhould he return before I do, how he may approve of this ſtep. However, from what I have ſeen of the prieſthood here, they are an inoffenſive claſs.

NEARLY oppoſite to his houſe is a broad wall of ſtone, 150 yards long and 4 feet broad, covered with looſe ſtones inſcribed with prayers. The length of time which muſt have elaſped before ſuch an extent of ſurface could have been ſo decorated by the hands of pilgrims, ſhows the great antiquity of *Tirtápúrí*. There are many little *Mat'hs* having niches in one ſide, in which are impreſſions, in unburnt clay, of *Lamas* and deities, and on ſome of the piles of ſtones are figures of *Lamas*, of *Nárâyan* and of *Bhaſmáſúr* carved on large flat pebbles.

Auguſt 1ſt.—THERMOMETER 40°. Leave the yak cows, calves, and my goats.—Commence our march at 10 A. M. meet a party of *Unias* going with ſeveral loaded yaks to the fair at *Ghertope*. The manes of the yaks were dyed yellow with the *Geru* earth. At 12800 paces come to our ground and encamp in a green pleaſant ſpot, in a hollow ſurrounded with many ſprings, at 4^h 30′ P. M. At 8 P. M. Thermometer 46°.

Auguſt 2d.—THERMOMETER 32°. A ſevere froſt during the night—ice a quarter of an inch thick over ſtanding water. March at 10^h 20′. At 10825 paces a large ſheet of remarkably blue water at the foot of the mountains to the right, called *Ráwanhrad* ſaid to give riſe to the principal branch of the *Satúdra*, and to communicate by a river with the lake *Mánſarowar*, named by the natives *Mapang*. *Ráwanhrad* bears S. 25 E. diſtant 8 miles. At 16327 paces halt and

encamp at 5 P. M. At 7 P. M. thermometer 47°. This day we ſaw more wild horſes than on any former one, alſo ſeveral wild aſſes of the kind, called *Gûrkhar*, and likewiſe I believe ſome mules. The aſſes are a little leſs than the horſes. Saw likewiſe *Barals* and many yaks.

Auguſt 3d.—SLIGHT froſt, thermometer 34°. March at 9h 50′. At 7287 paces, croſs a ſtream over a wooden *ſankhoo*. At 7325 encamp on a high ſpot. This is *Gangrí* or *Darchan*. There are four houſes of unburnt brick or ſtones, and about twenty-eight tents, amongſt which that of the ſervant of the *Latáki* agent is apparently the beſt. Sixteen years ago the old pundit ſays this was a place of conſequence. There we find many *Juarí* and *Dhérmu* merchants with grain, and three tea merchants, who ſay they are acquainted with *Pekin*, which they call the capital of *Maháchín*: but they themſelves reſide two months journey beyond *Pekin*. The *Tatars* of the diſtricts we have ſeen, wore their hair plaited: theſe people had it cut all round, ſo that it hung low and looſe in their necks, and they wear coats of kid ſkins made ſoft by rubbing, and the hair turned inwards.

A CASCADE iſſues from the rocks juſt above *Darchan*, and falls into the *Ráwaṅhrad*, which is ſupplied by the melting of the ſnow on the great mountains at the foot of which it is ſituated. It is ſaid to ſurround a conſiderable extent of mountains, inſulating them completely; but this, being the relation of natives, is to be received with caution.

Auguſt 4th—THERMOMETER at 7h A. M 57° We were reſolved to ſtay here to-day to recruit my ſtrength, which ſtood much in need of it after frequent attacks of illneſs.

Auguſt 5th.—THERMOMETER 48°; Leave *Darchan* or *Gangrí* at 10h

30'. At 2675 paces croſs a ſtream which in five or ſix branches comes from the *Cailás* mountains and diſembogues itſelf into the *Ráwan-hrad*. At 13235 paces reach the top: ſee a fine looking wild horſe.—Deſcend to five tents: a wild aſs grazing cloſe to us, and a prodigious flock of ſheep and goats. The lake of *Mánſarówar* or *Mapang* now appears at the foot of a long declivity of paſture bounded by immenſe mountains towards the South, and, having in front terraces of ſtone with the uſual inſcriptions, and a houſe inhabited by *Gelums*.

Auguſt 6th.—HALT on the bank of the lake *Mánſarówar*. Morning early, thermometer 47.° This lake is conſidered as the moſt ſacred of all the places of worſhip in the opinion of the *Hindus*, founded probably on the difficulty of acceſs to it, not merely on account of its diſtance from *Hindúſtan*, and the ruggedneſs and dangers of the road, but from the neceſſity of every pilgrim carrying with him money and proviſion, which latter he muſt occaſionally eat without any preparation on account of ſcarcity of wood. Few *Jógís* can afford the expence of this journey; and I met with two on the road, who muſt have returned for want of funds if I had not borne their expences. The name is derived from *Mán** and *ſarówar*, a *Sanſcrit* word ſignifying a lake. The ſtory upon which this appellation is founded is related at great length in the *Sáſtra*. Why it is called *Mapang* by the *Unias* or *Chineſe Tatars*, I have not been able to learn: but it is conſidered by them an act of religious piety and duty, that the neareſt relation of a dead perſon ſhould carry a portion of the aſhes of the deceaſed, and empty them out of a ſmall bag into the lake, as is practiſed at *Hardwár*.

HINDU geographers have derived the *Ganges*, the *Satrúdrá* and the

* At full length *Mánaſa*, divine: made by BRAHME, named MANAS, the mind, emphatically. C.

Kali or *Gogra* from this lake; and as I believe no *Europeans* ever before viſited it, I was anxious to aſcertain whether it really gave riſe to the two laſt mentioned rivers or not—as to the former, it is quite clear from the obſervations made in this journey, coupled with thoſe in the trip undertaken at the ſuggeſtion of the late Colonel COLEBROOKE by Meſſrs. RAPER, WEBB, and HEARSAY, that the *Ganges* derives its ſupplies from the melted ſnow of the mountains of the *Himálaya*, and a thouſand ſmall ſtreams, which fall into its various branches during their paſſage from theſe ſtupendous rocks to the great common mouth at *Hardwár*; and that it does not receive the ſmalleſt ſtreamlet from their extreme Northern face, nor from a ſource to the Northward of them.

HARBALLABH, the old pundit reported, that near the South-weſtern corner, a river iſſued from it, which flowing in a weſterly direction went along the *Ráwarhad*, and eſcaping from its Weſtern extremity near the foot of the great mountain, formed the firſt branch of the *Setlej*. Yeſterday evening I mounted upon a very high bank, and thought that I perceived diſtinctly the whole of the line of the ſhore, without ſeeing any outlet, with the exception of a ſpace near the S. W. angle which a projecting rock concealed from my view. Determined not to leave this point in doubt, I took a fiſhing rod and gun, thinking that I ſhould have time to amuſe myſelf a little in one or other diverſion and return by the evening.—At about ten I began my march; and, although very weak from the frequent attacks of fever to which I had lately been ſubject, I felt confidence that I ſhould accompliſh het object without any material degree of fatigue—as we were encamped about the middle of the northern ſide, I walked along the ſhore towards the Weſt—The beach was formed of fragments of ſtones rounded, and thinned when of ſmall ſize, by the continual action of the waves: but in ſome places great maſſes of red and green granite, marble, and lime ſtone had

fallen from the face of the rock, which in many parts was 300 feet perpendicular. Theſe ſtones frequently waſhed by the ſurf, and glazed by the ſun, afforded a very unſafe footing: however, at this time it required only care to prevent falling, which would have endangered a limb, as ſome of the ſpaces betwixt the ſtones were very deep. The ſteep band was here and there cut by profound and precipitous water courſes, now dry; but occaſionally ſerving to convey the ſnow water from the high tables upon the head of the bank into the lake. The front of the bank at the height of from ten to thirty yards, had houſes of looſe ſtems and wood built in receſſes upon ledges; but, as there were no ſtairs to them, I thought them inacceſſible to human beings, except by means of ladders, of which I ſaw none. They were inhabited, as I beheld ſmoke iſſue from many, and are I preſume the ſecluded retreats of monaſtic recluſes of both ſexes. One of theſe nuns accoſted me by the name of *Guni Lama*, and returning along with me, pointed to one of the rock habitations, which I concluded to belong to her, and appeared by her geſtures to invite me to it. However I was ſo ungallant as to refuſe the lady's hoſpitality: for I cannot ſuppoſe that ſhe had any other motive for her civility than to offer me refreſhment or to aſk charity, the diſpoſition to which, the view of the inconveniences ſhe was ſubjected to, by ſuch a lodging, might poſſibly excite. A weather-beaten, face, half ſtripped of its natural covering by the joint action of a hot ſun and cold wind, bliſtered lips, a long buſhy beard, and muſtachios, in a country where the former is carefully plucked out, with a gait not of the firmeſt, had probably raiſed emotions of pity, and induced her to think I might ſtand in need of repoſe. Be it as it may, with the moſt cordial ſalutation and expreſſion of thanks by dumb ſhow, I took my leave, and went on with my ſurvey.

After an hour's walk, the beach changed to a deep ſand, in ſome

places pure and in others mixed with pebbles. That on the water's edge was bordered by a line of wrack graſs, mixed with the quills and feathers of the large grey wild gooſe, which in large flocks of old ones with young broods, haſtened into the lake at my approach; and though I fired ſeveral times with buck ſhot, few took effect, from too great diſtance. Theſe birds, from the numbers I ſaw, and the quantity of their dung, appear to frequent this lake in vaſt bodies,* breed in the ſurrounding rocks, and find an agreeable and ſafe aſylum when the ſwell of the rivers of *Hindúſtan* in the rains, and the inundation of the plains, conceal their uſual food. Many aquatic eagles perched upon the crags of rock; and ſeveral kinds of gulls ſkimmed along the ſkirts of the water. An unuſually large body of great black gnats along the beach rendered walking troubleſome from their aiming to get into the noſe, mouth, and eyes: but, when the wind lulled, which it did for half an hour, they flew along the ſurface of the water, and became the prey of a kind of trout without ſcales, which roſe at them with extraordinary voracity, and with which the water ſeemed to be literally alive. I hoped by rounding the N. W. corner to have had ſport by throwing acroſs the wind; but it then ſuddenly chopped about, and a heavy ſurf beat upon the Weſtern ſhore. As the bank approached this angle, it declined to gentle elevations leading to interrupted Table Land, and at its baſe was a large bay, from the bottom of which roſe a pyramidical red rock, connected with a line of ridge of high land to the higher flats to the North, and ſteep towards the South. Upon this was the houſe of a *Lama* and many *Gelums*, pitched in ſituations which produced a romantic effect, not a little heightened by ſtreamers of various coloured cloth and hair, floating from high poles fixed on the corners and roofs of the houſes. Leaving this and divert-

* From the known reſort of the grey gooſe (the ſwan of *Hindu* poets) to this lake, the bird is called in poetic language *Manaſaucas*, or he, whoſe abode is the *Manaſa* lake. *Am. Coſh. b. 2. c. v. v. 23.* C.

ing my ſteps to the South, I went along the baſe of granite rocks amongſt ſuch troubleſome, rugged and ſlippery ſtones, as had interrupted my progreſs in the outſet, till I reached a high, level, and firm bank, which ſeparated the water of the lake from that which accumulated by the ſlope of the ſurrounding upland, directing the melted ſnow into it. At the end of this natural barrier, I ſaw a point of rock running into the lake, from the top of which I flattered myſelf I ſhould have a proſpect that would command the whole of the ſhore to the S. W. corner, and put an end to a taſk which I now found ſomewhat too much for the little ſtrength I poſſeſſed—But I was ſeverely diſappointed: for, on mounting a ſteep hill, of which the point in queſtion formed the front to the lake, another large mountain intervened to prevent my view, with a deep valley between it, and that, which I had too haſtily concluded would finiſh my labour. When I had reached the ſummit of this, another equally high preſented itſelf. My ſervants were much fatigued: for my own part, I was obliged frequently to lay down; and it was four o'clock when I reached a ſmall religious pile, whence I got a fair ſight of the ſhore I was ſo anxious to ſee, with the exception of a very ſmall portion that was intercepted by the projection of a high bluff angle ſtarting into the lake: unable to proceed from the aching of my limbs and intenſe thirſt, which I could not gratify, I ſent a truſty *harkárah* to explore the angle which was concealed from my ſight. The ſky, which had frequently been overcaſt and diſturbed with violent guſts of wind, now became clear, and ſunſhine illuminated the whole of the circumference of the lake, ſo as to enable me diſtinctly to define every portion of its ſhore cloſe to the edge of the water, and up to the foot of the mountains, by which it is embayed, with the exception of the point to which I had directed the *harkárah* to proceed: there were numerous traces of watercourſes leading into it, the moſt important of

which was the *Kriſhná* ſweeping down a ravine between two high mountains of the *Himálaya* range, and expanding like a ſheet as it approached the verge of the lake; but not a break, nor any other appearance indicated the eſcape of any river or even of any ſmall ſtream from it.—Although this was clear enough to the naked eye, I employed a teleſcope; and this as well as the evidence of two ſervants who gave me an account of what they ſaw, ſhewed that the *Mánſarowar* ſends out no rivers to the South, North, or Weſt.

At half paſt four I began to return, and deſcended to the ſhore, which was a bed of round pebbles that had fallen from the ſide of the mountains. Large maſſes of theſe ſtones imbedded in a hard cement like old firm mortar, in ſome places obſtructed the path, which apparently was more uſed by yaks than trodden by the feet of man. I was in hopes, that I ſhould be able to reach the N. W. corner before the fall of night; and by aſcending the high Table Land, that formed the ſummit of the Northern bank, avoid the deep ſand and dangerous ſtony beach which I had traverſed in the morning. Walking upon a flat ſurface in ſome degree relieved the active aching and ſpaſms of the thighs and legs brought on by great exertion in climbing and deſcending, but did not take away the ſoreneſs of the muſcles. However I laboured to the utmoſt extent of my power, but was much impeded in my progreſs by a ſtrong wind which poured into the lake with vaſt impetuoſity from the Weſt, and rendered breathing difficult. Since morning the wind had ſhifted four times, and had only been a little ſtill for half an hour. In ſpite of all my endeavours I could not attain the granite rocks to the S. of the *Lama's* houſe before night came on; and by another ſudden change of the wind, the ſurf was thrown ſo high on the ſhore, as to efface all traces of the path, and leave ſcarcely room enough to paſs between the face of the rock and the water.—In a ſmall receſs

we lay down for a few minutes; and as I had not ſeen the ſurface of the high land on the North, and the night was dark, I thought it on the whole more adviſable to encounter the fatigue of wading through the deep ſand, and the riſk of injuring our legs and feet amongſt the ſtones, than have the chance of falling over the precipice of the rock, or into any of the deep ravines by which its ſurface was broken. But there was another inconvenience, that was unforeſeen and very annoying. The wind had put in motion the dry ſand on the weſtern extremity of the northern ſhore, and this roſe into our eyes and almoſt blinded us—The ſervants, who were with me, had eaten nothing ſince the day before; I had only taken a cup of tea in the morning, and, though in health, they were little leſs exhauſted than myſelf. For my part, from the violent pain in my limbs and the ſingularly accelerated action of breathing, I was compelled to ſit down every ten or fifteen minutes; and was in one of theſe halts overtaken by my *harkárah*, who reported that he had gone nearly to the foot of the *Himálaya* mountains covered with ſnow, and had not ſeen the ſmalleſt trace of any river iſſuing from the lake. At half paſt eleven, benumbed with cold and completely overcome with fatigue, I reached my tent, where a cup of warm tea was a moſt welcome refreſhment.

Auguſt 7th.—THERMOMETER 49. Found my eyes inflamed; and obſerved that thoſe who were with me, had alſo ſuffered in the ſame organ. Sent for HARBALLABH, and obſerved to him that the river which he had croſſed on *Sankhos* ſixteen years ago, did not as he ſuppoſed proceed from *Mánſarówar*, but from ſome part of the *Hímálaya* to the weſt, and taking ſuddenly a weſtern courſe, fell into *Ráwanhrad*, and led him into error on this point. He was very poſitive on the ſubject; ſaid he could bring the evidence of all the inhabitants of the neighbourhood in ſupport of the truth of his aſſertion, and that my *harkárah*

had not gone as far as I ordered him to do. To ſettle this matter, the ſame *harkárah*, and HAR DEO, the young pundit, were directed to proceed as far as the ſouth weſt corner. At half paſt eleven at night, they returned much fatigued and ſuffering from the cold.—They ſtated, that they had gone beyond the ſouth weſt corner and within 500 paces of the *Kriſhna* river on the ſouth ſide, without finding any appearance of a river iſſuing from the lake, or of any former bed of a river which had eſcaped from it. The diſtance of the *Lama's* houſe from our encampment was 3521 paces; from the former place, to the foot of the mountain, from the top of which I made my ſurvey, 12500 paces: they went 5000 paces farther, making in the whole 21621 paces, or about eighteen *Engliſh* miles; which doubled by their return, made their day's journey thirty-ſix miles. According to their calculation, my journey conſiſted of twenty-four miles: but adding the croſſing of the hills, it may fairly be eſtimated at three more. The diſtance altogether is but trifling; yet the circumſtances of my weakneſs from previous illneſs, the badneſs of the road, being benighted, &c. rendered its performance very diſtreſſing.—However, the fact of *Mánſarówar* giving riſe to no large river has been aſcertained by it. The old pundit remained much diſſatisfied with the deciſion, and a *Latáki* traveller aſſerted, that eight years ago the ſtream, which he mentioned, actually exiſted; and that it ſince that period dried up, and the bed has filled. Perhaps an earthquake may have been the agent in this effect. I believe the period aſſigned tallies with that which was ſo miſchievous at *Sirinagar*, and might have extended to this place.

MÁNSARÓWAR or *Mapang*, of which we had no means of aſcertaining by aſtronomical obſervation, the exact geographical ſituation, is bounded on the ſouth by the great *Himálaya*, which pours its liquified ſnow into its baſin; on the Eaſt by a prolongation of the *Cailás* ridge; and

on the north and weſt by very high land under the form of mountain, table, ravine, and ſlope, all declining towards it. In form it appeared to me oblong; the ſides of the eaſt, weſt, and ſouth nearly ſtraight, that of the north and eſpecially to the north-eaſt where there is a plain at the foot of elevated land, indented and irregularly tending to the eaſt The angles were not ſharp, or its figure would have approached nearer to a ſquare than any other; but it may be conſidered as an irregular oval. Its breadth from ſouth to north, I eſtimate at about eleven miles; its length about fifteen. The water, except where diſturbed by the wind near the beach, where it is ſandy, is clear and well taſted. No weeds are obſervable on its ſurface, but graſs is thrown upon its banks from the bottom.—The middle and ſides fartheſt from the ſpectator reflect green; and, taken altogether; it has a noble appearance, whether in an agitated or a quiet ſtate. We had however but little opportunity of ſeeing it unruffled; for the changes of temperature of the atmoſphere are here extremely frequent and ſudden, attended with great mutability in the wind.—Conſidering the heat of the ſun in the middle of the day, the vaſt bodies of ſnow on the ſummits of the neighbouring mountains, which produce their influence when the ſun begins to decline, and the breaches and gullies through the ranges of hills, it is not ſurpriſing that there ſhould be an almoſt continual conflict between oppoſite currents of air, or that the ſhifts of temperature ſhould be frequent and great.—At what ſeaſon this large baſin is moſt full I could not learn; but I apprehend this muſt be the drieſt ſeaſon, as the greateſt part of the watercourſes which I ſaw were dry. But I found no appearance of water-mark above four feet higher than the preſent water line; which would be wholly inſufficient to produce any overflow of its banks.

I saw a great number of ſkeletons of yaks between the low and high

water mark; and, although the bones of the trunk and limbs were bare and bleached, the head was in almoſt every inſtance, and particularly its fore parts, covered with the ſkin to which the hair adhered. I could get no account of the cauſe of the number of the carcaſes: but think it probable, that in the ſevere ſeaſon the ſpace between the banks and the water is filled by drifts of ſnow, and that the yaks going towards the lake fall into them, and are ſuffocated. Adverting to the inſtinct and experience of this animal, this ſolution may be erroneous: but I have none better to offer.—At firſt it occurred to me that they might have been ſacrificed: however enquiry did not bear out this conjecture; nor could I diſcover any ground for thinking that theſe creatures are ſubject to epidemical diſeaſes, which might have compelled them to reſort to the lake, either to quench their thirſt, or to alleviate their ſufferings by bathing. With regard to the preſervation of the ſkin in the fore-part of the head, this would ſoon dry from the influence of alternate heat and cold, and there being little muſcular ſubſtance between it and the bone to become ſoft and enter into putrefaction.

Auguſt 8th.—Begin to return towards *Hindúſtan*; thermometer 45°.—Mr. H. cut his and my name on a ſtone and left it in a ſecure place. At eleven A. M. march. At 9100 paces paſs tents of *Tatars* and *Juáris*: croſs a watercourſe, at 10200 paces, which was dry, when we went toward *Mánſarówar*, but is now two feet deep. At 12126 paces encamp near ſeven or eight tents. The valley of *Gangrí* is about twelve miles broad and near twenty-four long. At the eaſtern extremity is *Mánſarówar*: oppoſite is *Ráwanhrad*.—The latter lake has always been repreſented as ſurrounding ſome large portions of rock a little detached from the great *Himáchal*: however the view, which I had of it, completely deſtroys this idea. It conſiſts of two legs, which are long, and not

very broad; one leg runs eaſtward towards *Mánſarówar*, is ſtraight, and ends in a point; the other goes to the ſouth amongſt the hills; and their divergence, forms an angle almoſt directly oppoſite to the town of *Gangrí* or *Dercham*. I think I ſaw a ſtream iſſue out of it at the weſtern ſide of this angle, which probably communicates with the many ſtreams which form the *Setlej*: but this point I purpoſed to make out decidedly.

Auguſt 9th.—THERMOMETER 42°. I ſuffered much from fever, and was unable to go to *Ráwanhrad*. About ſun-ſet the wind became very high, and thick clouds with loud peals of thunder announced the approach of a ſtorm.—This began with hail, turned to rain, and at midnight a fall of ſnow took place which laſted till morning.

Auguſt 10th.—AT ſix in the morning, thermometer 32°. Our tents covered two inches thick with ſnow which continues to fall. The ſtreams on the plain much ſwollen, many parts covered with water that were quite dry yeſterday. The ground very poachy, all proſpect of viſiting *Ráwanhrad* given up, and anxiety felt, leſt a continuance of this weather ſhould fill the paſſes of the *Himáchal* with ſnow, and exclude us from *Hindúſtan*. *Ráwanhrad* receives many rivulets from the ſouthern face of the *Cailás* ridge; but a large body of water, it is probable, falls into it from the northern front of its ſnow capped neighbour the *Himáchal* range.—I much regret to leave unſettled the queſtion of a branch of the *Satudrá* proceeding from it; but muſt bow to the neceſſity of the caſe.

ON its banks vaſt numbers of wild geeſe are bred, and it is probably better ſtored with fiſh than *Mánſarówar*, as one edge of its banks is fringed with graſs of conſiderable height, and there is ſwampy land at the

mouths of the ſtreams which empty themſelves into its boſom. At a diſtance its water was of an indigo blue. The eaſtern leg appeared about five miles in length; of that of the ſouthern one I could form no opinion, as it was loſt in the mountains. The name is derived from *Ráwan* ſo much famed in the *Rámáyana*, and the *Sanſkrit* word *hrad* ſignifying lake. The principal ſtreams, which riſe in the *Cailas*, and diſembogue, are 1ſt, The *Siva Gangá*; 2d, *Gourí Gangá*; 3d, *Darchan Gadráh*; 4th, *Cátyáyaní*; and there are many others without names. It is ſaid to be four times as large as *Mánſarówar*: but of this I can give no opinion. We have been forced to remain here all day. At nine the ſnow ceaſed to fall, and was followed by rain that continued till three. At twelve, thermometer at 62°. At ſun-ſet rained again; thermometer 43°. About midnight the rain ceaſed.

Auguſt 11th.—THERMOMETER 42°. March at 9¼, over a plain which is very poachy. Our yaks, though very ſtrong, labour through the ſoft ground into which they frequently ſink up to their bellies; but if left alone, would feed and wade along. *Engliſh* oxen would be much diſtreſſed and frightened in ſuch quaggy ſoil. A hail ſtorm induces us to halt at 9825 paces near a ſmall river at three o'clock. Thermometer, Even. 49°. *Cailás* mountain is ſuppoſed to be the favorite reſidence of MAHÁDÉVA, and is ſituated oppoſite to the great lake of *Ráwanhrad*, and little diſtant from that of *Mánſarówar*. As its ſummit is always cloathed with ſnow, it is but a cool ſeat: however this cold is ſaid to be neceſſary on account of the poiſon which has heated his frame ever ſince he ſwallowed it at the period of the *Sankh Avatár*.

Auguſt 12th.—THERMOMETER 40°. A party of people, having in charge a body of about ſeventy yaks loaded with *Awajow* in ſacks, paſſed our encampment in the direction which we mean to take. March

at 8¼. At 2400 paces, many wild aſſes, and ſome animals, which are thought more like mules than either horſes or aſſes. At 6780 *Gangrí* valley ends. The declivity goes to the left, and the water of this land falls into the *Tírtápúrí* river. At 7000, meet the old road. At 12,969 reach our ground oppoſite to our former encampment.

Auguſt 13th.—THERMOMETER 37°. March at 9h 15′. At 3970 paces fall into the *Miſar* road. At 4460 deſcend to the bed of a rapid river, which we paſs over a *Sankho*. Here we found many *Gelum* families of *Tatar* ſhepherds, who had been carrying to *Mánſarówar* the aſhes of their deceaſed relatives. At 5315 paces deſcend to another river in rapidity and volume of current, ſimilar to the former. As there was here a *Sankho* three feet in breadth, we thought it right to attempt to force our yaks over, loaded; but they diſliked going on account of the height of the planks from the water, and the roaring of the river as it deſcended through the contracted channel. One, which was cloſely preſſed, preferred leaping into the water from a bank of ſtones ſeven feet high, and ſwam under the bridge to the oppoſite ſide loaded. At 14,886 paces reach *Tírtápúrí*. Wait in the veranda of the temple, where our wool is packed, until the arrival of our cattle with the baggage, which did not take place till near ſeven in the evening. Went into the temple to hear the *Gelums* repeat their veſpers, the recital of which was accompanied with cymbals, and the beating of a deep toned drum. The performance of the ceremony was preceded by the blowing of conchs from the top of the temple. We generally found the *Gelums* aſſiſted by the *Juárís* or *Dhármís*.—One of theſe men ſaid that the breach of chaſtity in a nun was compenſated by a fine of fifty rupees, and that of a monk or *Gelum* by one of ſixty.

Auguſt 14th.—HALT at *Tírtápúrí*. Thermometer 38°. A report cur-

rent amongſt the *Juáris* and *Dhármis*, that the *Gorkhálí* governor of *Srínagar* has written, that he underſtands two *Europeans* have gone by the *Níti*, and two others by the *Dharma* paſs into the *Undés*. He deſires information may be conveyed to him, as to who they are and with what intention they are going.

Some *Juáris* whom we here met, were concerned in the tranſaction reſpecting conveying ſhawl wool to *Belebré* fair for Mr. Gillman, which had excited the attention of the *Latákhis*, cauſed their complaint to the *Garpan*, and his ſevere edict againſt the clandeſtine ſale of this article. One man told me, that he had been ſeized by Ahmed Khan the *Latákhí*, for having a ſmall quantity in his poſſeſſion, which he ſaid he was about to make into *pankhís*. This day I was much indiſpoſed with fever.

Auguſt 15th.—Thermometer 44°. March at 9h 30′: at 4700 paces come to an aſcent of high Table Land. At 5836, a large river ſuppoſed to iſſue from *Ráwanhrad* joins the *Térat* river, at S. 30 E. diſtant 1¼ mile, the little ſtream falls into it here likewiſe. The ſtream reſulting from this junction now takes the name of the *Satudrá*. At 6325 arrive at ſome mud temples with many caves in the rocks, ſhewing the place to have been once a winter reſort of the *Úniyas* but now deſerted. A violent ſtorm of wind, thunder, lightning, hail, and rain now ſets in and laſts till nearly an hour.—Rains again at ſun-ſet. Thermometer 59°. Find two *Juáris* encamped here on the road to *Kien-lung*: one of theſe traders reproached us with ſpoiling their market, by ſelling our goods at too low a rate. The *Juáris* have hitherto been the principal medium through which the *Úniyas* have received, ſince the conqueſt of the hills by the *Gorkhálís*, the produce of *Hindúſtan* and *European* merchandize; and they have ſold their wares at ſo high a rate, as to have confined the demand to a few rich individuals, ſuch as the *Garpan*, *Débas*, and *Nerbas*.

Auguſt 16th.—THERMOMETER 45°. March at 8^h 30′. River remaining cloſe to the left. The low warm ſwampy land in the vales about *Tírtápúrí* gives a graſs, which is cut and carried as hay for winter proviſion, for the horſes of the *Garpan*, and the people of *Kien-lung*, *Dábá* and *Dúmpú*. The grain called *Awa-jau* raiſed in *Tackla-kote* is alſo given to them during the rigorous ſeaſon, and ſaid to be hearty food. As this grain grows in a rigorous climate, it is worth while to ſend ſome to *Britain* for the uſe of the inhabitants of the weſtern iſles.

AT 5280 paces, reach a ſteep rocky paſs of a ſtone laminated, rolled and whirled as at *Tírtápúrí*, and apparently bound by the ſame agency. As 5600, broken ground preſents appearances ſimilar to thoſe in which gold duſt is found. At 5740 immenſe maſſes of broken rock of a brown colour, much veined with quartz, in the cavities of which is much rock cryſtal; that, which is ſmall, generally tranſparent and regular in form; the large cryſtals ordinarily diſcoloured, full of flaws, and fractured or ſhivered. At 6737, water drips over an inclined plain of rock and taſtes ſalt and nauſeous. At 7178 hot-water flows from the rock and covers the edges of its courſe with ſtony concretion of a yelloviſh colour. At 9465 reach a good *Jankho* over the *Setlej* about fifteen paces long, four feet broad. On the right bank a natural fountain throws hot-water a foot above its level, the edges of which are covered with a compact, hard, white, tufa at a diſtance looking like ice. Come to our ground at 4^h 10′: wait in a cave till our baggage arrives. Have this day come 9765 paces, and encamp in a hollow ſurrounded by rocks formed by hot-water, oppoſite to the town of *Kien-lung*, ſituated on ſpires of rock on the right bank of the *Setlej* diſtant $\frac{3}{4}$ of a mile. The road of to day has been of a very rugged deſcription; and the yaks with the wool and baggage were obliged to make a circuitous route over the tops of the hills, in order to prevent the loads being knocked

off by the ſtones which projected from the ſides of the path that we took. Yet, notwithſtanding, many of the loads fell, and at night it was diſcovered that the ſirkar's bundle was miſſing, along with a ſmall packet of *Caſhmír* ſaffron which I had bought from the *Latákhi* agent.

The whole of the country, from *Tirtápúri* to *Kien-lung* or *Chinglung*, exhibits abundant proof of the preſence of minerals, and the rocks teem with ſprings of hot-water, impregnated with various mineral and ſaline ſubſtances, which we had neither leiſure nor means to analyſe: the ſprings of *Tirtápúri* ſeem charged with calcareous matter alone, which in proceſs of time becomes lime ſtone, marble, and calcareous ſpar. Near *Kien-lung*, the hot-water contains calcareous matter mixed with ſalts. Still nearer to this town, it is charged with iron; and oppoſite to *Kien-lung* is a cavern into which drips water highly charged with ſulphuric acid. This cavern is about twelve feet in breadth, at its mouth five feet high, and about fourteen feet in depth, from the entrance to the back part. The floor conſiſts of projections of calcareous matter mixed with ſulphur, and cavities or pools of water about four feet deep, tranſparent, highly charged with ſulphur. Hot ſulphureous vapour iſſues through numerous holes in the floor, and a perſon is thrown into perſpiration almoſt immediately, without his breathing being incommoded, by the ſulphur ſteam, provided he ſtand upright; but he is ſeized with coughing and a ſenſe of ſuffocation, if he crouch on the floor as happened to a *Hindu* who ſat down. This occurs likewiſe in the grotto *dei cani*, and ariſes merely from the ſpecific gravity of the ſulphureous gas being greater than that of the atmoſpheric air, with which it does not mix with celerity. The ſides of the cavern were formed by calcareous matter, and flour of ſulphur, in ſome places ſtraw colour, in others of a deep brimſtone hue. The proportion of brimſtone to the other material is nearly two to one. The ſide is ſo ſoft, that it may be ſcooped off by

the hand, and is a little moiſt. It is rubbed into powder with eaſe, and then mixed with oil which unites with the ſulphur, and the calcareous matter ſubſides. Coal has not yet been found by the natives; and fuel is only afforded by the furze in ſmall quantity. If fuel were plentiful, I apprehend, that many hundreds of tons of ſulphur might be obtained from this cavern and the immediately ſurrounding calcareous rocks, which, even where white, is highly charged with ſulphur. Immediately in front of the mouth of the cavern, and forming as it were its threſhold, is a mound of calcareous ſtone, through chinks of which ſpring many jets of hot-water perfectly tranſparent, and of a ſmell and taſte very ſimilar to that of *Harrowgate*. The vaſt walls and maſſes of rock which have been formed by the action of hot ſprings in this neighbourhood, ſhew an antiquity that baffles reſearch and would afford food for ſceptics.

The town of *Kien lung*, conſiſting of about a hundred ſmall houſes, built of unburnt bricks painted grey and red, is ſituated upon the ſummit of a cluſter of ſpires or natural pillars of indurated clay in the face of high banks of the ſame material, which overtop it by at leaſt a hundred feet, whilſt the town itſelf is at leaſt 200 feet above the bed of the river, and in a retiring angle. This kind of ſituation ſeems particularly affected by the *Únias* for their winter retirements; and the preference is founded upon judicious principles; for, from the conical ſhape of the pinnacles which form the foundation of the houſes, the ſnow ſlips from them and falls into the valley below, the height of the rocks behind guards them from the force of the winds which ſweep over the ſummits of the hills, and the elevation of the town above the level of the plain prevents the inhabitants from feeling the blaſts which frequently ruſh along the courſe of the river with a violence which can ſcarcely be conceived.—At preſent from this being the ſeaſon moſt

favourable for paſturage, the greateſt part of the inhabitants here left the town and gone to a diſtance with their flocks and herds.

Auguſt 17th.—THERMOMETER 42°. Four men were diſpatched before day-break in ſearch of the ſirkar's bundle, which they found, and returned by nine o'clock: however, as the ſervants had begun to cook their victuals, we could not march till 1h 50. The heat was very great.—At 500 paces a ſtrong ſulphureous ſmell iſſues from hot ſprings; the rocks ſtained yellow with ſulphur, which appears in conſiderable quantity mixed with earth in interſtices betwixt maſſes of rock. At 2875, the channel of the river from being broad ſuddenly reduced to 50 yards; road along its edge ſtony. Reached our ground at ſeven P. M. 8383 paces This has been one of the moſt rugged marches we have had in the *Úndes*. As it grew dark, we fired carbines occaſionally to appriſe our people behind of the direction we were encamped in; and at half paſt nine had the ſatisfaction to ſee them arrive without having met with any ſerious accident.

Auguſt 18th.—THERMOMETER 37°. March at 8h 55′. Some of the yak cows left the water courſe and went up the rock, the face of which became ſteeper as they advanced. One of them, finding herſelf ſeparated from the great maſs of her companions, without heſitation, leaped from a height of about fourteen feet into the dry water-courſe, apparently without being hurt by the ſhock; and her example was followed by thoſe which had taken the ſame path.

AT 6900 paces, commence deſcending to a river formed of two branches, the right coming from S. 5 W. the left S. 35 W. They run N. 30 E. At 7625 reach the point at which the ſtreams juſt mentioned join, and breaking through a high mountain, fall into the *Setlej*. The

bank on this ſide is as it were diſſected; the ſofter parts having been waſhed from the harder ſtrata: the latter preſent a very irregular and extraordinary projecting ſurface. At 7700, croſs the river 1½ feet deep. at 8000 deſcend to ſecond river, the water of which is more clear, and its banks afford more graſs and furze for fuel. At 8050 croſs and encamp at one P. M. Here we obſerved on the banks of the river many *larva* of a kind of locuſt, which breeds on the ſtony plains of *Tatary*, marked on the body with a yellow ring on a black ground, and having a large horn in the tail. Two ſpecies of locuſts breed here; one with purple wings; by clapping the horny caſes ſtrongly together it makes a ſmart crack as it flies. The other is twice as large, the carcaſe and wings, of a yellow, ſpotted with points a little darker.

High wind from the *Himáchal*, which laſted from three to night fall. Thermometer at ſeven P. M. 56°.

Auguſt 19th.—Slight froſt. Thermometer 37°. March at 7. At 1300 paces, obſerve that the two rivers which we croſſed yeſterday join due eaſt about 900 yards. At 5000 commence aſcending the gorge, and reach the ſummit of height which ſhuts the valley. At 5240, arrive at a pile of ſtones and deſcend by a tolerably good road, on which were many ſmall fragments of different coloured jaſper and white agate: to the right is the river formed by two ſtreams, and now running parallel to our line of march about 2½ miles diſtant. At 15,700 commence deſcending: the town of *Dúmpú* in ſight. This is built on a ſteep eminence forming part of a ridge ſtretching from the ſide of a mountain and ſloping to a river, but riſing at leaſt 300 feet above the bed of the latter. Some ruined buildings on another eminence are ſeparated from the town by a deep glen, in which runs a ſtream of delicious water. The banks of this water courſe, cut into ſteps or narrow beds, are now covered

by the grain called *Awa-jau* now in ear, and watered by cuts from the ſtream begun near its ſource. The relief afforded to the eye by dwelling upon this, after having been ſo long tired with the repetition of bare rocks and of plains moſt ſcantily ſprinkled with verdure, is ſuch as cannot be conceived except by thoſe who chance to have been in ſuch ſituations. The inhabitants have alſo been equally induſtrious in turning to account a ſhelf of gently ſloping land at the foot of the ridge watered by the large river. The regularity and luxuriance of the crop ſhew that the ſoil would be very grateful if the farmer would irrigate ſufficiently.

Auguſt 20th.—HALT at *Dúmpú*. Thermometer 49°. The warmeſt day we have had ſince our arrival on the *Undés*. AMER SINGH arrived at ten this morning. It appears that a dawk or poſt carried by horſes regularly goes from *Ghertope* to *Ouchong* (*Laſſa*) Each horſe performs twenty kos a day; and the journey takes up twenty two days at this rate. So that, giving the kos as two miles, the diſtance may be eſtimated at 880 miles. The intermediate country is moſt thinly peopled. The ſhawl goats are from *Latákh* to *Laſſa*, where it is ſaid there are ſheep with finer wool than here. The *Ouchong* merchants buy woollen cloth at *Ghertope* from the *Latákhí* and *Juárí* traders.

THISDAY has been hot with the exception of about half an hour, during which we had a ſmart ſhower of hail. Thermometer at night 56°. We were obliged to halt this-day, on account of our cattle being much tired, not only from the continued marching that they have had, but from their having ſeldom been able to fill their bellies on account of the ſcarcity of graſs in the courſe of our route.

Auguſt 21ſt.—THERMOMETER 45°. Leave *Dúmpú* at 8^h 50′. At 380

paces croſs a ſmall river, the water from which is made uſe of for irrigating ſome ſteps of land ſown with *Awa jau*. At 6514 reach Table Land; a houſe of unburnt bricks about eighty yards to the left; to the S. four or five others, which conſtitute the village of *Gengoul*, formerly tolerably populous, but now nearly deſerted. It bears S. 60 W. from our encampment at 6740, at which we arrived at two P. M. The furze adjoining the *Awa jau* fields, with ſome ſpringy land, formed a favourite reſort to hares; and many *Chakórs** were heard in the neighbouring hills, and taking our guns, Mr. H. and myſelf had good ſport. Found a partridge very like that of *England* in plumage and ſize, but which had a ſtrange grunting call. This bird ran aſtoniſhingly ſwift, and I could not make it take wing. The *Chakórs* breed in the hill, and afforded excellent diverſion, although at the ſame time it was very laborious and not without danger. This day three of our loaded yaks fell over a ſteep bank from thirty to forty feet high into a ravine; and, although they had ſtruggled much to diſentangle themſelves, lay on their backs unable to get up; on the ropes being cut, they roſe apparently with very little injury. Thermometer at night 55°.

Auguſt 22d.—THERMOMETER 37°. March at 8h 45′. At 11,900 paces arrive at a pile of ſtones with religious inſcriptions carved upon them. *Dábá* looks larger from hence than from the approach to it on the *Níti* road. We were welcomed by a croud of half naked dirty ragged children in terms of friendſhip, and they were made happy for the moment by a few ſcraps of broken biſcuit and ſome raiſins. We proceeded to our original encampment in the town, having completed 12,575 paces at 4h 40′ P. M. We thought it proper to inform the *Wazír* and *Déba* of our arrival, and to enquire where it would be agreeable to them that we ſhould pay them a viſit; to this a reply was

* Perdir-ruſa.

ſent, that they ſhould be glad to ſee us the following morning.—About half paſt eight in the evening, the old *pundit* came to ſay that the moon was eclipſed, and we immediately heard the ſound of trumpets and beating of drums and gongs from the temple of NÁRÁYAN, and that erected on the ſite of the old palace of the SÚRJABANS RÁJÁ. This I preſume was intended to drive away the dragon, which during the time of an eclipſe, is ſuppoſed by the *Chineſe* to attempt to devour the moon. This eclipſe was a total one; but the obſcurity was much leſs denſe than I ever before obſerved it. Thermometer at night 55°.

Auguſt 23d.—HALT at *Dábá*, or as pronounced, *Dhápá*. Thermometer 40° at ſun-riſe. At nine a meſſenger from the *Wazír* and *Déba* ſtated, that they were ready to receive us. In an apartment on the roof of the government houſe, we found the *Wazír* and *Déba*, along with the brother of the *Garpan*, and a perſon whom we took for a commander of cavalry, ſeated in an open verandah, in front of which we placed ourſelves on a cuſhion.—The preſents made this time were leſs coſtly than thoſe on our firſt interview with the young *Wazír* and *Déba*. After the uſual complimentary enquires, the *Garpán's* brother remarked, that our journey had taken up a conſiderable time, and that he feared, if our return to *Hindúſtan* were much longer delayed, it might be ſtopped altogether by a ſudden fall of ſnow filling all the paſſes: a circumſtance not unuſual at this ſeaſon of the year. In anſwer to his remark, it was obſerved, that we had been ſomewhat delayed by an illneſs which attacked me ſoon after I left *Ghertope*; and that our cattle had been ſo reduced by continued marching and ſcanty ſupply of food, as to be incapable of proceeding as quickly as we wiſhed. That we were very ſolicitous to return to our homes, and ſhould depart as ſoon as our cattle ſhould be a little recruited, and the *Wazír* and *Déba* would aſſiſt us by

hiring cattle to enable us to carry our wool to *Ntti*. This latter they promiſed to do without delay. I exchanged a knife with the *Wazír* for a curved horn ſnuff box. After a ſitting of two hours, during which a plate of raiſins was placed before us, we took leave and made a viſit to the *Lama*. The old man was apparently much pleaſed to ſee us and had tea prepared, of which according to our *Hindu* character we could not partake. Mr. H. brought as much orange cloth as would make him a dreſs, but this he refuſed, ſaying the weight of the obligation would be too great, it being out of his power to make a ſuitable return for ſuch civility. I found that a knife and pair of ſciſſars would be acceptable to him, and I ſent for them. He was moſt highly gratified by this token of regard, and gave us ſome ſlips of gauze ſent to him by the *Déba Lama*, along with ſome red comfits made of flour, water, and ſome red colouring matter; they were inſipid, but having been made by the holy hands of the head of the church of this country, were ſaid to poſſeſs extraordinary virtues, provided they were eaten before any other thing in the morning. Theſe properties lay in a very ſmall ſpace; for the comfits were no bigger than partridge ſhot. Being deſirous of bringing a ſpecimen of the *Únia* writing, ſome of which had appeared to me very neat, I requeſted, that he would give me a written paper, as alſo one that had been printed. In compliance with my deſire he gave me three ſlips of blue paper, on which ſome prayers were written in letters of gold by a *Gelum* lately dead; and with his own hand he ſtruck off from a wooden block another prayer on a piece of coarſe *Litharux* paper. In the latter, having placed a few grains of *Awa-jau*, he bleſſed it, and wrapping it round with an orange coloured ſilk thread drawn out of an open ſtuff with looſe ends apparently for this purpoſe, he recommended us to hang it in a particular direction, and we ſhould find it in ſome reſpects uſeful to us. He cauſed ſome tea leaves in a maſs to be brought to us, along with a

ſmall piece of ſoda, which is in this country always employed to extract more of the colouring matter and flavour of the tea than would be done by the water alone which is here hard. A cheeſe made of meal and milk ſlightly daubed over with coarſe ſugar, and having a few raiſins ſtuck in it, with a cake of a ſweetmeat made of ſugar and butter, and a large plate of raiſins, formed his preſent. The cheeſe had a very ſtrong ſmell, and as well as the tea and ſweetmeat was given to our ſervants. The old man finding, that we would not take back the cloth, requeſted that it might be given him the following day in the preſence of the *Gelums*. The more we have ſeen of this prieſt the more we are pleaſed with the ſimplicity of his manners and the liberality of his ſentiments, as far as the ſtupidity of our interpreter would give us to underſtand his converſation.

In the evening we were deſired again to viſit the *Wazír* and *Déba*. They were engaged in writing to the *Garpan*; and we requeſted, that a letter, in general terms, informing him of our ſafe arrival, and expreſſing our thanks for his attentions, might be tranſmitted to him in our name; which was done. It was promiſed, that on the following morning ſome cattle ſhould be brought, that we might ſelect two for our own riding, at the rate of fifteen rupees nominal per head, and that others ſhould be furniſhed to carry our wool and baggage. Two trays containing rice with a lump of butter ſecured in a piece of the ſkin of a yak with the hair on, were put before us as a preſent, along with a plate of raiſins; and a written order ſigned by the *Wazír* and *Déba* for five goats was directed to be given to the ſteward, who would on receiving it immediately forward the animals. Thermometer 55° in the evening. At night the *Wazír* ſent an agate ſnuff box, in exchange for that of horn. After I had the latter in my poſſeſſion, I obſerved a ſmall ring of gold, by means of which the bottom was capable of being taken out in

order that the ſnuff may be put in, the mouth being too ſmall for this purpoſe. I could not help thinking, that the *Wazír* had overlooked this circumſtance in the firſt inſtance, and now recollecting it, thought he had made a bad bargain. Under this impreſſion, and reſolving to defeat his avarice in this matter, I pretended to miſunderſtand his meſſage, and returned another knife with a ſmall ſilver capped glaſs ſalt muffineer that had been admired in the morning by him. The agate box was in the ſhape of an urn flattened at the ſides, and ſurmounted at each ſhoulder by the maſk of a Satyr. This appears to me an antique of *Grecian* workmanſhip; or, if it ſhould be of *Tatar* fabric, the following does credit to their ingenuity. The *Wazír* ſeemed pleaſed with his new bargain.

Auguſt 24th.—THERMOMETER 39°. This morning we went to the lodging of a *Latákhí-Caſhmirian* merchant, who ſhewed us *Ruſſian* leather and *French* woollen cloth. The *Latákhí* ſaid, that the *Ruſſians* had latterly imported much merchandize into this part of *Tatary* through *Yarkund*, which is forty days journey from *Latákh* and fifteen from *Bokhara*.

AT night the *Wazír* and the reſt of his council ſent for the old pandit, and the brother of the *Garpan* ſaid, that they were anxious for our departure, leſt ſome accident might occur to us, which would be a ſource of great uneaſineſs to them. That we had now paſſed through their country once; and as we were *Firinghis*, we could not be allowed to come a ſecond time. The pandit ſaid, that they well knew he was conſcious that they had it not in their power to prevent our viſiting the country whenever we pleaſed. That whether we ſhould do ſo or not depended upon the orders of our ſuperiors; but, if we ſhould, our dealings would always be governed by the ſame integrity which they

had already witneſſed, and which they could not but approve. He then departed This day a well looking *Juarí* in a clean dreſs, of the name of DEB or DEBO SINGH, came to pay his reſpects to us; he was ſon to a man of conſequence of the name of DHAMÚ, who had ordered him to come over, and, whether we were *Mahants* or not, to offer his ſervices in whatever we thought he might be uſeful. If he thought us not *Mahants*, he was directed to ſay that 2000 men were ready to take arms for the cauſe of the *Rájá* whenever a rallying point was furniſhed. He ſaid, that, as our journey had been long, and we had, he underſtood, been made to incur unneceſſary expence, he ſhould be happy to furniſh a draft on *Sirinagar* for a thouſand rupees, if it would afford us any accommodation, and would take the amount at *Haridwar* either in goods or money, as might be moſt agreeable to us. We thanked him for the offer; which we declined, but employed him in ſome little offices in which he was ſerviceable. I ſold the whole of the coral beads I had provided for ninety rupees to AMR SINGH, who paſſed them over to DÉB SINGH for fifty ſhawl-wool goats and twenty ſheep, to be delivered to him at *Niti*, and to be brought down to *Chilkia* by HARKH DÉB. This, though much under their value, was the beſt return I could form, as, in the event of accident to our firſt batch of goats, the ſecond might fill their place, and this precaution was the more neceſſary, as all the perſons we met with, ſaid, that by far the greater part of theſe animals, if taken through the hills before the cold weather ſhould have ſet in, would die on the march.

Auguſt 25th.—THERMOMETER 41°. The *Wazír* and *Déba* ſent word, that the yaks would be ready to take our loads this morning; we returned an anſwer, that we ſhould not be able to march until the following morning; and that this would depend upon their performing their contract A meſſenger returned with twelve rupees from the *Wa-*

zír and *Déba*, instead of a like number of goats which they had undertaken to supply, but now said they could not furnish; and this was soon followed by those persons who said that the people from *Ghertope* were extremely anxious to return, and expected we would set off this morning, as they could not depart until we had begun our march. We repeated our arguments and ordered our cattle out of the town to graze. An order was given by the *Wazír*, &c. to shut the gates, and we sent two resolute men to open it, and to turn out the yaks. This they effected without resistance.—We then remonstrated in very strong terms with the *Wazír* and *Déba* on the impropriety, and meanness of their conduct: after a little conversation they both appeared ashamed and said they did not act from themselves, but under the authority of the *Ghertope* messengers by order from the *Garpan*. Immediately after the *Wazír* and *Déba* returned, these people learnt our intention, and without waiting for our visit, saddled their horses and went off. The *Wazír* and *Déba* sent word privately, that, if we would take saffron, they would in the evening take some of our cloth. The *Latákhí* saffron is received by the *Latákhís* from the *Cashmirian* traders in payment for the shawl wool furnished by the latter; and again given to the *Únias* in payment for the wool taken from them. It appears to me pure, but dear; however the highness of price is in some measure owing to the form of the transaction being by barter. According to our promise we went to the government house, where we were received with a cordiality calculated to efface the impression of the late transactions, and which our conduct on the occasion shewed had produced that effect. The *Wazír* and *Déba* said, that really there was much danger of our entering *Hindústan* being prevented altogether, if our departure were delayed; that if they followed their own inclination, they could wish us to stay longer; but the season was advanced, and it would much grieve both the *Garpan* and themselves if any accident were to occur to us.

Auguſt 26th.—Thermometer 37°. We commenced our march from *Dábá* at ten A. M. following the direction by which we arrived at firſt, in which line we continued and croſſing the *Tiltil*, reached the junction of the two ſtreams before mentioned at twelve, having come only about three miles. Here the meaſurement commenced as we took a new road. At 2h 30′ took up our ground for encampment. Our baggage did not reach us till eight at night, in conſequence of many of the loads falling off, from the ruggedneſs of part of the road, and from our people having kept in the direction of the former line inſtead of following us exactly. The road we have now taken is in the ſtraight line for *Níti*, the other was circuitous, but better. Déb Singh came in the evening, and promiſed to ſend us three fat ſheep for our conſumption on the road. When the ſun ſet it became very cold; before ſun-ſet thermometer 48°.

Auguſt 27th.—As our cattle had been much reduced by their long journey from *Ghertope* to *Manſarówar* and back to *Déba*, they had performed their work of yeſterday but weakly, and it was therefore judged adviſable to halt, that they might have a chance of filling their bellies, although the paſturage was even here but ſcanty. Déb Singh was very anxious to receive a certificate of his endeavours to be uſeful and a recommendation that he ſhould be permitted to enter the Company's provinces paying only the uſual duties. The papers required by Deb Singh were given to him, and he took his leave highly ſatisfied in appearance; much ice in the river this morning.

Auguſt 28th.—Hard froſt. In ſome places the ice was 2½ inches thick. Thermometer 28°. Marched at 9. At 7300 paces reach our ground, and encamp at 12h 30. Thermometer in the open air 67°. Found many ammonites in iron ſtone, generally broken. Much iron in the moun-

tains, which have ſcarcely any vegetable upon them, and are rapidly frittering into fragments. We are now about one-third of the *Ghátí* which ſeparates *Hindúſtan* from *Tatary*. Mountains are leſs high and bold than thoſe farther on in *Bútán*. Two yaks have been left behind from fatigue, although the march has not been long, yet parts have been very diſtreſſing. The rivulet or rather river (for when it fills its channel it well deſerves this name,) is call'd *Chang-lu*. It is formed by three or four branches, which iſſue from the heights below the *Nití Ghátí*, and it diſembogues itſelf into the *Setléj*.

Auguſt 29th.—THERMOMETER 29°. Hardfroſt; and very cold to our feelings. Leave our ground at ten A. M. At 3745 paces reach the bed of the river near which we halted on the firſt day, after croſſing the *Ghátí*, in our road to *Dábá*. The name of this is *Jandú*. It riſes N. 85 W. and runs N. 80 E. to the *Setléj*. The banks are formed by ſtupendouſly lofty mountains. At 6125 reach the *Ghátí*, which ſeparates *Butan* from the *Úndés*, and which has upon it a large pile of ſtones, the offering of travellers, ſurmounted by rags in token of the victory they atchieved in reaching ſo great a height. The *Ghátí* is about a half mile broad, almoſt without any vegetable. The wind from the *Bútan* mountains covered with ſnow is moſt piercingly cold. We turned out of the road, to the left hand, and, in order to ſave a little diſtance, ſcaled an aſcent which coſt us double in time. One of the yaks, which had fallen from a precipice a few days before, and received ſuch a ſhock as rendered him unfit for carrying a load, after he had aſcended a few ſteps, ſuddenly returned, and ran downwards towards the river as rapidly as the badneſs of the road would admit, and faſter than any one who has never ſeen theſe animals travel over crags would ſuppoſe poſſible. I had got upon a *Jabú* (or mule between a yak and a cow), &c. was bringing up the rear. The animal charged me, and

endeavoured to overthrow my ſteed: who however ſtood firm. Luckily he took my thigh between his horns, and did not hurt me materially. When he found room, he did not repeat the attack, but continued his courſe towards the river, upon the bank of which he ſtood ſtill. I leaped off the *Jabú*, had him ſecured, and paſſed a cord through a hole in his noſe. Though one of the moſt tractable animals I had ever ſeen, before the fall, he now was become wholly the reverſe: I ſaw, that ſome derangement of the brain had taken place, and was obliged to abandon him. Another yak, the beſt of my herd, actually ſeparated the hoofs from the toes of the hind feet in exertions to climb the ſtones, and after bleeding very largely and proſecuting his journey in great pain; when a ſtop was made to allow of the others taking breath, he alſo refuſed to proceed. The *Únias*, who had brought the wool on hire, on the *Wazír* and *Déba's* cattle, ſat down every five or ſix ſteps on ſtones, and ſmoked and ſpun yarn till the animals were diſpoſed to proceed. This was a terrible day. The deſcent was very ſlippery as well as ſteep, and required great precaution. The aſcent of the *Ghatí* meaſured 2110 paces, the deſcent 1750. At 9835 reach a good graſſy plain on the left bank of the rivulet, which runs from the *Ghatí* to the ſouth, in order to fall into the *Doulei* and encamp at 5° 50′. The goats reaching the bottom of the *Ghátí* firſt, inſtead of taking the right road, by the careleſſneſs of the people in charge, went up a crag about 500 feet above the level of the road, and very leiſurely placed themſelves on the very edge of the precipice; a mountaineer, native of *Kámáún* followed them, and by throwing ſtones and calling, at length ſuceeded in diſlodging them from the dangerous poſt they had taken. The latter rank in coming down, deranged looſe ſtones which tumbled down an abrupt ſlope, by which they deſcended with a force that threatened to overthrow thoſe which were neareſt the bottom; and it really was entertaining to ſee with what

addreſs, whilſt at a run, they avoided the blows of the rolling ſtones without turning their heads in the direction of their deſcent. In this march we met with much wild *Chaná*,* not yet ripe. This might be an acquiſition to the mountains of *Scotland* and *Wales*. Thermometer at night 39°, wind high.

Auguſt 30th.—Snow falling on the adjacent mountains and in leſs quantity on our tents; thermometer 37°. Had we not croſſed the *Ghátí* yeſterday, we ſhould have found it difficult to-day. As the paſturage here was good, and it is a long time ſince our cattle have fairly filled their bellies, we halted this day. In the courſe of the morning the *Únías* in charge of the *Wazír's* ſheep came up, and ſtated that they could not bring up our cattle: that at the foot of the dry watercourſe being unwilling to move, and the other very lame. Thermometer at night 41°.

Auguſt 31ſt.—Thermometer 41°. Water frozen during the night. Froſt greateſt juſt before ſun-riſe. March at eight A. M. At 1280 paces arrive at the bed of the *Daulí* river. The ſtream is now much broader and deeper than when we croſſed before. The rivulet near which we encamped laſt night, falls into the *Daulí* here, which is about two feet deep and very rapid. The deſcent was very rugged and winding amidſt large blocks of ſtone: much of the *Chaná* on the both banks of the river, the grains ſmaller than that cultivated; but the plant throws out many pods, much foliage, and appears hardy.—At 3700 paces reach the ground on which we encamped in going; and, finding our cattle much fatigued from the badneſs of the road, abandon our intention of endeavouring to reach *Gótang*. When we went to the *Úndés*, the mountains, by which we are now ſurrounded, were almoſt entirely bare; they are

* Cicer arietinum?

now covered with verdure; and many of the plants going to ſeed. The white, yellow, and red flowering ſtrawberry have bore abundance of flowers, but only a cone of ſeed without any pulp. Whether in a more kindly ſoil, they would produce fruit may be worth trying.

September 1ſt.—THERMOMETER 36°. March at eight by the ſame route we came. Deſcend the ſteep *Ghâti* to the bed of the *Dauli*. One of the yaks could not be driven round the projection of rock which led to it, but reſolutely charged back again in ſpite of ſticks and ſtones. The *Únias* went by a lower load along the ſteep face of the rock. The ſtream of the *Dauli* was very rapid and reached half way up the yak's ſhoulder. After having gone about a hundred yards, perpendicular rocks dipping into the river, compelled them to croſs again to the right bank, and a third croſſing took place immediately above the *Sanga*, which was ſo bad that our men were afraid of going along it even with very light loads. Their apprehenſions were reaſonable enough, for the *Sanga* was made only of two looſe ſticks of fir, with large looſe ſtones ſloped nearly in the angle of 45°. At 6100 paces, the *Dauli* meets the ſtream which comes from behind the *Nar-Nárágan Parbat* near *Bhadrí-náth*. This river is larger than the *Dauli*. Of the two arches of ſnow, which lay over the river as we paſſed before, one had diſſolved, and nothing remained but the abutments; the other was entire and ſtill of great thickneſs. The road was almoſt as bad as poſſible. Indeed it is ſcarcely in the power of imagination to ſuppoſe, that ſuch a ſurface could be trodden by men and cattle, without their being precipitated into the *Dauli*, which rolled a tremendous current at the foot of the ſlope, over which the path run (if that could be with any propriety called ſuch a name, when effaced in many places by recent ſlips, and in others by blocks of ſtones, for nearly a quarter of a mile together.) This was a march of diſaſter. The yaks, in inclining their bodies to-

wards the mountain to prevent their ſlipping into the river, ſtruck their loads againſt portions of rock, and tore the packages. At every hundred yards, there was a cry of ſomething being wrong. The people anxious to get over the dangers and difficulties of the march, in oppoſition to what I could ſay, perſiſted in driving the cattle too faſt. The day was very hot; and the yaks, oppreſſed by the heat, the weight of their burthens, and the inceſſant calling and ſlinging of ſtones, found no more effectual way of eſcaping from theſe annoyances, than by running down the almoſt perpendicular face of the rock and daſhing into the cold ſtream. Sometimes by the ſlipping of the ſoil they fell into the water with ſome violence, and after cooling themſelves, to my great mortification, generally loſt their loads in climbing over ſtones to regain the road. At three reached our ground; and in the evening, I had the mortification to learn, that two yaks in the laſt detachment could not be brought forward. One had ſlipped into a niche in the bank of the river and could not get up; and the other had become ſo very lame, as to be unable to paſs over the ſharp edged blocks of ſtone which lay in the road. At night thermometer 56°.

September 2d.—HALT at *Gótang*. Thermometer 56°. At night, 54°.

September 3d.—THERMOMETER 44°. March at 10 A. M. The ſight of trees is extremely pleaſing after our being ſo long abſent from them. The rhubarb had now run to ſeed. I cut up many roots, but found the whole more or leſs ſpongy and rotten. From the holes I have ſeen in the *Turkey* rhubarb, and its irregular knobby form, I apprehend that this is its uſual habit; gentian is met with in great abundance, is called here *Catcí* and given in infuſion to goats and ſheep; moſt eſpecially, when, in travelling towards *Hindúſtan*, they are ſuppoſed to be diſtreſſed by heat. The woods here are compoſed of birch, the

great *Rhododendron**, willow†, and mountain aſh with brown berries. The road was extremely bad; and the trouble we had from the falling off of the loads, and from our yak cows and calves ſtraying up the mountains, and down the ſides of ſtupendous precipices, when it was ſcarcely poſſible for them to fix one claw, is not to be conceived. It was nearly night when I reached *Níti*, notwithſtanding AMR SINGH brought ſeveral yaks to aſſiſt us. The lame yak was brought to *Gotáng*, and there left to recruit in the abundant paſture of that place; that, which had fallen into a nook of rock near the river, could not be found. The upper part of *Bútán* is now ſuffering much from ſcarcity of grain, in conſequence of the *Júarís* and *Dharmís* plundering the *Gungárís*, or people living on the banks of the *Ganges* within the hills, who were in the habits of bringing up the grain they raiſed, and that which they procured from below.

September 4th.—THERMOMETER 54°. in the morning; 80° at noon. In the afternoon there was a fall of rain accompanied by thunder. At night Thermometer 54°. The gooſeberry buſhes, which were in flower when we were here before, are now full of fruit, of which only a few are ripe. They are, as I conjectured, of the burgundy kind, but ſmall; and the pulp is much ſmaller than that of *England* in proportion to the bulk of the ſeed; but this may be remedied by cultivation. Of currants I found two varities, one orange coloured with ſmall fruit in ſmall cluſters, the other of a dark purple or rather nearly black in large bunches from a tree, with bark like that of the black currant in *England*, but with the flavour of the red one, only more acid. This morning we ſent to announce to the *Séyánas*, that we had arrived, were anxious to depart, and were in want of proviſions. In the evening

* Rhododendron puniceum. *Rox.* † Salix tetraſperma. *Rox.*

ARJUN and GÚJAR came, and ſaid that the terms of carrying the baggage ſhould be adjuſted to-morrow.

September 5th.—THERMOMETER 48°. At night 62°.

September 6th.—MORNING cloudy with ſmall rain; thermometer 52°. At night 54°.

September 7th —A PARTY of *Gorkhalí Sipahís*, conſiſting of a havildar and four privates, arrived to-day for money due from the *Nítías* to their company under the command of BHACTI THÁPÁ. The havildar brought a letter from BHOWÁNÍ SINGH, ordering the *Nítí* people to render every aſſiſtance in their power to us; and that, if they ſhould not do ſo, he would levy a heavy fine upon them. The havildar came to pay his reſpects to us, and ſaid that he had received directions to pay every attention to us in his power, and that he ſhould immediately procure carriers. We gave him five rupees in *Timaſhas* as an earneſt of what he might expect if he exerted himſelf. He promiſed, that we ſhould ſtart to-morrow. In about an hour he returned with three other *Sipahís*, and twenty rupees were tendered to him as ſubſiſtence money to the carriers. He refuſed this at firſt, ſaying that our effects were to be conveyed free of expence to *Jóſhí Math*. This we declined, ſaying it was improper for people coming on objects of *Dharm* (piety) to have baggage carried without hire; and he took the money.

September 8th —AT 12ʰ 30′ we began our march. At 3200 paces reach *Gamsálí*, whence the people took up our loads immediately. At 3315 croſs the *Sankha* of the rivulet from the right, now much ſwollen. At 4182 reach *Bampa*. Here the loads were again carried on towards *Pharkía*; and at 4886 paces encamp to the north of our for-

mer ground near the village, at 4^h 55′. Wind high and ſome rain. The crops of *Pháphar Buck* wheat are very good. Theſe with the *Awa-jou* are nearly ripe. Barberries are affording a ſecond crop. The *Shíkarí*, who received from us two rupees on the banks of the *Chang-lá* for killing a *Baral* was engaged at *Gamſalí* watching the crops, and ſaid he was debarred uſing his gun by the *Seyánas* until the crops were got in, as ſnow would certainly follow the exploſion. We reſpected their prejudices, and did not go out, although the black partridge tempted us to do ſo in purſuit of them by their frequent calls.

September 9th.—Thermometer 50°. Marched at 11. The villagers of *Pharkíah* made much heſitation in taking up our loads, notwithſtanding the *Gorkhalí* havildar threatened them with a fine, and offered a deduction of two rupees from their payment of revenue. At length they agreed, and a party ſet off. At 4900 paces croſs the *Sankha* over the *Daulí* at the place where a wall is built with a door in it for the purpoſe of preventing the goats und ſheep laden with ſalt and wool, coming from the *Úndés* or northernmoſt part of *Bútán*, ſpringing into the river. Whilſt taking a little reſt upon a ſtone I heard the call of *Chakórs* on ſome rocks of great height, to which I gained acceſs by a ſteep, long and difficult route. Whilſt clambering up, I had very nearly placed my hands upon a brown ſnake which had got half its body into a hole, before I was able to ſtrike it. I ſucceeded in getting three *Chakórs*, one of which was of great ſize, and had large double ſpurs, one above the other on each leg. At 4^h 35′ reached *Malárí*, having come 5740 paces. The crops of *Millet*, *Pháphar* and *Awa-jou* look well. The bed of ice, which filled the bed of the *Malárí* river, has diſappeared, but the tops of the high mountains to the eaſt are covered with ſnow.

September 10th.—Thermometer 54°. Rained till 11. Halted on

account of our loads not having come up yeſterday. As far as *Látá* ſouthwards, the country is called *But'hant*, but it is underſtood that the *Rengní* river ſeparates that country from *Hindúſtan*. The *Bùtias* pay a ſmall ſum of money annually to the *Únías*; or its value in kind; and the quota of *Maláŕí* is ſix rupees, which is commonly in barley. The inhabitants of the whole tract between *Látá* and *Níti* complain much of the extortions of the *Gorkíahs*. The pooreſt man is compelled to pay a poll tax of four kacha rupees. This has cauſed many villages to be deſerted; and the population is now much diminiſhed. This evening, whilſt looking at our goats, a *Maláŕí* man came to us and entered into converſation. We aſked how it happened that one portion of the village was in ruins, and that ſo many of the houſes were in ſuch a ſtate of decay? The former inhabitants, he ſaid, were dead; and when enquiry was made, if there had been any ſudden and violent ſickneſs, he anſwered, that, of the particular quarter to which we pointed, the tenants had been plundered of their goats by the *Juáŕís*; that, unable without theſe animals to carry on their uſual traffic of grain and ſalt with the *Úniás*, they were deprived of the means of paying their rent to the *Gorkíahs*, who took the remainder of their cattle, their cooking utenſils, the rings out of the noſes of their wives and daughters, and ſeized their children as ſlaves. Many perſons were actually ſtarved to death, and others fled. Including the regular rent, he ſaid, the inhabitants of *Maláŕí* had an annual ſum of 1000 rupees forced from it, although the firſt only amounts to 250. "In the time of our *Rájás*," ſaid the man, "theſe yards, now empty, were filled with goats; each old inhabitant had one houſe to place his ſon in when married, and another for his daughter, who had a portion in cattle. We were then, if not wealthy, at leaſt at our eaſe, and occupied and happy. At preſent we are poor and wretched. If we had maſters like you once again, theſe pens might contain the ſame

number of cattle as formerly; but at preſent, if a man by his induſtry raiſes a ſmall ſtock of goats, a *Juárí* or a *Darmí* plunderer attacks him and carries them off, and we can get no redreſs from our preſent maſters, nor are we ſtrong enough to reſiſt or make repriſals." Independently of the direct plunder they obtain, without any other caution than putting a number of men under arms, the *Juáris* are intereſted in deſtroying the trade of the *Niti Ghátí*, in order that they may have a larger proportion of the profitable traffic with the *Undes*. At night, the thermometer was 58°.

September 11th.—THERMOMETER 51°. March at ſeven by the route we came. At 3575 paces croſs a *ſankha* over the *Dauli* to the right bank. The deſcent from hence is very rapid, and the ſtream is much broken by vaſt fragments of rock and heaps of timber which have been much accumulated ſince our paſſing upwards. In one place the river has worked its way under a kind of arch formed of theſe materials. At 6240 paces reach the village of *Jhelim*, now in ruins with the exception of two or three houſes. A villager ſaid that ſome time ago DÉB SINGH, our *Juárí* acquaintance, ſwept the country during the ſpace of two months, and carried off two thouſand head of goats, ſheep and neat cattle, without receiving any molestation from the *Gorkiahs*, or being compelled to make reſtitution or any kind of reparation.

September 12th.—HALT at *Jhelim*, as our loads did not come laſt night.

September 13th.—THERMOMETER 52°. March at ſeven and half A. M.; no tidings of the loads. The village of *Jhelim* is ſituate on the face of a hill conſiderably higher than the road from *Láta* to *Malárí*: deſcending therefore, we fell into the old road. On the road we were

met by a meſſenger from BHAWÁNÍ SINGH NÉGÍ, with a letter from him, and another from JAGRUP jamadar of the party now at *Baragaon* and *Jóſhí Math*. The former ſtated, that the *Gorkiahs* had diſtreſſed him much on account of having aſſiſted in forwarding our baggage; that his life would have been forfeited had we not returned by this road; but that now he was perfectly at eaſe and diſpoſed to do every thing in his power to ſerve us. JAGRUP ſaid, that he would take care that we ſhould have every facility that he could afford us in our return: BHAWÁNÍ SINGH ſtated, that we might take the *Páin Khandí* or *Búdán* road, as might be moſt agreeable. At 5645 paces croſs the *Daulí* over a very bad *Sankko* to the left bank. Here the road, which is very bad, aſcends rapidly; in many places, little more than a foot broad; and projections from above oblige the paſſenger to creep under them almoſt immediately over the bed of the river, which is about 500 yards below. At 7025 paces reach the ſummit from whence the deſcent is very difficult and ſteep; indeed were a perſon from below to ſee travellers above, he could not fail of feeling much anxiety for their ſituation. At 7650 paces reach our former ground and encamp. A *Sankho* had been waſhed away, and the loſs of a long tree not worth three rupees in this country, endangers the loſs of life to every one who attempts this moſt dangerous route, of which no conception can be formed by deſcription. Let it ſuffice to ſay, that the very goats reſiſted attempting ſome parts of it for a conſiderable time; and that we were in more than one place reduced to the neceſſity of creeping on our hands and knees: yet every one arrived without accident, and the *Jabú* climbed and deſcended in a manner that created admiration; but in one ſpot it was thought adviſable, that he ſhould attempt an almoſt perpendicular face of rock, rather than be obliged to come down by another ſo ſteep that it was a taſk of great danger for man. By a long detour he reached us over a tract known to our guides.

only, but the man who had the care of him declared, that this care was ſuperfluous, for that he could come down a ſurface as ſteep as was practicable for man. He had been brought to the ſide of the river under an idea that he might have croſſed; and from the height of the bank where I ſtood, I thought the attempt attended with little danger; in ſo much, that the beſt ſwimmer in the party having declined the taſk, I had reſolved upon trying. However on reaching the bed of the river and paſſing one ſtream, I was deterred from the experiment, in conſequence of the force and velocity of the current, the extreme coldneſs of the water, and the danger of being daſhed againſt the ſtones or ſtumps of trees.

Although money had been given to the *Séyanas* of *Jhelim* for the hire of the carriers, they had kept the money, and not furniſhed a particle of food to the unfortunate people who had to bear the burthen and heat of the day. The oppreſſion exerciſed by the government renders natives equally oppreſſive in proportion to their power; Thermometer at night 62°.

September 14th —Thermometer 58°. March at 9h 25′ along the left bank of the *Dauli;* one of my fineſt goats, heavy with young, and the boldeſt in the whole herd, fell into the ſtream and was hurried away by the current. The bridge was about twelve inches broad and formed by a fir-tree, a little flattened on its upper ſurface and a round ſapling on each ſide. Whilſt the goats crowded at the foot of the *Sankho,* two went on boldly, but when they had reached within a few feet of the oppoſite ſide, the preſſure of the feet of the goats had puſhed forwards one of the ſide ſpars, and unluckily that on which a goat was; one end fell down, and the other tilting up, threw the poor animal into the ſtream. This ſpot has brought me much diſaſter; for it was on

its bank, within twenty yards of the *Sankho*, that the pandit's ſlave daſhed my watch from my girdle upon the ſtones. However this accident did not affect me, although ſeriouſly inconvenient, one-tenth ſo much as the loſs of one poor goat that coſt only a rupee: but this latter had been attained with more difficulty than the watch had coſt me. At 8025 paces reached the road running under the village of *Tolma*, which, ſurrounded by fields of the crimſon *marcha*, looks very pretty. The *marcha* is a plant which I miſtook in my journey upwards for the *lal-ſag* of *Hindúſtan*, or the *Amaranthus Gangeticus*, and the *ſipahis* who had accompanied the party which went in 1808, to ſurvey the *Ganges*, fell into the ſame error and uſed it as a pot-herb. In a ſhort time, thoſe who had eaten much of it were affected with purging and ſoreneſs in the inſide of the mouth. The natives of the hills, however employ it without injury whilſt it is young, but I neglected to enquire in what manner it was dreſſed. I thought we ſhould be able to reach *Látá* this evening, and therefore puſhed on. Having arrived at the foot of the mountain (which we aſcended on leaving *Látá*) the ſky became ſuddenly clouded, and large drops of rain with guſts of wind announced an approaching ſtorm. As the day cloſed rapidly, I ſaw it would not be poſſible to paſs over the rugged mountainous road without accident, as much of it lay on the edge of the cliff over the river, and therefore determined to take up my lodging for the night. A ſmall cavity under a ledge of rock juſt ſheltered me from the rain. Having ſtretched my carpet and blanket on the ground, I went to bed dinnerleſs; and my companion fared no better. The principal part of our ſervants remained behind taking ſuch lodging as they could find: but they were much better circumſtanced than their maſters, as they had their food along with them.

September 15th.—THERMOMETER 58°. At eight A. M. began our

march. The town of *Látá*, conſiſts only of eight or nine houſes, and a temple of NANDA *Déba*, at which officiate ſome prieſteſſes, who do not, according to report, either take a vow, or obſerve the practice of chaſtity, being allowed what intercourſe with the other ſex they may think proper to take without reſtraint.—JOWÁHIR SINGH had now a knowledge of our real character, and ſaid that he would fetch the loads from *Mallári* as ſoon as he ſhould have ſeen his brother. He was anxious to have a goat to ſacrifice to the Deity of the place in gratitude for our ſafe return, but I believe that his own appetite had a greater ſhare in inducing him to prefer this requeſt, than any motive of religion. JOWÁHIR ſays that proviſions are very ſcarce, owing to the viſitations of the locuſts, with which the country has been plagued for the laſt two months. For the preceding two days we have ſeen many locuſts directing their flight towards the *Undés*, where they breed. Thermometer at night 72°.

September 16th.—THERMOMETER 64°. March at 8. At 1340 paces we come to a *Sankho* over the river *Reni* which ſeparates *Bátan* from *Hindúſtan*, and falls into the *Daulí*. At 7542 encamp in the fields belonging to the village of *Dak*. Our dinner conſiſted of ſome pumpkins boiled with *dal*, and hunger made the diſh palatable.

September 17th.—THERMOMETER 66°. March at 8 A. M. rain increaſes to ſuch a degree as to prevent us enjoying the pleaſure of the ſhade of the horſe cheſnut and rhododendron trees under which we paſs. In one of the former were monkies feeding heartily on their fruit which is reliſhed by few animals. At 1140 paces reach the ſummit of the aſcent; and at 3145 reach a fountain, near which we encamp, on a ſpot of uncultivated ground ſurrounded by the *Sarſon* or muſtard in flower.

THE *Nishánchí* or colour bearer of a company belonging to BHACTÍ THÁPÁ, paid us a visit. Afterwards BHAWÁNÍ SINGH NÉGÍ made his appearance. He says that our loads shall be brought from *Mallári* in a short time, and that he will charge the expence as a set off against our account of 101 rupees advanced to him on his bond. Thermometer at night 64°.

ber 18th.—THERMOMETER 62°. At noon 74°. Night 64°. Many flowers of short continuance but smart in the course of the day with intervals of sun-shine and heat. The jamâdar JAGRUP sent some rice and flour last night, and to-day a present of game.

THIS man was with SHERISTHA THÁPÁ at *Sirínagar* in 1808, when Mr. H. came with the party to survey; but on account of his disguise did not recognise him. He gave the following account of the transactions which had reached us in a confused manner, whilst in the *Úndés*. DASRAT'H, who was formerly in power at *Sirínagar*, but had been displaced, had written information to CATMANDU, that BHACTÍ THÁPÁ had allowed two *Europeans* to go through the country in his division into the *Úndés*. The *Nepalese* government sent BHACTÍ a reprimand, on the receipt of which he sent JAGRUP with thirty men to examine into the foundation of the reports propagated by DASRAT'H, with whom he had long been at enmity. On JAGRUP reaching *Baragaon*, he found that BHAWÁNÍ SINGH, had left his house to avoid the oppression of a party of DASRAT'H's men, which to the amount of ninety had taken possession of his premises, broken open his granaries, and used the grain they had found in them. He had armed all his dependents: but on JAGRUP sending him assurances of his personal safety, he went over to him. BHAWÁNÍ then made a declaration of his ignorance of our being *Europeans*, and of his having received the sum of eighty-seven rupees to forward

our baggage to *Niti*. DASRAT'H, in his letter to BHACTÍ, accuſed BHAWÁNÍ SING of having taking three thouſand rupees, and made uſe of this falſehood, as a plea to ruin BHAWÁNÍ by extorting that ſum from him. The report forwarded to CATMANDU ſtated, that we had gone with an intention of building two forts, one at *Niti* and one in the *Undés*, to garriſon them with *Marchas*, and thence proceed by *Bubeſin* to join the *Sikhs*, with whoſe arms we propoſed to invade the country. The accounts amongſt the country people were ridiculous enough. One reported that a letter had arrived from *Delhi*, ſtating that we had ſtolen the philoſopher's ſtone, and three lacks of rupees from the Company's wife.

A LETTER arrived from BANDHU THÁPÁ's ſon, now at *Solúr*, directing JAGRUP to treat us with attention, and to take care that no part of our property ſhould receive any injury. He was anxious, that we ſhould march to-morrow to *Solúr*, which is five kos below *Jóſhí-math*. To this the rainy ſtate of the weather was objected: but it was promiſed that we would go as ſoon as the weather became fair. The motive he aſſigned for our going thither was, that we ſhould be able to get proviſions eaſily, which could not be done at *Baragaon*.

September 19th.—THERMOMETER 59°. During the night the ſummits of the neighbouring mountains have been covered with a fall of ſnow. Halt at *Baragaon*. About 2 P. M. it began to rain ſmartly and continued without intermiſſion until 6, leaving the air cold and diſagreeably damp. After ſun-ſet thermometer 16°.

September 20th.—THERMOMETER 57°. The jamâdâr having ſtrongly repreſented that they could not procure proviſions without the greateſt difficulty at *Baragaon*, but that they ſhould be able to get abundance at *Solúr*, we agreed to march as far as *Jóſhí-math* to-day,

provided it did not rain. At 11h 15′ we marched. At 1300 paces croſs a watercourſe from which the air before us was filled with an immenſe body of locuſts, ſome of which were of a light yellow; but the greater number of an orange colour. On heaps of weeds that were dry, and on ſtones, they aſſembled by forties and fifties, and remained c[illegible] he ſun-ſhine; but others were actively employed in eating the h[illegible] *Mandua** now nearly ripe. They had been here about two n[illegible] but had not done as much miſchief as I ſhould have ſuppoſed. A leopard made frequent viſits to this neighbourhood, had taken away three children, and killed two men; but the place to which he reſorted with his prey was unknown. At the ſame place where we encamped before, we now pitched our tents, cloſe to a temple. Every other ſpot for a great extent was occupied by a crops of rice, *Marcha*, *Mandua*, and *Sawah*.† The people of the neighbourhood ſaid, that the leopard would certainly make an attack upon our goats in the night; and we took precautions accordingly by ſetting a ſtrong watch with loaded guns, and keeping up a good fire.

September 21ſt.—THERMOMETER 55°. The leopard has committed ſome ravage in a village to the Eaſt of *Jóſhí-math*. In this village my goats were yeſterday entangled, and with no ſmall trouble and loſs of time I extricated them out of the filthy and intricate roads. Goats are cleanly animals: when they reached one filthy ſpot, the leading animals ſtopped, and the whole flock was delayed in a narrow path overhung with long graſs, and from which iſſued a ſtreak drawn upwards by the heat of the ſun, that was ſcarcely ſupportable by man, and muſt have been greatly annoying to the animals ſhut up in an

* Eleuſine Coracana.
† Panicum Colonum

alley of this offenſive vapour. At length they clambered up ſome large blocks of ſtones.

Our march did not take place till 2^h 15′, owing to the *Gorkha* party, having ſerved themſelves with carriers for their loads, before they gave any to us. On reaching the foot of the hill, half way up which, are many detached cottages which form the village of *Selúr*, I found my flock, which had ſtarted at an early hour. We went up, and after an aſcent of about a mile through narrow paths and nelds in *Marchi*, *Sawa*, and *Sarſon*, reached the reſidence of Bhawáni Singh, at the cloſe of day, where was a ſtone threſhing floor almoſt covered with hemp, on which we pitched our tents. Gave the body of a goat which died, to the *Gorkia Sipáhis*, who requeſted to have it for their night's repaſt.

September 22d.—Halt. Bhawáni Singh has not come here according to his promiſe. We found Bandhu Thápá's ſon, the nephew of the general, Bhactí, ſick of an intermittent.

September 23d.—After breakfaſt we ſet off accompanied by a farmer, who ſaid that he thought it likely we ſhould find wild hogs, bears, deer, and pheaſants, if we would go up to the top of a high wooded mountain to the left, which formed part of the great *Túgasí* range. We aſcended a ſteep ridge and paſſed through a foreſt of fir, cedar, and cypreſs,* with ſycamore, horſe cheſnut, walnut and yew trees, the latter are called *Túnér*. The cedars were of enormous ſize; one meaſured 18 cubits in girth at 4 feet from the ground, and was about 180 feet high; another that had fallen down was 159 feet in length: and trees of this ſize were not uncommon. From this

*Pine ?

eminence I had a fine proſpect, in which a caſcade forming the ſource of the *Parál-Gangá*,' that ran in the bottom between two ranges of hills formed the moſt prominent feature. This caſcade appeared to have a fall of from 80 to 100 feet and was about 20 feet broad. It had almoſt eſcaped me to remark, that in our return we met with very large Service trees bearing fruit much larger than thoſe of this tree in England. I ſtopped to examine ſome plants of hemp ſown near a houſe, many of theſe were twelve feet in height, and few lower than ten; where thinly ſown, the plants had very thick ſtems and ſent out many ſide branches; but when numerous, they were thin, tall and without branches. The perſon, who ſowed them ſaid, that when the plant was ſuppoſed ſufficiently ripe for pulling, which is conſidered to be the caſe when it is in flower, it is placed on the roof of the houſe, and expoſed to the ſun till thoroughly dry; when the bark is ſtripped off and tied in bundles for uſe. During the time it is on the houſe, care is taken to prevent its being wetted, as wet is ſuppoſed to weaken the fibres. In ſtripping, one half of the bark is ſeparated from the wood, by the nails of the finger and thumb of one hand, whilſt the finger and thumb of the other are placed, one upon and the other under the bark, during the time that it is drawn from the butt towards the point of the ſtem: this proceſs is performed on the other ſide, and the bark by the two operations is completely taken off. From what I have ſeen of the growth of hemp in this country, I have no heſitation in ſaying, that its luxuriance is ſuch, when ſown upon the lands of valleys in *Garwhál* and *Páïn-khaṅḍí*, as to be capable of ſupplying a great portion of the navy of *Great Britain*, if its value in *England* will cover the freight and other expences.

September 24th.—THE NÉGÍ's mother laſt night informed us that JAWÁHIR SINGH had abſconded as well as BHAWÁNÍ SINGH, in order to

avoid the oppreſſion of the *Gorkhas*. She gave an afflicting ſtatement of the grievances inflicted by them; aſſured us that our loads ſhould be forwarded, and that BHAWÁNÍ SINGH would not be faithleſs to his engagements: but that we ſhould not ſee him, as both he and JAWÁHIR feared to be ſeized and ſent to *Sirínagar*. She was very anxious to impreſs us with a belief, that the warmeſt wiſhes of the whole of her family were with us. We then deſired BANDU THÁPÁ's ſon and the jamâdár would come to our tent, and remonſtrated with them on our ſituation. BANDU THÁPÁ's ſon and an old man his governor expreſſed their concern at the delay in our journey, and ſaid they were ready to accompany us to *Pálí*, when we ſhould ſee BANDU THÁPÁ; and that we might rely upon it our effects ſhould reach *Pálí* within three days after our arrival. We were obliged to remain ſatisfied with this explanation, but ſaid, that if we had not an account of the baggage being on the road to us in three days, we would certainly march.

September 25.—As a perſon acquainted with the management of goats and the culture of the mountain rice would be uſeful in going to *Calcutta* with the former, and perhaps eventually to *England*, I gave the ſum of thirty rupees for a ſlave offered to me by JAWÁHIR SINGH, who was apprehenſive that he would be forcibly taken from him by the *Gorkhas* if he did not diſpoſe of him.

September 26th.—THE jamâdár JAG-RÚP came to take leave. As I ſaw he expected a preſent, I filled a *China* box with five rupees in *Timáſhís* and gave it to him. He appeared highly gratified with this, and we ſaw no more of him.

AT 9^h 15′ left the village of *Solár*. At 8380 paces reach *Panki-math*. The latter part of this journey was very embarraſſing, as the rain now

was continued and heavy. The path was covered with a glazed surface so slippery, that few of the party escaped without one or more falls. When quite dark I reached the *Garúl Gangá*, whose current dashed along with great impetuosity. Having safely reached the bank, we were involved in the deepest darkness, and could only ascertain that we were at the foot of a steep hill. Here we were obliged to wait about three quarters of an hour, till a light was brought which shewed a steep narrow path much obstructed by stones and long grass. With much trouble we collected the goats and forced them into the path; but they frequently stopped. Not being able to get them on after a stop of unusual length, I endeavoured to pass through them, and when I got to the foremost rank, felt myself suddenly slip through the grass over a steep ledge, which came along the edge of the path, and down the face of a bank or precipice; for the darkness prevented me from judging of the extent of the danger. A tuft of grass, after I had a short fall, came between my legs, and in a few seconds more I found myself seated upon a stone as if upon a saddle, my feet not touching the ground. By dint of groping about, I found some stout tufts of grass a little above me, and well within my reach. These proved firm and enabled me, by there being a succession of them, and by placing my toes against the face of the bank, to raise my head to the level of the path in the grass; and the hand of a servant drew me up.

September 27th.—THERMOMETER 60°. This is a deserted village called *Panki-Math*, situated on the top of a hill, but surrounded, except towards the river, by an amphitheatre of others still higher. BANDU THÁPÁ's son's party had turned out the inhabitants of a village on the opposite side of the *Garúl Gangá*, and taken refuge from the rain of last night in their houses. I thought it right to halt. Thermometer 67°. At four P. M. the son of BANDU THÁPÁ and his party, marched to

Pípal Koti to day, and was ſoon followed by JAGRÚP jemâdár and his party.

September 28th.—THERMOMETER 53°. At 1462 paces reach the ſteps, which in going up, were an object of terror, but which now ſurpriſe us that we ſhould have thought formidable; this change in our ſentiments has been worked by our having become familiar with worſe roads, and likewiſe by the declivity being concealed by graſs. Encamp at *Purkothu*. At 1° 45′ diſtance 3225 paces. The *Gorkhas* wiſhed us to pitch cloſe to a ſmall houſe or fort; they were preparing to command the road to *Bhadrináth*, and that of the *Jhúla* acroſs the *Alacananda* to *Bandháth*, and the temple of *Kédárnát'h*. The invitation was declined for obvious reaſons.

September 29th.—HALT this day. We are told that on the ſummits of the neighbouring mountains there was a large red tiger, which feeds on elks and the largeſt kind of game, but ſeldom comes to the lower part of the country. He is deſcribed to be of the ſize of a ſmall horſe, his neck is covered with hair ſo long as to fall over his face and almoſt conceal his head, as he comes down hill. From this account, it is preſumable that the animal is a lion.

September 30th.—THERMOMETER 60°. Noon 78°. Night 68°. This land was given by the *Rájás* in *Jaghír* to *Bhadrináth* for the maintenance of the officiating prieſts; and the *Gorkhas* have not diſturbed the tenure, though they live at free quarters upon the farmers, when they come either to collect rents in the neighbourhood or for any other purpoſe, as in the preſent inſtance, when a force is collected to impoſe upon us, a belief of their ſtrength.

October 1ſt.—BHAWÁNÍ SINGH by meſſage though HARK DEO requeſted us to be particularly on our guard againſt treachery which he apprehended would be employed againſt us. The *Gorkálís* having ſent ſome coolies, we marched with due precaution, our fire arms loaded, at half paſt two. At 1135 paces encamp on a narrow plot of graſs formerly cultivated.

October 2d.—THERMOMETER at ſun-riſe 51°. Noon 82°. Night 61°. This day about 11, the ſubadar came to pay us a viſit. He is a relation of the depoſed *Palpa Rájá*. It is worthy of notice, that two-thirds of the troops of BHACTI THÁPÁ, conſiſt of the natives of the ſubjugated countries.

October 3d.—INTERMITTENT fevers are very common at this ſeaſon, and attributed by the inhabitants to the rain which falls almoſt continually at the end of *Bhadon*, and the great moiſture of the ſoil. But to the humidity of the atmoſphere and the ground, may be added, the vegetable traſh they eat, and the cloſe and filthy ſtate of their houſes, and eſpecially the accumulation of all kinds of dirt round their habitations.

October 4th.—WENT accompanied by a few *Gorkha ſipáhís* in purſuit of bears, ſaw and wounded ſeveral.

October 5th.—A LETTER had come from BANDU THÁPÁ ſtating, that, as he deſired much to meet us, he wiſhed we would march as ſoon as poſſible, and he would wait for us at *Chandpúr*.

October 6th.—No coolies came. The jamádár ſaid, we ſhould certainly have them the following day.

October 7th.—THERMOMETER 60°. At 9 begin our march. As I thought it probable, that I ſhould not be able to overtake the goats before night, and as the road was bad, and the ſky looked wild and threatening, I endeavoured, as I paſſed ſome rocks, to find out ſome cavern in which I might take up my lodging, for the carriers were ſo far behind as to leave me little hope of their arriving with my bed. I ſaw at a diſtance from the road a deep receſs in the face of the rock, and congratulating myſelf on my good luck, went to examine it more cloſely, when I ſuddenly felt an offenſive ſmell, and proceeding to the cave, found the dead body of a man. In what manner he came by his death, I could not learn from the appearances about him; but, as he was not ſtripped and had white clothes, I ſuppoſe he was ſome pilgrim from *Hindúſtan*. At 8900 paces, I found the goats on a ſandy and ſtony part of the bed of the *Alacananda*. My bed arrived about ten o'clock, and my tent in the middle of the night. The *Bichāú* pretends to be our friend, and recommends us to be on our guard. We ſet fire to piles of firewood, in order to keep off the leopards.

October 8th.—THERMOMETER 56°. March at 9. The deſerted condition of the villages, threatens this unfortunate country with the loſs of all its inhabitants, if it remain under the dominion of the *Gorkális*. It is odd enough that every governor, and indeed every *ſipáhí* ſees what is to happen, but no one ſeems to make any attempt on principle, to check the threatened depopulation. The governors of the different diſtricts remain in them but for a few years, and it appears a maxim with them to make hay whilſt the ſun-ſhines, whatever ills befal the misfortunate *rayut* from their exactions. Thermometer at night 65°.

October 9th.—THERMOMETER 59°. It began to rain briſkly ſoon after I commenced my march, and continued two-thirds of the way.

The road lay through a country, that once was highly cultivated, but which exhibits now little more than traces of what it has been. This day I found two men under the *Píppal* tree near the *Nandákní*, who wiſhed to become my ſervants: one of theſe was a one eyed fellow who had aſſiſted in carrying our loads from *Najìbábád*. As they ſeemed ſtrong enough to be uſeful as carriers, and ſaid they were ſtarving in this country, had no connections, having loſt their wives, I took them into employ. Having mentioned the general features of the country, we went through this-day in our route upwards, it is unneceſſary to ſay more than that the luxuriant vegetation had ſo altered its face in many places, as to render it a work of ſome time to recogniſe them. After a very complete wetting, the ſeel of the ſun which ſhewed itſelf nearly unclouded, near *Karn Prayág*, we reached the *Pindar-Gangá* at 6357 paces, when we croſſed the *Jhúla*. On the oppoſite ſide, on a ſtone *Chabútra* under a *Píppal* tree, we found BANDU THÁPÁ, who roſe at our approach. He is a ſtout old man of ſeventy, plain in his manners and dreſs, and altogether not ſuperior in his appearance to one of the *zamíndárs* of *Gházipúr*. He ſent word by the *Bichárí*, that when we had eaten and taken ſome reſt, he would wait on us. He came in the evening accompained by the *Bickárí* and the *Kamuníah*. On enquiring what were the motives for our paſſing through their country, we replied that we wiſhed to ſee the horſes of the *Úndés* and to procure ſome ſhawl wool goats. Why did we diſguiſe ourſelves? To this it was anſwered, that he muſt well know it was the general cuſtom of pilgrims ſo to do, but that we had a farther inducement, for, if this had not been done, we ſhould not have been able to enter the *Úndés*, as he muſt not be ignorant that all entrance to that country is interdicted to the *Gorkálís* and to *Europeans* alſo. Why, he next aſked, had we not applied for a *Parwáná?* Our anſwer was, that had we waited the time neceſſary for procuring a *Parwáná*, the ſeaſon for going through the

Himáchal would have paſſed, but that had we found the horſes required, we ſhould have applied regularly for permiſſion for going through the *Gorkáli* country. We then enquired, if he had to complain of our having committed any violence or irregularity in the courſe of our march. He anſwered in the negative. He was then informed, that hundreds of the *Nipaleſe* went through the Company's provinces in any direction they pleaſed without interruption. He admitted the truth of the remark, but ſaid that he wiſhed us to remain five days at *Karn-Prayág*, and afterwards ſaid that this period might extend to fifteen or ſeventeen days, until a deciſion ſhould be formed by the different chiefs as to the line of conduct to be taken. We ſaid that we had been much detained at various places on different pretences, that our money was nearly exhauſted, and that we could not make any further halt than one day, when we would proceed towards *Páli*, where we would halt two days. He ſaid, that he was obliged to go to *Serínagar* on account of the *Das'harà*, and we might not find any bearers the next day, but that we might depend upon them the following day; and that he would order the *Bichárí* to attend us to *Chilkiah*. We parted apparently on the beſt terms; and BANDU THÁPÁ was much pleaſed with his preſent.

October 10th.—AT 8 o'clock BANDU THÁPÁ ſet off in a *Dandí* or blanket collected in gathers at the two ends and tied to a long pole. He was carried by two men, who muſt have been abundantly loaded, as he cannot weigh leſs than fifteen ſtone. The town of *Karn Prayág*, contained many inhabitants in 1808; but at preſent a few *Brahmins*, who attend the temple, and ſome *mullahs* who take care of the *Jhúla*, conſtitute the whole number.

October 11th.—THERMOMETER 55°. Noon 80°. Night 61°. After

having completed 3358 paces in a ſoutherly direction with ſome eaſting and weſting, we encamped near a *Pípal* tree, having the *Pindar* on our left, and the *Chandpur* nullah emptying into this river in a broken ſtream a little before us, and about a quarter of a mile below our former ground of encampment. The ſoldiers along with us have ſcarcely any cartridges, and would have the worſt of it, were they to attack us, but I truſt this is not their intention, although I perceive their numbers are increaſed.

October 12th.—THERMOMETER 50°. Night 57°. A ſervant, I had brought from *Pípal Kótí* had been ſeveral times at *Adh-Bhadrí*, and ſtated that the road on the right ſide of the *Chandpur* nullah was ſhorter and better than that by *Tope* or *Támbá Kótí*, and that the people from this part of the country always went by this road. As it was a great object with me to ſave diſtance, I reſolved to go by this road; my companion determined to go by the other. I conſidered this a matter of little conſequence as the ſeparation would only be for a few hours. Whilſt on the road a ſtout *Gorkálí*, whom I had not before ſeen, and who from his dreſs appeared of a rank ſuperior to the reſt, ſpoke to me in a very inſolent tone, and placed himſelf in a menacing poſition ſtriking his muſket violently againſt the ground. I ſnatched my gun from my ſervant, cocked it, and ſtopped with the intention of ſhooting him if he advanced a ſingle ſtep towards me. Another ſoldier, ſeeing what I was about, ran, begged me to deſiſt, and abuſed the man who had been impertinent. The village was on a very high ſpot. I left my goats a few yards behind, and with my *Khalási*, CHETA, went into a ſquare flagged, on two ſides of which were low buildings for cattle, and in front a high *Chabutra* connected with ſome houſes. On the edge of this ſtood twenty-five *Gorkáli Sipahís*, principally new faces, and on the flags below were my loads. I aſked who was the head of this force,

and, on his being pointed out, aſked him what was the meaning of this deception. He ſaid it was expected that I ſhould halt there, and every thing was ready for my accommodation; I told him that it was my intention to croſs the *Chandpur* nullah, that night, and deſired to know if he meant to furniſh bearers. He anſwered, that no bearers were to be had, and that it was impoſſible from the lateneſs of the hour to reach *Chandpur*. I ſaw that nothing was to be expected in the way of aid. A guide was even refuſed. I therefore ordered my people to throw away my things of leaſt value, divide the reſt, and march.—Well aware that it would be impoſſible for me to reach the banks of the nullah, as the night was ſetting in, I pitched my tent on an elevated ſpot cloſe to the *Math*. I placed a ſentry on each road, and had a fire made ſufficiently large to throw light upon them. My men were placed upon the *Chabutras*, and altogether my poſition was more reſpectable than could be expected on ſuch an emergency. The fakirs, who live at the *Mat'h*, deſired us to be watchful, as a very large tyger had lately taken off three men from that neighbourhood.

October 13th.—The night has paſſed in quiet. I marched about 9, and in about an hour over a deſcending and ſlippery road came to the ſteep bank of a watercourſe, Mr. H. ſent a note, ſtating that he had been ſtopped at the village of *Tope* yeſterday, and deſired to go to where I was. This he refuſed, and by ſhewing a firm determination to proceed was not oppoſed, but the *Gorkálís* left behind, at the moment of his going on, were buſily engaged in putting flints in their guns. He had reached *Adh-Bhadrí*, was under arms, and deſired me to join him as ſoon as poſſible. In about an hour, I found Mr. H. encamped in ſome flat ground between the temples of *Adh-Bhadrí* and a nullah. In a ſhort time the carriers from *Bandólí*, moſt probably inſtructed by

by the *Gorkálís*, all at once ſtarted up and ran off. It is believed, that this was done to delay our marching. We here diſencumbered ourſelves of the leaſt valuable of our property, and divided the reſt amongſt our ſervants to carry. In the evening we ſet off. The *Gorkalís* ſoon followed us. We were overtaken juſt as on the point of leaving our ground, by HARKH DEO, who ſaid KANAK SINGH was in the rear of the loads, which moved very ſlowly. We reached the *Malsí* mulberry tree. The *Gorkálís* encamped about a hundred yards above us. The march of this morning was about 4000 paces, that of the evening 2500.

October 14th.—THERMOMETER 48°. At 3500 paces I reached the ſummit of *Dewálí-kalkí Ghátí*, having for the laſt mile proceeded through a fine foreſt of horſe cheſnut, walnut, ilex, and rhododendron of the red kind. Many people have, it is ſaid, been killed by tygers at this ſpot, within the laſt three months. At 5058 paces, croſs the rivulet. Here we ſtopped to eat ſome *d'hál* and rice. Inſtead of ſtopping near us, as heretofore, the *Gorkálís* proceeded about two miles in front to dreſs their victuals and to make arrangements for ſtopping us at the *Sobha* paſs. Had we not been embarraſſed by our goats, a march acroſs the *Gadra* to the right, leaving the *Rámgangá* to the left, and ſteering towards *Langúr* green, would have completely diſconcerted their ſchemes, and have brought us into Mr. H's *jagheer* near *Láldáng*. However, circumſtanced as we were, it only remained for us to perſevere, until we ſhould have gained the *Sobha* paſs beyond which it would be difficult for them to ſtop us. After taking our frugal meal we proceeded. The diſtance from our halting place is 2600 paces, and we encamped upon a flat on the left bank of the river, where we were met by ſome *Domes* with muſick. At night a farmer brought his ſon that was ſick, and expreſſed his concern at our ſituation, believing us in

confinement. When it was explained that this was not the caſe, he ſaid, that it muſt happen, as all the troops were to meet at *Sabha*, and detain us there, as they had failed of effecting their purpoſe before. Orders had been iſſued to all the farmers to aſſiſt them, in caſe we ſhould reſiſt them. Here again our eſcort departed for the night to a village at a diſtance, and had we not had the goats, we might have availed ourſelves of this opportunity; but I had determined, as long as it might be in my power, not to quit the animals which it had coſt me ſo much pains to obtain.

October 15th.—HOAR froſt, thermometer 47°. I marched with the goats. After having gone about a mile, I obſerved, that I had paſſed on the right, and below me, a body of about 80 or 100 men armed with muſkets. They were evidently ſurpriſed, and hurried much to overtake me. I fell to the rear of the goats and continued my pace; a man aſked me where HEARSEY ſahib was, and deſired me to ſtop. I aſked him who he was, and by what authority he took the liberty of interrogating me. He replied that he was the jemadar of the party, and was ſent to prevent our proceeding until his ſubadar and the principal zemindars of the country have a meeting with us. I told him, that I was proceeding quietly on the high road moleſting no one, that I expected not to be moleſted, and that I ſhould reſiſt in the beſt way I could any attempt to ſtop me by force. That we had promiſed BANDU THÁPÁ to ſtay two days at *Palí*, and that we ſhould ſtay that time according to our word. He then dropped his tone, and requeſted me to order my people, not to go on, which I refuſed. As the ſoldiers had gathered round me, and were cloſing, I told him that if he did not order them to go to a diſtance, I ſhould conſider myſelf attacked and act accordingly; and adviſed him to reflect on the conſequences which might enſue by his forcing me to defend myſelf. He ordered the ſol-

diers to keep farther off. I continued to march, followed by the whole of the party. After reaching the bank of the river which was forded, a man of BANDU THÁPÁ's party came to know if I wiſhed the goats to be carried; for this civility, I thanked him, but declined giving him any trouble, ſave that if any of the goats ſhould chance to be carried down the ſtream, that he would order his men to ſtop them juſt above a rapid at a ſhort diſtance. I continued my march, when the jemadar ſaid that if I would ſtop only one day, oppoſite SUMÉRU's houſe, the meeting would take place, and we might proceed. I refuſed to ſtop any where ſhort of *Mehelchowri*. In half an hour more I ſaw a large new houſe half way up the hill on the right, and on the plain cloſe by the road the party of ſoldiers was aſſembled, they having preceded me from our laſt converſation; a tall man, whom I underſtood to be SUMÉRU came forwards, made a ſalam, ſpread a blanket and begged I would go to his village until the ſubadar ſhould come. I ſaid that I was upon the principal road; and I was determined not to leave it until I ſhould arrive at *Mehelchowri*. He requeſted me to ſtay only one day, during which the buſineſs would be ſettled: I told him we had been much deceived before, and at *Páli* only would we halt willingly. I reſolved to wait for my companion coming up, that we might defend ourſelves with more advantage againſt the force which now amounted to as much as the country could muſter. Wiſhing likewiſe to draw SUMÉRU away, I gradually, whilſt converſing, walked back again and he followed. At a proper place the note from D S. was given. He ſaid he knew its contents, and would furniſh proviſions and bearers, if we would only ſtop one day. In a ſhort time Mr. H. came up, he was of opinion, we ought to get beyond the *Sobha* paſs, as if they failed to ſtop us there they could not have an equal opportunity elſewhere. I agreed with him and took charge of the advance, whilſt he brought up the rear. The goats were with me.

A body of *Sipáhís* ran before to gain a narrow part, which confined the path. One went through the goats; I followed to puſh him from amongſt them, and found about twenty men had formed a line upon the path. The man I had purſued, probably exaſperated by being obliged to run in the ſight of his countrymen, put himſelf in a menacing poſition on the path. I retired a few paces, dropped on one knee, in order to get a ſteady and low aim, when another advanced humbly, and the perſon, who appeared ſo reſolute, threw down his muſket and preſented his neck alſo. I ordered the ſoldiers to quit the path, and they drew up on the ſide for me to paſs. Whilſt this was going on, Mr. H. was engaged in warm converſation with the *Sipáhís* behind, had formed his few men into two diviſions, and agreed to no other terms than thoſe I had before propoſed, viz. that we would go to *Mehelchowrí* and wait there the remainder of the day. To this place we went; and, having only made 4500 paces, encamped under the ſhade of a mulberry tree and ſalinga tree, cloſe to the habitation of a *Goſain*. This perſonage was tall, thin, with a long beard and about eighty years of age. He approached with much reſpect, and deſired me to ſit down on part of the *Chabutra* under the mulberry, ſurrounded by ſtone figures of deities. In a ſhort time bringing a pomegranate, he particularly requeſted that we would ſtay a few days, as violence would certainly be offered if we did not. He repreſented himſelf to be an inhabitant of *Oude*; and, after reſiding here forty years, was anxious to die at *Benares*. He was tired of living in a country where religion was neglected, and every thing tended to deſolation. In the evening a *Brahman* who was called a major, and who we underſtood executed the writing buſineſs belonging to the Company, now made his appearance with a meſſage from the ſubadar, ſtating that to-day he was much engaged in ceremonies of ablution and worſhip, but that early in the morning he would certainly wait on us. To this we replied, that we had made a very ſhort march

to accommodate him, that he had not come agreeably to his promiſe, and that if he were diſpoſed to ſee us, we would wait for him at the *Khutſar Gudrah*, on the ſouth of the *Sobha* paſs. The major repreſented, that it would much gratify him and the whole party, if we would ſtop here four or five days. This we poſitively refuſed. The old pundit was very deſirous of our ſtay; but, as we plainly perceived that time was all the ſubadar wanted, we reſolved to perſevere. The appearance of one of Mr. RUTHERFORD's agents, who ſaid he was come on his maſter's buſineſs, makes us diſbelieve the report of there being any rupture between our government and the *Gorkális*, and makes us ſtill more deſirous to avoid actual hoſtilities.

October 16th.—MORNING very foggy. Thermometer 52°. We were ſtirring very early, and as the *Gorkális* were round us in conſiderable bodies, I had my breakfaſt placed on a ſtone and ate it, with my gun in my hand. Many jemâdars and havildars came round Mr. H's tent, and the ſoldiers cloſed. I called to the principal jamadar, and ſaid, if the ſoldiers did not immediately retire, I ſhould look upon their preſence as an hoſtile aggreſſion, and act in conſequence. Seeing me thoroughly prepared, ſeveral of the officers came, offered their necks, and deſired me to take off their heads, as if they did not ſtop us that would be their fate: obſerving that many had got round me, I ſtepped away from them; and the ſervants who had been ſent off with the goats, ſaid they were not allowed to proceed. I then ſaw that a body of about thirty had barred the path, were forming in a ſemicircle, and coming on to attack us. I called to my companion to prepare, and ſprung into the path, deſiring the ſoldiers to ſtand clear. The main body opened a little, and I independently advanced with too much impetuoſity. A man or two advanced, and I ſhoved them back. My gun had in an inſtant as many hands upon it

as could find room to touch it, but they could not wreſt it from me. I had at leaſt ſeventeen or twenty upon me, but this rather prolonged than ſhortened the conteſt, as they pulled in oppoſite directions. It would have been maintained for even a longer time, had not one man got upon my neck and ſtuck his knees into my loins, endeavouring to ſtrangle me with my handkerchief, whilſt another faſtened a rope round my left leg and pulled it backwards from under me. Supported only by one leg and almoſt fainting from the hand round my neck, I loſt my hold on the gun, and was inſtantly thrown to the ground. Here I was dragged about by the legs until my arms were pinioned. When I had got up, nothing could ſurpaſs the ſavage expreſſion of joy depicted in the countenance of the victors; nor was the ferocity of their actions much behind hand. For fear of my getting looſe, two ſoldiers held me faſt by a cord, and every now and then gave me a violent jerk by way of letting me know my ſituation. I deſired to be placed upon the *Chabutra* out of the croud; and, after ſome heſitation, this was complied with. Mr. H. it ſeems had little ſuſpicion of ſo immediate an attack, as he was waſhing his mouth when the affray begun, and did not hear my call to him. Our ſervants were abſent from the ſmall pile of arms we had. I had only one armed man in my ſuite, having given over my other double barrelled gun to Mr. H. for his own immediate uſe; and to my ſervant who had a long duck gun, I had given the moſt expreſs orders not to fire unleſs the *Gorkálís* fired firſt. Mr. H. and the whole of our ſervants, except two or three who eſcaped this fate, I know not how, were ſecured. Mr. H. was not bound, but ſecured by perſons holding his arms. Some of the others were ſtruck with the butt ends of muſkets and much maltreated. In about two hours, during which I remained bound, the ſubadar made his appearance. He ſeemed quite a beau juſt ſtepping from his toilette, ſaluted all the ſoldiery with a ſimpering ſmile of exultation playing on his countenance. He did not

deign to ſalute either Mr. H. or myſelf, and we were certainly not in the humour to pay any compliments. After caſting upon us ſome looks of ſurvey, he retired to hold a council. In a few minutes he came again, and having a carpet ſpread near Mr. H. ſeated himſelf upon it and entered into converſation. I aſked him whether the rope ornaments placed round my arms were the bands which connected the friendſhip of the *Engliſh* and the *Gorkalís*. Whether this was a conduct that was juſtifiable towards a traveller who entered into the country peaceably, who had demeaned himſelf in the moſt peaceable manner whilſt he remained in it, and was returning peaceably towards his own home. To this he aſked why I went through the country in diſguiſe? I anſwered to avoid expence, unneceſſary delay, and to enable me to get into the *Undés*. During this time I remained bound. He deſired me to be ſeated: this I refuſed, until the cords were taken off my arms; which he ordered. The excuſe he urged for not coming before, was that the day was one of great religious ceremony. If ſo, I obſerved, what reaſon was there for his having delayed, not making his appearance till ſo late an hour, its being now near twelve. He ſtammered out ſome imperfect apology. I pointed out the bound people, and deſired that either they might be unbound, or that I might be re-ſhackled. He ſaid, that they all ſhould be ſet at liberty; and two or three were looſed. In about half an hour the ſubadar left us, and after a long conſultation, in which jemâdars, havildars, and ſípáhís bore a part, a letter was written to BAM SAH at *Almora*. This cowardly fellow had prudently kept himſelf out of the way, till the ſcuffle was over. By acting as we have done, we have got into a part of the country leſs remote from the plains, and more in the way of ſending information of what has occurred. In the evening, our low country ſervants were unbound; but thoſe we have hired to bring in our baggage, were ſtill bound, as well as the *Pundit* and his nephew. The former acted with firmneſs,

the latter was much caſt down. I deſired that ſome of my ſervants might go to attend my goats. This was acceded to. On looking over the events of this day, and reflecting on the conſequences which may reſult from them, I cannot but be grateful to the Author of all, for having given me firmneſs to bear my preſent ſituation without the dread of the death, now likely to cut ſhort my career. About fifty peop[le] are ſet to guard us; and they are ſo noiſy as to afford little ch[ance] ſleep to-night.

October 17th.—This day was uſhered in, by the hammering of a blackſmith preparing fetters. In the forenoon, the two *Pundits* were taken away, as we apprehended, to be put to the torture; however in this we were miſtaken, as it was for the purpoſe of placing one leg in a ſquare hole cut out of a heavy log of wood, and a ſtrong peg being driven acroſs the two ſides of the notch retained the foot. Several of my ſervants, were ſhackled in this manner, and of Mr. H's. One of my bearers offered to carry a letter, as alſo did my goatherd. This man came up as a fakír, the ſecond day after we had come over the *Níti* paſs, and ſaid he would take ſervice, provided I would furniſh him with victuals till we ſhould reach the plains. He purpoſed going to the ſubadar, ſaying that he was a fakír, had only accompanied us for his victuals, and wiſhed to depart. If he got permiſſion, he ſaid he knew what road to go by, to prevent being ſtopped at any of the *Gorkálí chokís;* and ſhould, bating accidents, reach *Chitkúh* on the third day. I wrote a letter to Sir E. Colebrooke, open, relating the general circumſtances of our ſituation, and that the only matter which could be laid to our charge, was going through the country in *Hindu* dreſſes. This along with one from Mr. H. to his brother-in-law Lieutenant Salmon, were put into a piece of my orange coloured mantle, and ſewn within the doubles of an old woollen wrapper, in which the

fakír kept the inſtruments he uſed in prayer. He made his repreſentation to the ſubadar, but was ordered back into confinement. This did not diſconcert him. He was confident that he ſhould be able to execute the commiſſion he was charged with. He ſaid that he had eaten my ſalt, would not be ungrateful; that he ſhould not ſtop here, but having his beard ſhaved, and having changed his dreſs, he ſhould proceed with an anſwer to *Almora*, or wherever we might be. He left me, and I ſuffered an hour to elapſe before I looked for him. He was then ſitting down on the ground with his blanket on his head and arranging ſome wood in a bundle, as if for cooking. When another hour had paſſed again, I ſaw the heap of wood with a bundle of clothes laying by it, cloſe to one of the ſentries, but the fakír had diſappeared. Should he ſucceed, we owe him great obligation, as the probability of our deliverance depends almoſt entirely on the repreſentation Sir E. COLEBROOKE will make to the chief of *Almora*. We deſired the ſubadar to allow the major to write a letter from us jointly to the *Choutra*, BAM SAH ſtating in general terms, that as we had been impriſoned, and bound by his order, we deſired to be taken to *Almora*. We encloſed a note to Mr. HAWKINS, mentioning the impriſonment, and requeſted the *Choutra* to forward it to that gentleman. I gave the major a pair of ſciſſars for his trouble, and a rupee to each of the two ſoldiers, who were going to *Almora* with the letter. A reward of three more was promiſed if they brought us an anſwer on the fourth day. A conſiderable number of farmers was brought together by order of the ſubadar, in order to ſhow them the puniſhment he had inflicted on the *Sahib log*; commiſeration was depicted in their countenances, which formed a ſtriking contraſt with thoſe of our guards. The old *Goſain* continues his kindneſs in bringing all the milk his cow gives, morning and night. This is very little; but it ſhews his will.

October 18th.—About 10 o'clock, the fakír was miſſed. A great noiſe was made; and a ſtrict ſearch for about an hour; and perſons ſent out in every direction: however, I truſt, that our meſſenger will have got completely out of their reach. This eſcape has made them doubly vigilant, and a man looks into the tent every hour at leaſt.

October 19th.—The old *Pundit*, his nephew, and our hill ſervants were releaſed from their logs, but had their hands bound and were taken away to *Almora*. To the *Pundits* I gave preſents of money and an order for a further ſum on my agent; and in the event of their deaths, I made a proviſion from my effects for the maintenance of their families. We were told that our low country ſervants ſhould now be releaſed from their logs. An abbatis of ſtakes interwoven with bruſh wood was made round. The ſtakes, being only driven ſtraight down, might eaſily be drawn up. I mention this, becauſe, after the *Gorkálís* have made an attack, they uſually entrench themſelves in this manner.

October 20th.—Thermometer 45°.

October 21ſt.—The fogs are ſaid to hang over the *Rámgangá* at this ſeaſon, for about half this month: when they diſperſe, they are very denſe and penetrating. One of the hill ſervants I hired as a cooly on the banks of the *Nandákní* arrived with his load. He had been ſick and obliged to ſtay at a village behind. The other man Tilak, now gone to *Almora*, ſaid that we might rely upon his honeſty and fidelity; and he has given a proof of it, as if he had been diſhoneſt, he might have gone off with his load unmoleſted: but though evincing ſome little courage in coming to perſons in captivity, after learning the fate of his comrade, we find it is confined to this, for on ſounding him as to

taking a letter to *Moradabad*, he expreſſed his fears, and though apparently recovered, cited his illneſs as one cauſe for his not undertaking the journey.

October 22d—Our ſervants were this day releaſed from their logs and had more liberty allowed them for moving about. Seventh day of impriſonment.

October 23d.—In the evening the two jamâdârs arrived with a letter from Bam Sah. This acknowledged the receipt of our letter, and a copy of an order from *Nipal*, ſtating that having heard that two perſons had gone towards the *Úndes* in diſguiſe with guns, &c. Bandu Thápá was ordered to ſtop them on their return, and know their buſineſs, and who they were, and alſo to detain them till an anſwer ſhould be received from *Catmandu*. The jamâdârs ſaid that they were ſurpriſed we had gone privately when we might have commanded the country. We returned the ſame anſwer as to Bandu Thápá, that it was to avoid delay and inconvenience, but from all I have ſeen, I am thoroughly convinced, that, if we had applied for permiſſion, it would not have been granted.

October 24th.—The jamâdârs, who brought the letter from Bam Sah, came this morning to ſay that they had orders to procure whatever we might ſtand in need of. The jamâdârs pretended to expreſs aſtoniſhment at the ſeverity of the uſage we had met with, which they ſaid was not agreeably to the orders the ſubadar had received; and ſtated that this had not been reported to Bam Sah.

October 25th.—A letter to Bam Sah was finiſhed and ſealed. We determined to ſend Kangh Singh with it, that we might be ſure of

its reaching BAM SAH, and that he might fully repreſent the treatment we had experienced. A half kind of conſent was given to this by the jamâdârs. A copy of our former diſpatch to Sir E. COLEBROOKE, to which were added recent incidents, was given to the father of a boy, whom I had relieved by tapping for dropſy. He ſaid, that he ſhould go to his houſe immediately, would place the letter in the ſole of one of his ſhoes, and carrying theſe in his hand, would reach *Chilkíah* on the third day.

October 26th.—THIS evening we took a walk out of the northern gate of the abbatis, and prolonged it for about an hour, in order to reconnoitre the adjacent country, for the purpoſe of attempting our eſcape ſhould there appear a neceſſity for the meaſure. Our guards apparently did not miſs us for the firſt half hour, when our abſence gave them much alarm; and ſuſpecting we had actually effected our eſcape, people were ſent out in every direction to apprehend us. The attempt to eſcape from hence would be difficult, as in ſuch caſe we muſt proceed completely through the wildeſt part of the country; and almoſt all the ſmall water-courſes, by which the mountains are ſeparated, ſerve as the retreat of bears and other wild beaſts.

October 27th.—WHEN we reached this place, the ſides of the mountain were beautifully green: but in this ſhort ſpace, by the night froſts, they have aſſumed the ruſſet livery of autumn: ſo rapid is the change of ſeaſon in this country.

October 28th.—EARLY this morning a jamâdâr came into our tent; and ſeating himſelf, ſaid the object of his journey was to convey us to *Sirínagar*, where AMR SINGH wiſhed us to be. This man brought no letter; and his interference was evidently the cauſe of ſome perplexity

to our jamâdárs. AMR SINGH is the head of the army; and BAM SAH, the chief of theſe diſtricts.

October 29th.—THE watchfulneſs of our guards has not in the leaſt diminiſhed. A zemindar brought to the troops ſome *Ghee* for ſale. Some one complained, that oil was mixed with it. The ſervant of the owner was laid hold of, and through fear of being puniſhed, if he did not confeſs that his maſter had adulterated the *Ghee*, made an accuſation to this effect. The ſuppoſed culprit was ſeized, ſtripped, bound, and flogged ſeverely with thongs. The *Ghee* was confiſcated for the uſe of the ſoldiers; and twenty-five rupees as a fine were ordered to be paid as the fine to the ſubadar—ſhould the poor wretch not be able to pay this in money, his cattle or children will be ſeized to the amount, and the value will be paid by the perſon who is to benefit by the property.

October 30th.—TO-DAY more troops reached us from *Sirínagar*; and we have with us in all about 190 men.

October 31ſt.—ANOTHER jamâdár now came with a few men, ſaying that he had the orders of BANDU THÁPÁ to proceed with us to *Sirínagar*, from whence we were to go to *Haridwár*; and that on the road we were to be met by RANJUR KAJEE, the ſon of AMR SINGH. Although BANDU THÁPÁ did not write, we thought it right to ſend him a ſhort letter, ſtating that as we now were on the high road to *Chilkia*, it would be highly inconvenient for us to leave it. This jamâdár is about ſixty, of a more frank character than any of his brethren we have met with, and is employed in going through the diſtrict to prevent the farmers running away. He ſaid his efforts to give confidence to the farmers were ineffectual, and the orders of the *Rájá* were diſobeyed. An order had been iſſued under the great ſeal of the prince, in conſequence of

the great loſs in the population of *Garuhál*, prohibiting the ſoldiers from taking any of the inhabitants as ſlaves: but this was wholly disregarded, and the ſoldiers always eſcaped the puniſhment with which they had been threatened. Living in free quarters, without receiving any check for his conduct, the ſoldiers had, the old man obſerved, ſo far oppreſſed the country, that where there were formerly twenty-five families, now only one was to be found.

November 1ſt.—THE jamâdárs from *Almora* came at an early hour to report that orders had arrived from BAM SAH to return all the things which had been taken from us; and after the lapſe of about two hours, they returned with the guns, &c.; we now found ourſelves in the way to liberty, and reſolved not again to part with our arms except with our lives. This day our hill ſervants arrived. The old *Pandit* and his nephew were in irons, but were furniſhed with victuals by BAM SAH.

November 2d.—HOAR froſt. Thermometer 36°. Night 60°. We made preparations for marching at 9ʰ 15′, left *Mehelchowrí*; and aſcended the *Sobha* paſs. At the foot of the deſcent from the *Sobha* paſs is the *Khatſúr* valley, and half way down is a knoll of calcareous rock, the weſtern ſide of which about thirty feet high, and overhanging the baſe, forms a ſhallow cavern attributed to one of the *Súrs*. From chinks in the ſtone exudes a ſmall quantity of black bitumen. The *Khatſúr* valley is about a mile broad: in the middle the edges are full of ſprings, the water of which is collected for irrigating the flats. This valley produces the *Bunſmatí* rice, next in quantity to that of *Chookum*, and would give vaſt crops of hemp of the fineſt quality. We pitched on a rice flat, on the right bank of the *Rámgangá*, oppoſite to a ſmall village called *Jhalah*. KANGH SINGH overtook us here with a letter from BAM

Sah, ſtating that his ſon was on the road to meet us, that our ill treatment did not proceed from him, and that the authors of it ſhould be ſeverely puniſhed.

November 3d.—Thermometer 41°. Night 69°. March at 10, we encamped under a *Pípal* tree a little below *Maſhí*, on the left bank of the *Ramganga*. The top of *Ghenſáli ka Ling*, covered with ſnow, was very viſible in a Northern direction. Our ſuppoſed march to-day about ſeven miles. There was here an immenſe quantity of fiſh. The people place looſe bundles of rice ſtraw in the river, and keep them down with large ſtones. The fiſh coming into them to depoſit their ſpawn, are ſeized by the hand before they can get from within the ſtraw. In front up the hills are three ovens for extracting tar; but the pines are ſmall, and of courſe do not contain much turpentine.

November 4th.—Thermometer 50°. Night 62°. The ſon of Bam Sáh was announced juſt as we had finiſhed dinner: when he came, preceded by an old man repeating his titles, &c. and five or ſix bazar girls. His name is Lachbír Sáh, about twenty-ſix or twenty-eight years of age. He was dreſſed in fine *Dacca* muſlin, and had about twenty ſhabby orderlies in attendance. He expreſſed the concern his father was under, at learning how we had been treated; and was anxious to have us believe, that the *Sipáhís* had acted not only without his father's orders, but even without any orders at all. He appeared deſirous, we ſhould ſay we forgave what had happened, and the perſons who had committed the outrage ſhould be puniſhed; we requeſted that the *Pundits* might be releaſed, and ſtated that we were unwilling that ſervants ſhould be puniſhed, for having acted agreeably to their orders. Lachbír Sah ſaid, that he would make a ſevere example of the ſoldiers, who had been moſt active in ſeizing us, if we would point them out. It

was obviouſly his intention to have given up a few of theſe wretches to condign puniſhment, in order that we might have the odium and conſequences of the act, and that his government might retaliate upon the *Pundits*. It was ſtated by us, that we ſhou'd derive no pleaſure or ſatisfaction from the immediate agents being puniſhed; but we ſhould be glad to know the authors of our arreſtation, who were principally to blame; and we farther ſaid, that, as far as we were concerned, we ſhould forgive the men, provided the *Pund ts* were immediately returned, ſo as to quit the country with us. He ſaid he would write this propoſition that evening to his father, and wiſhed us to ſtay till a meſſenger ſhould return from *Almora*, with an anſwer. He ſaid that DASRATH BAKSHÍ had written to *Nepál*, that we had taken up between 4 or 500 men with muſkets &c., had erected forts on the border between *Bóthant* and the *Undés*, and were endeavouring to raiſe the *Marchas* and *Unías* againſt the *Gorkális*.

November 5th.—THE jamâdárs laſt night requeſted, that the ſubadars might be furniſhed with a certificate of their good conduct towards us. We ſaid that we had no objection to give a certificate of the good behaviour of the one, and that we pardoned the other, provided he would aſk pardon of the old *Pundit* for the treatment he had experienced from him and his ſoldiers. LACHBÍR SAH came in the afternoon, and announced the receipt of a letter from the *Rája* of *Napal*, ordering us to be ſeen ſafe out of the country with all our effects, and that we ſhould be treated with civility. He obſerved we were at liberty to depart whenever we might think proper.

XI.

On the Dryobalanops Camphora or Camphor-tree of Sumatra.

BY THE PRESIDENT.

IN the fourth volume of the researches of the Society, in an essay on the express subject, the camphor of *Sumatra* is stated to be 'the produce of a tree growing on the north-west side of *Sumatra*, from the line to 3° north.' A familiar description of the tree is given, on the authority of a gentleman, who long resided at *Tapanooly*: and its botanical place is assigned 'in the class *Enneandria Monogynia* of LINNÆUS, differing however in the form of the leaf from the *Arbor camphorifera Japanica*, and much resembling the bay in leaves.' *

IT is evident, that the author of that essay (M. MACDONALD), or the person from whom he derived his information (Lieutenant LEWIS), considered the plant in question to be a laurel; as the camphor tree of

* *Asiatick Researches*, 4 p. 19.

Japan is deſcribed to be.* But, as neither of thoſe gentlemen ſeems to have been converſant with botany, it continued to be far from improbable, that the botanical character of the plant might have been miſtaken by them; and that it was referred by the author of the eſſay cited, to the genus *Laurus*, or to the claſs and order to which that genus belongs, upon no other foundation but a preconceived notion grounded upon the exiſting information concerning the camphor tree of *Japan*. It was the leſs unlikely, that the two plants might belong to different genera, or even to different orders, as camphor is well known to be a production of a great variety of plants, though in a leſs pure ſtate, and not ſo readily and abundantly afforded; and as it was obſerved by KŒMPFER, in ſpeaking of the *Laurus camphorifera* and of the extraction of camphor from its wood and roots with the aid of the heat, that "natural camphor in ſubſtance and of greateſt value is furniſhed by a tree on the iſlands of *Sumatra* and *Borneo*, which is not of the *Laurus* genus." "Camphoram naturalem et criſtallinam perquam pretioſam ac raram impertitur arbor in *Sumatrâ* et *Borneo* inſulis. Sed hœc arbor ex Daphneo ſanguine non eſt."†

CONSIDERING then the ſpecific character of the camphor tree of *Sumatra* to be unſettled, and the generic character dubious, botaniſts in *India* have been long ſolicitous of more correct and definite information on this ſubject, and Doctor ROXBURGH in particular was at great pains to procure living plants with ſpecimens of the fructification. His endeavours had not been ſucceſsful at the time of his quitting *India:* but he had received a rough ſketch of the fruit and leaf, from the appearance of which he was led to name the plant *Shorea*

* Kœmpf. Amœn. 770, Thunb. Jap. 172.

† Amœn. Exot. p. 773.

camphorifera; * and his conjecture, as will be ſhown, was not very remote from the truth.

It has been my fortune, in his abſence, to receive from Doctor Roxburgh's correſpondent at *Tapanooly*, (Mr. Prince, the reſident at that ſtation,) a number of the ſeeds in very perfect condition, and a few living plants. The latter, I am ſorry to ſay, did not outlive the ſubſequent cold ſeaſon: but the examination of the ſeed enables me to determine the genus of the plant with entire confidence. It undoubtedly belongs to the *Dryobalanops* of the younger Gœrtner; and is not unlikely to be the identical ſpecies, which furniſhed the ſpecimen inſpected by him, and which he named *Dryobalanops aromatica*. Gœrtner's information indeed ſtates the ſpecimen to have been received from *Ceylon* with an intimation that the bark of the tree is the genuine and beſt cinnamon. But, as there is every reaſon to be ſatisfied, that cinnamon is excluſively produced by a ſpecies of the laurel,† the information, which accompanied the ſpecimen in queſtion, may have been in every part inaccurate.

As this point, however, is uncertain, and the ſpecific characters of Gœrtner's ſpecies are unknown, or at leaſt unpubliſhed, it is for the preſent neceſſary to allot a diſtinct name to the camphor tree of *Sumatra*. I propoſe therefore to name it *Dryobalanops camphora*, until its identity with D. *aromatica* be eſtabliſhed. The deſcription, which I ſhall offer of it, is unavoidably imperfect, as the flower has not yet been ſeen by a botaniſt. But the generic character is ſo ſtrongly pronounced in the fruit, that there can be no doubt of its place in the ſame

* "Shorea camphorifera. Roxburgh. Sp. char. Leaves oval, acuminate, parallel veined, ſmooth; Flowers axillary."— Roxburgh's MSS.

† *Laurus* cinamomum.

natural order with the *Shorea*, the *Dipterocarpus*, and *Vateria*, to which the *Hopea* of Doctor ROXBURGH is to be added; and most probably in the same class and order in the linnean artificial arrangement, viz. *Polyandria monogynia*.

THIS section of JUSSIEU's natural order of *Guttifera* comprises trees remarkable for their aromatic and resinous productions. *Shorea robusta*, and *Zambuga*, and perhaps other species of the genus, yield in great abundance the resin called by the *Hindustánis*, *Dhúna*, and by the *English* in *India* *Dammer*, which is very generally used as a substitute for pitch for marine purposes. The natives of *India* also employ it in their temples in the manner of incense. Dipterocorpus costatus, turbinatus, incanus, alatus, and probably other species of the genus, afford the several sorts of balsam called by the natives of *India*, *Garjan*; by the *Singhalese*, *Dhornatél*; and by the *English*, *Wood-oil*. *Vateria Indica* produces the resin in *India* called *Copal* as very nearly approching the true resin of that name: the best specimens are employed as ornaments, under the denomination of amber (*Kahroba*) to which it bears exterior resemblance: in its recent and fluid state it is used as a varnish in the south of *India*, (BUCHANAN's *Mysore* 2, p. 476,) and dissolved by heat in closed vessels is employed for the same purpose in other parts of *India*. Another plant of the same genus, *Vateria lancæa-folia*, affords a resin from which, as from other resins, the *Indians* prepare one of the materials of their religious oblations.

DESCRIPTION.

DRYOBALANOPS CAMPHORA. *Cole.*

ESS. CHAR.

Calyx one-leaved, permanent: the five divisions of the border growing into long, remote, reflex wings.

COROL—

Capſule, ſuperior, one-celled, three valved, one-ſeeded. Embryo inverſe without periſperm.

A LARGE tree, native of foreſts on the north-weſtern coaſt of *Sumatra*: and eſpecially in the vicinity of *Tapanooly*. *Sans.* Carpura. *Arab.* Cáfúr. *Mal.* Cápúr. *Hind.* Cápúr.

Trunk arboreous. *Bark* browniſh.

Leaves, ſuperior alternate; inferior ones oppoſite; elliptic, obtuſely acuminate, parallel veined, entire, ſmooth; 3–7 inches long; 1–2 broad.

Petioles ſhort. *Stipules* in pairs, ſubulate, caducous. *Perianth* one-leaved; five-parted, perſiſtent.

Capſule ſuperior, ovate, woody, fibrous, finely ſtreaked with longitudinal furrows, embraced at the baſe by the calycine hemiſpherical cup and ſurrounded by its enlarged leaflets, which are converted into remote, foliacrous, ſpatulate, rigid, reflex wings: one-celled, three valved.

Seed ſolitary, conform to the cavity of the capſule. *Integument* ſimple, thin, membranaceous, thickened along one ſide and thence penetrating to the axis and continued between the interior fold of the cotyledons. *Periſperm* none. *Embryo* conform to the ſeed, inverſe, milk white. *Cotyledons* two, unequal, almond-fleſhy, thick, chryſaloid-contortuplicate; the *exterior* one larger, convolute, and cheriſhing the interior one, ſmooth without, wrinkled within: the *interior* one much ſmaller, wrinkled on both ſides, uniform or round cordate (as is the exterior one, if its folds be expanded.) *Plumule* ſimple, conical, two-leaved. *Radicle* near the ſummit towards the back, columnar, a little curved and ending in a ſhort conical tip; aſcending.

THE ſeed has a ſtrong terebinthine fragrance.

THE following particulars, concerning the extraction of the camphor, were communicated by Mr. PRINCE, reſident at *Tapanooly* to Doctor ROXBURGH.

"THIS tree grows ſpontaneouſly in the foreſts; and is to be found in abundance from the back of *Ayer Bongey*, as far north as *Bacongan*, a diſtance of 250 miles. It may be claſſed among the talleſt, and largeſt trees that grow on this coaſt; ſeveral within daily view meaſuring ſix or ſeven feet diameter. Before it acquire ſuch dimenſions its age is conjectured to be years; but it will produce *Camphor* at a much earlier period, when the tree does not exceed two and two and a half feet in diameter. The ſame tree which yields the oil, would have produced *Camphor* if unmoleſted, the former being ſuppoſed to be the firſt ſtage of the latter's forming, and is conſequently found in younger trees. The natives have no certain means of aſcertaining the tree which produces either the one or the other, although there are ſome men ſtyled *Toongoo Nyr Cappoor* who pretend to that knowledge, but they cannot give any reaſons for their judgment, beyond favorable dreams, which ſuperſtition has rendered infallible: and it muſt be admitted that the ſucceſs of this deſcription of people, in diſcovering and procuring, is greater than the majority of thoſe who go in ſearch, of the *Camphor*: the diſtinction may have ariſen from the peculiar favor of fortune to ſome individuals over others as in moſt other circumſtances of life from whence they have acquired a celebrity, otherwiſe they could give ſome rational explanation of their ſuperior ſucceſs. Both *Oil* and *Camphor* are found in the heart of the tree, occupying a vacuum, which, in others, is frequently filled with pitch; but it does not extend to the whole length; on the contrary, they are found in ſmall portions of a foot, and a foot

and a half long, at certain diſtances. The method of extracting the oil is merely by making a deep inciſion with a *billiong* or *Malay* axe, in the tree, about fourteen or eighteen feet from the ground till near the heart, where a deeper inciſion is made with a ſmall aperture; and the oil, if any in the tree, immediately guſhes out, and is received in bamboos, or any other utenſil better approved of; in this manner, a party proceeds through the woods wounding the camphor trees till they attain their object. The *Camphor* is procured in pretty nearly the ſame way. The trees are cut to the heart about the ſame height from the ground as in the former inſtance, till the *Camphor* is ſeen; hundreds may be thus mutilated before the ſought for tree is diſcovered; when attained, it is felled, and cut in junks, of a fathom long which are again ſplit, and the *Camphor* is found in the heart, occupying a ſpace in circumference, of the thickneſs of a man's arm. The produce of a middling ſized tree is about eight *China catties*, or nearly eleven lbs. and of a large one, double the quantity. The *camphor* thus found is called *Se Tantong*. It is often the caſe that the trees which have been cut, and left ſtanding in that ſtate, will produce *camphor* in ſeven or eight years after, which is diſtinguiſhed by the name of *Oogar*, but is inferior in appearance, though of the ſame quality. The ſorts of *camphor* called *belly* and *foot*, are the ſcraping of the wood which ſurrounded it."

XII.

Abſtract of an account, containing the particulars of a boring made near the River Hooghly, in the vicinity of Calcutta, from May to July 1814 *inclusive, in ſearch of a ſpring of pure water.*

COMMUNICATED

BY SIR EDWARD HYDE EAST.

THE NUMERALS REPRESENT FEET FROM THE SURFACE:

2	0	Dry earth with ſoorky (brick duſt.)
3 to	6 (Incluſive)	dry ſand with a little clay.
7 —	21	Blue clay, with ſand, more or leſs.
22 —	31	Blue clay, with ſhear coal.
32 —	52	Blue clay, with a little rotten wood.
53 —	56	Blue clay, with coal.

57 — 0 Very ſtiff blue clay, with a little conker (gravel.)
58 — 61 (Incluſive) The ſame, but the conker mixed in a greeniſh clay.
62 — 0 The ſame, without the greeniſh clay mixture.
63 — 65 ..... Very ſtiff blue clay, with a little yellow clay, mixed with a little conker.
66 — 68 ..... The ſame, but yellow ſand, vice yellow clay.
69 — 70 ..... Stiff blue clay, with a little yellow ſand and clay.
71 — 76 ..... Damp reddiſh clay, with a quarter of ſand, with a tinge alſo of yellow from 73.
77 — 84 ..... Reddiſh yellow clay, mixed with ſand, with a little talc.
85 — 92 ..... Yellow clay, mixed with ſand.
93 — 96 ..... Yellow ſand inclining to clay.
97 — 100 ..... Blue clay with yellow ſand.
101 — 102 Lead coloured clay, with yellow ſand.
103 — 105 ..... Blue and yellow clay, with yellow ſand and a little conker.
106 — 107 Stiff blue, inclining to yellow clay, with yellow ſand, and a little conker.
108 — 113 ..... The ſame, without the conker.
114 — 118 ..... Stiff deep yellow clay, with a little yellow ſand.
119 — 122 ..... Soft deep yellow clay, with more yellow ſand.
123 — 125 ..... Coarſe greeniſh yellow ſand.
126 — 127 ..... The ſame, with a little yellow clay.
128 — 131 ..... Coarſe dark grey ſand.
132 — 0 The ſame, red and grey.
133 — 138 ..... Dark grey ſand, with a little talc, the ſand getting coarſer downwards.
139 — 140 Coarſe dark grey ſand.

At this depth the boring tackle having ſeveral times given way, and the borer remaining unextricable from the ground, the further proſecution of the experiment was abandoned. The different ſtrata, through which it penetrated, have furniſhed the following obſervations.

1. The primary object of getting at ſprings of freſh water entirely failed, of which ſanguine expectation had been formed by the projector of the experiment, grounded, as it ſhould ſeem, upon the common opinion, that the ſoil of all the lower part of *Bengal* was particularly moiſt and full of ſprings; an opinion, which this experiment, if it can be taken as affording any criterion of the ſoil throughout the vicinity of *Calcutta*, has ſo far happily diſcountenanced. The firſt appearance of any damp was at the depth of 71 feet, in a reddiſh clay with a quarter of ſand, and below 76 feet the earth was as dry as before; though the borer muſt have deſcended nearly to the level of the ſea, which as the crow flies, cannot exceed 70 miles in diſtance, while the fall of the river is commonly computed at one inch a mile according to its bendings.

2. The damp of the climate, not being attributable to the moiſt nature of the ſoil, nor affected by it, otherwiſe than as an admixture of ſaltpetre in the ſoil may be ſuppoſed to have ſome influence on the exhalations from the ſurface, muſt be looked for principally at leaſt from cauſes upon or above the ſurface; to the want of a general ſyſtem of drainage in a level country, and the luxuriant vegetation, with inadequate openings through the woods for ventilation, which prevent or impede the copious falls of rain at the periodical ſeaſon, and not unfrequently at other times, from running off properly. The heavy dews at other ſeaſons, are not probably more than ſufficient to ſupply the daily exhauſtion of the ſun, and would rather contribute to the

healthineſs of the climate. All that ſeems to be wanting therefore is ſurface draining upon a general plan, and the cutting of broad ſtraight roads through the woods, as much as poſſible in the direction of the prevailing winds. The acknowledged improvement of the climate in and about *Calcutta*, of late years, appears to be the natural reſult of the ſuperior attention which has been paid by the local police to theſe two objects, the benefits of which will be extended with the extended application of the ſame means. The culture of rice could only be partially, if it all, affected by it, and the neighbourhood of towns and populous villages would be much improved by ſubſtituting the ſuperior and more wholeſome cultivation of potatoes, which ſeem to be ſpringing into general uſe every where with the increaſing population of the world.

3. On the deepening of the great tank at the beginning of the *Chowringhee* road in the laſt year, there was found a quantity of decayed wood at the depth of 35 feet below the ſurface, which was imagined at the time to be an accidental circumſtance, of which no ſatisfactory account could be obtained: but the borer, in this experiment, having perforated rotten wood in a ſtratum of blue clay from the depth of 32 to 52 feet, at the diſtance of half a mile from the former ſpot, gives reaſon to ſuppoſe that the remains of an ancient foreſt forms a ſubſtratum of a more general extent at this depth, and ſupports the theory, which has been drawn from the like diſcoveries in different parts of the world, that ſome great convulſion of nature, probably the deluge, proſtrated and covered the ancient foreſts.

4. The finding of this layer of rotten wood between layers of coal, ſeems to ſupport the ſuppoſition, that coal is a formation from wood, probably gradual; the middle parts being the laſt transformed:

or poſſibly the transforming principle, if lying in the adjacent earths, may have been in this inſtance exhauſted before it reached the middle part of the wood.

5. There is no trace of any volcanic matter throughout all the different ſtrata penetrated by the borer to the depth of 140 feet; which renders it probable that the ſhocks of earthquakes not unfrequently left in this part of *Bengal*, (whether ſuch phenomena proceed from the direct action of fire, or from the ſudden contact of heated ſubſtances with water in the bowels of the earth, thereby expanding into to vapour; and not merely, according to Doctor Stukely's hypotheſis, from electrical ſhocks on the ſurface,) do not proceed from any very proximate cauſe; and the general feebleneſs of thoſe ſhocks leads to the hope that the cauſe is remote, and conſequently that the effect is not likely to be ſevere. The *Monghir* hills, which are ſaid to contain volcanic matter, are at the diſtance of about 300 miles.

XIII.

Statistical view of the population of Burdwan, &c.

By W. B. BAYLEY, Esq.

H. T. COLEBROOKE, Esq.

PRESIDENT OF THE ASIATICK SOCIETY.

SIR,

I HAVE the honor to submit to the *Asiatick* Society, the accompanying statements arranged principally from materials which I collected in the year 1813 14, while in charge of the office of judge and magistrate of the district of *Burdwan*.

The document marked No. 1, exhibits an abstract statement of the population of 98 towns and villages situated in some of the western districts of *Bengal*, procured with the view of ascertaining the general average proportion of inhabitants to each dwelling.

THE document marked No. 2, contains an abſtract ſtatement of the total number of dwelling houſes reſpectively inhabited by *Hindús* and *Mahomedans* in the diſtrict of *Burdwan*, arranged under the head of the ſeveral police juriſdictions.

THE paper marked No. 3, exhibits an abſtract claſſification of the *Hindú* inhabitants of 26 villages in the diſtrict of *Burdwan*, arranged under their reſpective caſts or profeſſions.

THE paper marked No. 4, exhibits the average price of ſome articles of common conſumption in the town of *Calcutta*, in each year from 1753 to 1814.

THE papers reſpectively numbered 5, 6, and 7, contain ſtatements of the average price of rice and ſome other articles of conſumption in each year from 1783 to 1814, at the towns of *Súrúl* and *Elambazar*, in the diſtrict of *Bírbhúm*, and at the town of *Máńcaur*, in the diſtrict of *Burdwan*.

I PROCEED to offer ſuch remarks in explanation of each of the annexed ſtatements as appear neceſſary.

No. 1. THE detailed enumerations from which this paper is formed, were obtained partly through the agency of ſome reſpectable native proprietors of eſtates with whom I was perſonally acquainted, and partly by the aid and influence of *European* gentlemen reſiding in the ſeveral diſtricts, from which the returns have been furniſhed.

I HAVE reaſon to be ſatisfied that few of theſe returns are inaccurate, and none of them materially ſo. The towns and villages included

in this paper are ſituated in various parts of the diſtricts of *Burdwan*, *Húghli*, *Midnapúr*, *Birbhúm*, and the *Jungle Mehâls*. They differ in their ſize, opulence, and other circumſtances; ſome of them are market towns or places of eſtabliſhed manufactures, ſome are principally inhabited by *Hindús* and others by *Mahomedans*, ſome are heavily aſſeſſed, others again are nearly rent free.

Under theſe circumſtances an accurate average of the proportion of inhabitants to each dwelling throughout the diſtrict of *Burdwan*, may be deduced from the annexed abſtract, and as there exiſts no very material difference in the ſtate of ſociety, the ſame average may probably be conſidered to be generally applicable throughout *Bengal*.

It is ſcarcely neceſſary to obſerve that many dwellings, eſpecially thoſe of the more opulent claſſes of inhabitants, include ſeveral diſtinct buildings, huts, or out-offices within one encloſure; and frequently contain diſtinct families of ſeveral brothers or other near relations. A dwelling of this deſcription whatever may be the number of buildings included in it, is intentionally conſidered and rated as one dwelling both in this ſtatement and in that marked No. 2, exhibiting the total number of dwelling houſes in the diſtrict of *Burdwan*. With reference to theſe circumſtances, the proportion of $5\frac{1}{2}$ inhabitants to a houſe reſulting from the general average of the paper marked No. 1, appears ſmaller than might have been reaſonably expected, and is in fact leſs than the average proportion of inhabitants to each houſe in *England*.

The number of males appears from the ſtatement to be ſomewhat greater than that of the females being 82,285 of the former, to 81,149 of the latter. The population returns of other countries generally exhibit a larger number of females than of males; in *England* however, if

the males employed in the army and navy be included, the ſexes are very nearly equal in number.

No. 2. The ſtatement marked No. 1, having furniſhed me with the average proportion of inhabitants to each dwelling, I proceeded to aſcertain the actual number of dwelling houſes in the diſtrict of *Burdwan*, diſtinguiſhing them as occupied by *Hindús* and *Mahomedans* reſpectively.

The proprietors of every *mauza* or village in the diſtrict or their reſident agents were furniſhed through the police officers of each diviſion with a form in the *Bengalí* language, intended to ſhew the name of the village, of the *pergannah*, and of the police juriſdiction, the total number of dwelling houſes in each village, and the number occupied by *Hindús* and *Mahomedans* reſpectively.

Such inſtructions and explanations were at the ſame time furniſhed as appeared neceſſary to prevent miſtakes and omiſſions, and to remove all grounds of ſuſpicion and jealouſy on the part of the inhabitants. The proprietors, farmers, or their reſident agents were directed to ſupply the information required, and to inſert it in the form with every poſſible attention to accuracy. The ſtatements after being ſo prepared, were atteſted by the proprietor or his agent, and by ſome of the *mendels* or moſt reſpectable inhabitants of each village, and were then delivered to the police officers of the juriſdiction by whom they were arranged alphabetically, under the head of each *pergannah*.

I believe that the returns have been generally prepared with due care and accuracy, and I met with no inſtance of reluctance on the part of the proprietors or their agents in communicating the information required.

ACCORDING to the ſtatements ſo furniſhed, the diſtrict of *Burdwan* contains 2,62,634 dwelling houſes, of which 2,18,853 are occupied by *Hindús*, and 43,781 by *Mahomedans;* allowing $5\frac{1}{2}$ inhabitants to each dwelling, the total population of *Burdwan* will amount to 14,44,487 ſouls. The area of the diſtrict of *Burdwan*, as its boundaries are at preſent arranged, compriſes about 2,400 *Engliſh* ſquare miles. On an average therefore, each ſquare mile contains a population of more than 600 perſons.

THE total population of *England* gives an average of near 200 inhabitants to each ſquare mile, but if ſome particular countries are ſelected, the proportion will be found to approximate much more nearly to that of *Burdwan*. The county of *Lancaſter*, for inſtance, contains about 1,800 ſquare miles, and its population in the year 1811 amounted to 8,56,000, furniſhing an average of 476 inhabitants to a ſquare mile.

IT ſhould be obſerved however that the diſtrict of *Burdwan* is one of the moſt productive and highly cultivated portions of *Britiſh* territories in *India*, and that it contains ſcarcely any *jungle* or waſte land.

THE materials from which I have calculated the population of the diſtrict of *Burdwan* appear to be ſufficiently ſolid and accurate for every practical purpoſe, and I am ſatisfied that the total population of *Britiſh India* and the proportion of *Hindú* to *Mahomedan* inhabitants might be aſcertained in a ſimilar manner with little difficulty or inconvenience.

THE reſult of ſuch a general enquiry conducted on uniform principles, would not merely be gratifying to public curioſity, but might eventually prove of great practical importance in the improvement of the

police, and in the general adminiſtration of the extenſive territories ſubject to the *Britiſh* government in *India*.

No. 3 This ſtatement exhibits the total *Hindú* population of 26 villages in the diſtrict of *Burdwan*, the inhabitants are claſſed under the heads of their reſpective caſts or profeſſions, and according to their ages; the males as being above or below 16 years of age, the females as above or below 12 years of age; the villages, from which this abſtract was formed, were ſelected in preference to others as containing more than the uſual proportion of *Hindú* inhabitants; the ſtatement ſhews almoſt all the claſſes and profeſſions into which the *Hindú* population is generally divided in the weſtern parts of *Bengal*, but it cannot be conſidered to furniſh any accurate average of the proportions which the different claſſes bear to each other: it may be remarked that the proportion of females to males is generally larger in the higher claſſes, while in the lower claſſes the males are more numerous than the females.

No. 4. This ſtatement has been prepared from accounts preſerved in a reſpectable *Hindú* family in *Calcutta*. The average is deduced from the ſum total annually expended in the purchaſe of each article for the ordinary conſumption of that family, compared with the total quantity of each article purchaſed within each year.

No. 5. I am indebted for this document to Mr. Cheap, the commercial reſident at *Súrúl;* it contains the current prices of coarſe and fine rice, of ſalt, oil, ghee, molaſſes, and turmeric in the month of *Púſ*, during the laſt 30 years at the town of *Súrúl*.

No. 6. The accuracy of this ſtatement which was obligingly furniſhed to me by Mr. Erskine, a gentleman reſiding at *Elambazár*, in the

diſtrict of *Birbhúm*, may be relied upon. The difference in the price of rice, in the reſpective months of *Pús* and *Áſárh* of each year is worthy of obſervation: a ſimilar variation of price at thoſe periods is general throughout the interior of the weſtern diſtricts of *Bengal*, and is a ſource of abundant profit to the more opulent *mahajans* or ſpeculators in that article, and of conſiderable injury to the indigent claſſes of cultivators; theſe laſt are generally in debt to the village *mahajans*; they procure rice for ſeed and for the conſumption of their families either by a ruinous mortgage of the enſuing crop, or at an exorbitant rate of intereſt in the month of *Áſárh*, a period when the price is almoſt uniformly higher than at any other period. In *Pús* when the principal harveſt is gathered, they are under the neceſſity of immediately diſpoſing of the produce of their fields to enable them to diſcharge the heavy inſtalments of their rent which then become due. They have neither reſources ſufficient to diſpoſe of the grain at a diſtant market, nor to poſtpone the ſale until a more favorable period. They are thus compelled to throw nearly the whole produce of the village into a confined market at the ſame time, and the only purchaſers are the *mahajans* of the village, who are thus able to fix the rates almoſt at their own diſcretion. This evil is of courſe leſs felt in the neighbourhood of navigable rivers, (*Elambazár* is on the banks of the *Ádjy*,) and in the vicinity of large towns, and the price in *Calcutta* does not eſſentially vary at thoſe ſeaſons which in the interior of the country are reſpectively the cheapeſt or deareſt periods.

No. 7. I PROCURED this document from a reſpectable grain merchant reſiding at the town of *Máncaur*, in the diſtrict of *Burdwan*. From the enquiries which I had an opporunity of making on the ſpot, I have reaſon to believe that it is prepared with perfect accuracy.

FROM the Papers marked No. 4, 5, 6, 7, it may be observed that the period of ten years from 1793 to 1803, was generally a cheaper period, than the ten years preceding or following it, and that the price of rice, and generally of other articles has not experienced any very material or permanent augmentation from the year 1761 to the present time.

I have the honor to be,

SIR,

Your moſt obedient humble Servant,

W. B. BAYLEY.

CALCUTTA,
17th September 1814.

No. 1. RETURNS of the population of ninety-eight villages and towns, ſituated in the weſtern parts of *Bengal*, procured with the view of aſcertaining the general average proportion of inhabitants to a dwelling.

No. 2. STATEMENT of the total number of dwelling houſes reſpectively inhabited by *Hindús* and *Múſelmans* in the diſtrict of *Burdwan*, arranged under the head of the ſeveral police juriſdictions.

No. 3. ABSTRACT claſſification of the whole number of *Hindú* inhabitants in twenty-ſix villages of *Burdwan*, arranged under the heads of their reſpective caſts or profeſſions.

No. 4. ANNUAL average price of ſome articles of common conſumption in the town of *Calcutta*, in each year, from 1753 to 1814.

No. 5. AVERAGE price of articles of general consumption at *Súrúl*, from 1783 to 1813.

No. 6. AVERAGE price of fine and coarse rice at *Elambazár*, from 1783 to 1813.

No. 7. WHOLESALE price of coarse rice in *Pús* at *Máncaur*, in zillah *Burdwan*, from 1783 to 1813.

No. 1.

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male inhabitants.	Number of Female inhabitants.	Total population Male and Female.	Proportion of inhabitants to a House.
1st.	Gopál Nagar,	Zillah Burdwan,	8	19	21	40	5
	Jamál Mát,	.... Ditto,	11	30	32	62	5 1/2
	Bedchala,	.... Ditto,	13	36	32	68	5 1/4
	Bhagwánpúr,	.... Ditto,	15	37	37	74	5
	Camal Nagar,	.... Ditto,	17	46	50	96	5 1/3
	Cáncáta,	Jungle Mehals,	20	78	75	153	7 1/3
	Mat'hurapúr,	Zillah Burdwan,	21	0	0	137	6 1/2
	Defferpúr,	.... Ditto,	24	70	58	128	5 1/3
	Bamúnpúr,	.... Ditto,	26	61	74	135	5 1/2
	Múlra,	.... Ditto,	27	74	69	143	5 1/4
	Ásápúr,	.... Ditto,	28	88	73	161	5 1/4
	Máncunda,	Zillah Bírbhúm,	29	0	0	152	5 1/4
	Rádhá ramanpúr,	Zillah Burdwan,	30	73	76	149	5
	Hershapúr,	.... Ditto,	31	0	0	180	6 nearly.
	Total of 14 villages,		300	612	597	1,678	5 1/2
2d.	Morádpúr,	Zillah Burdwan,	32	0	0	229	7 1/6
	Gopicant'hpúr,	.... Ditto,	34	101	88	189	5 1/2
	Nagargáchi,	.... Ditto,	37	97	94	191	5 1/6
	Dhunai,	.... Ditto,	39	110	104	214	5 3/5
	Bijípúr,	.... Ditto,	41	118	106	224	6
	Diemnagar,	.... Ditto,	42	150	146	296	7
	Ak'hulíya,	.... Ditto,	43	122	107	229	5 1/3
	Kaïmnagar,	.... Ditto,	44	122	125	247	5 3/5
	Bhásapúr,	.... Ditto,	46	109	113	222	5 nott.
	Rámbáti,	Zillah Bírbhúm,	47	0	0	305	6 1/4
	Mohabetgerh,	Zillah Burdwan,	48	112	114	226	4 2/3
	Pátpúr,	Jungle Mehals,	49	133	128	261	5 1/3
	Palasan,	Zillah Burdwan,	50	146	117	263	5 1/4
	Náranga,	Zillah Húgli,	53	131	138	269	5
	Total of 14 villages,		605	1,451	1,363	3,368	5 1/2

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male inhabitants.	Number of Female inhabitants.	Total population Male and Female.	Proportion of inhabitants to a House.
3d.	Cútruci,	Zillah Burdwan,	55	204	206	410	7½
	Babuishol,	.... Ditto,	56	157	143	300	5⅓
	Baggiepúr,	Zillah Bírbhúm,	59	0	0	322	5½
	Jhijra,	Zillah Burdwan,	60	172	145	317	5¼
	Ramcrishénpúr,	.... Ditto,	60	0	0	423	7
	Rádhácrishenbáti,	.... Ditto,	63	181	169	350	5½
	Gérh Simlapol,	Midnapúr,	65	179	168	347	5⅓
	Dépúr,	.... Ditto,	66	184	163	347	5¼
	Mank'hóta,	.... Ditto,	67	175	177	352	5¼
	Abudanga,	Zillah Bírbhúm,	68	0	0	331	5
	Bhagwánpúr,	Zillah Burdwan,	69	178	166	344	5
	Baumonia,	.... Ditto,	69	164	185	349	5
	Berdaba,	.... Ditto,	70	157	169	326	4⅔
	Srigaon,	.... Ditto,	73	201	177	378	5⅕
	Total of 14 villages,		900	1,952	1,868	4,896	5½
4th.	Bhagwánpùr,	Zillah Burdwan,	78	283	266	549	6⅘
	Dubrájpúr,	Jungle Mehals,	79	239	212	451	5⅔
	Shicarpúr,	Zillah Burdwan,	84	275	234	509	6
	Gangadáspúr,	Zillah Húgli,	84	0	0	667	7¾
	Baricha,	Zillah Midnapúr,	91	300	335	635	7
	Baricrishenpúr,	Zillah Burdwan,	93	231	222	453	5 nearly.
	Gawáltor,	Zillah Midnapúr,	113	295	278	573	5 above.
	Dhánccáror,	Zillah Burdwan,	120	315	356	671	5⅗
	Nandgäon,	.... Ditto,	128	318	350	668	5
	Sultanpúr,	.... Ditto,	129	345	352	697	5⅖
	Angaríya,	.... Ditto,	136	411	420	831	6
	Ramcrishenpúr,	.... Ditto,	140	362	327	689	5 not quite.
	Sudersanpúr,	.... Ditto,	143	426	382	808	5⅔
	Mohanpúr,	.... Ditto,	147	376	383	759	5
	Total of 14 villages,		1,565	4,176	4,117	8,960	5¾
5th.	Caraunda,	Zillah Burdwan,	153	406	359	765	5
	Alifnagar,	.... Ditto,	154	478	484	962	6¼
	Hírangaön,	.... Ditto,	164	440	400	840	5⅛
	Rámes'warpúr,	.... Ditto,	171	445	457	902	5¼
	Gopinát'h Báti,	.... Ditto,	178	465	505	970	5½
	C'handárá,	.... Ditto,	187	634	695	1,329	6½
	Jamtárá,	.... Ditto,	187	446	457	903	4⅘
	Crishennagar,	Zillah Midnapúr,	200	484	516	1,000	5
	Uch'hgaön,	Zillah Burdwan,	204	514	494	1,008	5
	Bersúl,	.... Ditto,	209	664	607	1,271	6
	Jhícra,	Jungle Mehals,	216	691	517	1,308	6 and above.
	Rascúnd,	Zillah Midnapúr,	218	560	652	1,112	5 above.
	Gítgaön,	Zillah Burdwan,	253	686	620	1,306	5⅑
	Savantí,	.... Ditto,	257	827	777	1,604	6⅕
	Total of 14 villages,		2,751	7,740	7,540	15,280	5½

	NAMES OF THE VILLAGES.	Where situated.	Number of Houses.	Number of Male inhabitants.	Number of Female inhabitants.	Total population Male and Female.	Proportion of inhabitants to a House.
6th.	Daroghapára,	Zillah Burdwan,	267	698	709	1,407	$5\frac{1}{4}$
	Betagerh,	Zillah Midnapúr,	284	738	764	1,502	$5\frac{1}{3}$
	Iral,	Zillah Burdwan,	310	844	859	1,703	$5\frac{1}{2}$
	Deriyapúr,	.... Ditto,	319	778	789	1,567	5 nearly.
	Súdpúr,	.... Ditto,	323	872	887	1,759	$5\frac{1}{2}$ nearly.
	Caití,	.... Ditto,	338	1,051	900	1,951	$5\frac{2}{3}$
	Rájgáon,	Jungle Mehals,	342	1,134	1,142	2,276	$6\frac{2}{3}$
	Bedengunj,	Zillah Midnapúr,	365	1,220	1,186	2,406	$6\frac{2}{3}$
	Cayapat,	.... Ditto,	389	1,112	1,154	2,266	6 nearly.
	Amaragerh,	Zillah Burdwan,	415	1,038	1,067	2,155	$5\frac{1}{2}$
	Satgachia,	.... Ditto,	422	1,482	1,516	2,998	$7\frac{1}{10}$
	Sencarí,	.... Ditto,	443	1,178	1,143	2,321	$5\frac{1}{4}$
	Palási,	.... Ditto,	448	1,108	1,187	2,295	$5\frac{1}{4}$
	Maro,	.... Ditto,	474	1,272	1,100	2,372	5
	Total of 14 villages,		5,139	14,575	14,403	28,978	$5\frac{2}{3}$
7th.	Khajuanwer,	Zillah Burdwan,	496	1,466	1,528	2,994	6 and upwards.
	Bancada,	.... Ditto,	501	1,251	1,195	2,446	5 near.
	Carúi,	.... Ditto,	581	1,387	1,358	2,745	$5\frac{1}{4}$
	Mendelgaón,	.... Ditto,	524	1,273	1,218	2,491	5 nearly.
	Elambazár,	Zillah Birbhúm,	544	1,463	1,487	2,950	$5\frac{2}{5}$
	Bijar,	Zillah Burdwan,	610	1,618	1,745	3,363	$5\frac{1}{2}$
	Bhalcí,	.... Ditto,	656	1,640	1,680	3,320	5 above.
	Chandghós,	.... Ditto,	744	1,892	1,826	3,718	5 nearly.
	Dignagér,	.... Ditto,	941	2,493	2,456	4,949	$5\frac{1}{4}$
	Bainchí,	Zillah Huglí,	1,074	2,930	2,910	5,840	$5\frac{1}{2}$
	Mancaur and its suburbs,	Zillah Burdwan,	1,562	4,417	4,265	8,682	$5\frac{1}{2}$
	Keerpoy,	Zillah Huglí,	1,776	0	0	10,525	6 near.
	Chandercona,	.... Ditto,	2,836	9,120	9,025	18,145	$6\frac{2}{5}$
	Chandernagar,	French settlement,	8,484	20,829	20,548	41,377	5 near.
	Total of 14 villages,		21,266	51,779	51,241	1,13,545	$5\frac{1}{3}$

ABSTRACT of the preceding Tables.

NUMBER of TABLE.	Total number of Houses.	Total number of Male inhabitants.	Total number of Female inhabitants.	Total population Male and Female.	Average proportion of inhabitants.
1st,	300	612	597	1,678	$5\frac{1}{2}$
2d,	605	1,451	1,383	3,368	$5\frac{1}{2}$
3d,	900	1,952	1,868	4,896	$5\frac{1}{2}$
4th,	1,565	4,176	4,117	8,960	$5\frac{3}{4}$
5th,	2,751	7,740	7,540	15,280	$5\frac{1}{2}$
6th,	5,139	14,575	14,403	28,978	$5\frac{2}{3}$
7th,	21,266	51,779	51,241	1,13,545	$5\frac{1}{3}$
Total of 98 towns and villages,	32,526	82,285	81,149	1,76,705	$5\frac{1}{2}$ nearly.

No. 2.

STATEMENT of the total number of Dwelling Houſes reſpectively habited by *Hindús* and *Múſelmans*, in the diſtrict of *Burdwan*, arranged under the head of the ſeveral police juriſdiction.

Number of Thannas.	THANNAS.	Total of Mauzas.	Total of Houses.	Total of Houses inhabited by Hindús.	Total of Houses inhabited by Múſelmans.
1	Catwa,	230	20,790	18,688	2,102
2	Cait'hí,	157	13,046	9,923	3,123
3	Chand Ghós,	220	14,548	11,770	2,778
4	Banpas,	92	11,554	10,096	1,458
5	Balerísheu,	115	9,218	7,528	1,690
6	Cúchat,	310	22,847	19,786	3,061
7	Mengelcót,	235	19,331	15,954	3,377
8	Calna,	336	24,811	20,817	3,994
9	Sondah,	121	10,934	8,978	1,956
10	Salímabad,	458	29,341	23,188	6,153
11	Pubet'hal,	265	15,033	12,671	2,362
12	Dignager,	145	19,814	17,533	2,281
13	Somander Gher,	160	8,239	6,049	2,190
14	Bersúl,	110	8,981	6,895	2,086
15	Town of Burdwan and suburbs,	72	9,805	7,651	2,154
16	Cútalpúr,	470	24,342	21,326	3,016
	Total	3,496	2,62,634	2,18,853	43,781

On an average each police juriſdiction contains about 218 mauzas. Each mauza about 75 houſes, each houſe contains about $5\frac{1}{2}$ inhabitants. The proportion of *Hindús* to *Mahometans* is as 5 of the former to 1 of the latter, and of males to females about 100 of the former to $98\frac{5th}{8}$ of the latter. The total number of inhabitants in the diſtrict, at the average of $5\frac{1}{2}$ to each houſe will be 14,44,487. The juriſdiction of this zillah includes an area of about 2,400 ſquare miles, and the proportion of inhabitants to a ſquare mile is more than 600.

No. 3.

ABSTRACT classification of the whole number of *Hindú* inhabitants in 26 villages of *Burdwan*, arranged under the heads of their respective Casts or Professions.

CASTS.		Number of Houses.	Males above 16 years.	Females above 12 years.	Males below 16 years.	Females below 16 years.	Total number of inhabitants.	Proportion of inhabitants to a House.
Bramhans,		1,297	2,356	2,738	1,266	947	7,307	5 2/3
Cshettries,		5	10	10	5	2	27	5 1/2
Rajpúts,		69	121	151	53	47	372	5 2/5
Vaidyas,	Physicians,	17	42	42	26	14	124	7 1/3
Káyesthas,	Scribes,	408	701	839	421	288	2,249	5 1/2
Gandh-Banias,	Druggists,	283	500	581	260	191	1,532	5 1/2
Cansáris,	Braziers,	25	58	65	31	22	176	7
Sáncáris,	Shell ornament makers,	12	16	16	12	6	50	4 1/6
Aguris,	Farmers,	557	981	1,113	538	359	2,991	5 1/3
Málacárs,	Florists,	20	36	40	16	12	104	5 1/6
Napits,	Barbers,	128	221	243	131	115	710	5 1/2
Cumars,	Potters,	85	159	181	71	53	464	5 1/2
Mairas,	Confectioners,	108	162	199	78	50	489	4 1/2
Tantis,	Weavers,	149	271	265	142	77	755	5
Carmacars,	Blacksmiths,	167	268	339	145	97	839	5
Barrooes,	Paun-sellers,	2	4	5	5	2	16	8
Tambulis,	Venders of betel leaf,	99	161	193	83	74	511	5 1/6
Sat-Gopis,	Cultivators,	826	1,463	1,630	854	547	4,494	5 1/2
Gwalas,	Herdsmen,	352	623	680	333	221	1,857	5 1/2
Bayestomes, Mohants,	Religious mendicants, or Priests,	139	175	197	88	58	518	3 2/3
		3	3	7	1	3	14	4 1/2
Bhats,	Encomiasts,	42	63	80	41	28	212	5
Panc'hias,	A class of beggers,	4	4	6	3	1	14	3 1/2
Daibagis,	Astrologers,	42	74	86	46	18	224	5 1/3
Kayebartas,	Cultivators,	50	90	100	43	31	264	5 1/3
Sonarbanias,	Bankers or money-changers	61	120	137	69	38	357	5 1/8
Swernacars,	Goldsmiths,	63	132	143	62	53	390	6 1/6
Télliyas,	Oilmen,	250	427	512	224	136	1,299	5 1/6
Calus,	Oilmen,	158	276	322	145	134	877	5 1/2
Jellias,	Fishermen,	55	98	99	57	34	288	5 1/4
Chutárs,	Carpenters,	81	135	147	64	43	389	4 2/3
Dhobahs,	Washerman,	44	77	86	41	24	228	5 1/5
Jugís,	Weavers,	15	36	36	15	12	99	6 1/2
Bayutes,	Mat-makers,	19	32	31	21	15	99	5 1/5
Saratís,	Carters,	14	22	27	12	14	75	5 1/3
Chunarias,	Lime-burners,	12	17	61	7	1	41	3 1/2
Lohars,	Porters, Labourers, Cultivators, Boatmen, Sweepers, Watchmen, Palankeen carriers, Fishermen, &c. &c.	9	16	20	3	4	43	4 2/3
Bawuris,		197	262	306	248	175	991	5
Cotals,		263	435	476	216	142	1,269	4 7/8
Haris,		109	203	215	118	77	613	5 1/2
Bagdís,		841	1,205	1,384	858	641	4,088	4 6/7
Dulias,		57	90	113	50	36	289	5
Malls,	Snake-catchers,	5	6	6	7	3	22	4 1/2
Chandalls,	As Cotals,	39	53	53	18	22	145	3 2/3
Domes	Basket-makers,	201	285	321	254	174	1,034	5 1/3
Súrís,	Distillers,	137	286	305	111	63	765	5 2/3
Muchis,	Curriers,	86	158	165	97	104	524	6
	Total	7,605	12,922	14,726	7,382	5,208	40,238	5 1/3

No. 4.

ANNUAL Average Price of the following Articles of common consumption in the town of *Calcutta*, in each year from 1753 to 1814.

Bengal Style.	A. D.	Rice coarse 80 Sa. Wt. per Seer per Rupee.			Oil 80 Sa. per Wt. per Seer per Rupee.			Ghee 80 Sa. Wt. per Seer per Rupee.			Goor 80 Sa. Wt. per Seer per Rupee.		
		mds.	srs.	chts	mds.	srs.	chts	mds.	srs.	chts	mds.	srs.	chts
1160,	1753-4,	1	15	0	0	11	8	0	3	12	0	20	0
1161,	1754-5,	1	12	0	0	12	0	0	3	12	0	20	0
1162,	1755-6,	1	14	0	0	11	10	0	3	12	0	18	0
1163,	1756-7,	1	6	0	0	12	0	0	3	8	0	16	0
1164,	1757-8,	1	15	0	0	10	8	0	3	0	0	18	0
1165,	1758-9,	1	7	0	0	10	8	0	3	12	0	16	0
1166,	1759-60,	1	15	0	0	12	0	0	4	8	0	12	0
1167,	1760-1,	1	2	0	0	8	8	0	4	0	0	14	0
1168,	1761-2,	0	31	0	0	6	12	0	3	0	0	18	0
1169,	1762-3,	0	31	0	0	6	0	0	2	4	0	18	0
Total of 10 years,		11	28	0	2	21	6	0	35	4	4	10	0
Or on an average per annum,		1	6	12	0	10	2	0	3	8	0	17	0
1170,	1763-4,	0	35	0	0	8	0	0	3	4	0	15	0
1171,	1764-5,	0	30	0	0	6	0	0	3	0	0	15	0
1172,	1765-6,	1	6	0	0	7	0	0	3	8	0	18	0
1173,	1766-7,	1	5	0	0	8	0	0	3	0	0	16	0
1174,	1767-8,	1	5	0	0	8	0	0	2	12	0	16	0
1175,	1768-9,	1	0	0	0	7	0	0	2	12	0	16	0
1176,	1769-70,	1	12	0	0	7	0	0	3	8	0	17	0
1177,	1770-1,	0	12	0	0	8	8	0	3	0	0	10	0
1178,	1771-2,	0	28	0	0	4	8	0	3	8	0	16	0
1179,	1772-3,	0	30	0	0	6	4	0	3	0	0	16	0
Total of 10 years,		9	3	0	1	30	4	0	31	4	3	35	0
Or on an average per annum,		0	36	4	0	7	0	0	3	2	0	15	8
1180,	1773-4,	0	31	0	0	6	0	0	2	4	0	18	0
1181,	1774-5,	1	0	0	0	5	0	0	3	0	0	16	0
1182,	1775-6,	0	35	0	0	8	4	0	2	12	0	17	0
1183,	1776-7,	0	37	0	0	7	12	0	3	0	0	16	0
1184,	1777-8,	0	39	0	0	5	12	0	4	8	0	16	0
1185,	1778-9,	0	25	0	0	5	0	0	2	10	0	13	0
1186,	1779-80,	0	34	0	0	5	8	0	2	6	0	16	0
1187,	1780-1,	0	35	0	0	8	0	0	2	8	0	17	0
1188,	1781-2,	1	0	0	0	7	12	0	2	14	0	17	0
1189,	1782-3,	1	5	0	0	4	12	0	2	10	0	16	0
Total of 10 years,		9	1	0	1	23	12	0	28	8	4	2	0
Or on an average per annum,		0	36	1	0	6	6	0	2	13	0	16	3

	Bengal Style.	A. D.	Rice coarse 80 Sa. Wt. per Seer per Rupee.			Oil 80 Sa. Wt. per Seer per Rupee.			Ghee 80 Sa. Wt. per Seer per Rupee.			Goor 80 Sa. Wt. per Seer per Rupee.		
			mds.	srs.	chts	mds.	srs.	chts	mds.	srs.	chts	mds.	srs.	chts
	1190,	1783-4,	0	36	0	0	6	10	0	3	0	0	18	0
	1191,	1784-5,	0	26	0	0	6	4	0	3	4	0	16	0
	1192,	1785-6,	1	2	0	0	7	6	0	3	12	0	16	0
	1193,	1786-7,	1	1	0	0	8	0	0	3	10	0	16	0
	1194,	1787-8,	0	20	0	0	7	0	0	2	0	0	12	0
	1195,	1788-9,	0	32	0	0	6	8	0	2	8	0	14	0
	1196,	1789-10,	0	32	0	0	6	12	0	2	12	0	13	0
	1197,	1790-1,	0	34	0	0	7	0	0	2	12	0	16	0
	1198,	1791-2,	0	30	0	0	5	0	0	3	0	0	16	0
	1199,	1792-3,	0	24	0	0	6	0	0	3	2	0	17	0
Total of 10 years,.....			7	37	0	1	26	8	0	29	12	3	34	0
Or on an average per annum,.....			0	31	11	0	6	10	0	2	15	0	15	6
	1200,	1793-4,	0	36	0	0	5	8	0	3	4	0	16	0
	1201,	1794-5,	1	0	0	0	6	8	0	2	8	0	14	0
	1202,	1795-6,	0	39	0	0	5	0	0	2	8	0	14	0
	1203,	1796-7,	1	2	0	0	6	0	0	2	4	0	13	0
	1204,	1797-8,	0	35	0	0	5	12	0	2	12	0	14	0
	1205,	1798-9,	0	36	0	0	5	0	0	2	0	0	13	0
	1206,	1799-1800,	0	32	0	0	5	8	0	2	8	0	13	0
	1207,	1800-1,	0	37	0	0	6	8	0	2	4	0	13	0
	1208,	1801-2,	0	35	0	0	7	0	0	2	0	0	12	0
	1209,	1802-3,	0	37	8	0	3	6	0	2	4	0	13	0
Total of 10 years,.....			9	9	8	1	16	2	0	24	4	3	15	0
Or on an average per annum,.....			0	36	15	0	5	9	0	2	6	0	13	8
	1210,	1803-4,	0	35	0	0	5	0	0	2	0	0	13	0
	1211,	1804-5,	0	30	0	0	8	0	0	2	4	0	13	4
	1212,	1805-6,	0	35	0	0	7	0	0	2	12	0	14	0
	1213,	1806-7,	0	37	0	0	5	8	0	2	10	0	13	0
	1214,	1807-8,	0	25	0	0	4	12	0	2	0	0	14	0
	1215,	1808-9,	0	35	0	0	4	8	0	2	2	0	14	0
	1216,	1809-10,	1	3	0	0	5	4	0	2	0	0	15	0
	1217,	1810-11,	0	30	0	0	4	12	0	2	0	0	13	0
	1218,	1811-12,	1	4	0	0	5	0	0	2	0	0	13	0
	1219,	1812-13,	0	31	0	0	5	12	0	2	0	0	13	0
	1220,	1813-14,	0	34	0	0	5	12	0	2	0	0	13	0
	1221,	1814-15,	1	0	0	0	9	8	0	2	8	0	13	0
Total of 10 years,.....			10	19	0	1	30	12	0	26	4	4	1	4
Or on an average per annum,.....			0	34	14	0	5	14	0	2	3	0	13	7

No. 5.

AVERAGE Price of Articles of general consumption at *Súrúl.*

	Bengal Style.	A. D.	RICE. FINE. Prices in Pús weight 73-4 Sa. Wt. per Rupee. mds.	srs.	chts	RICE. COARSE. Prices in Pús per Rupee. mds.	srs.	chts	Salt 58-10 Sa. Wt. per Seer. Seers per Rupee. mds.	srs.	chts	Oil ditto, Seers per Rupee. mds.	srs.	chts	Ghee ditto, price per Maund. rs.	as.	gs.	Goor as used in Pús Seers of about 22 Pús Seers to a Maund of 58-10. mds.	srs.	cht	Haldi per Maund of 58-10 Sa. Wt. per Seer. rs.	as.	gs.
	1190,	1783-4,	0	23	8	0	29	2	0	15	0	0	7	0	11	7	0	0	17	0	2	3	11
	1191,	1784-5,	1	10	6	1	15	5	0	14	0	0	8	6	10	0	0	0	16	0	2	1	14
	1192,	1785-6,	1	31	10	1	37	4	0	17	0	0	7	0	10	10	0	0	17	0	2	5	13
	1193,	1786-7,	1	10	6	1	15	14	0	16	0	0	8	6	10	0	0	0	18	0	2	6	16
	1194,	1787-8,	1	6	3	1	12	4	0	14	0	0	8	6	10	0	0	0	7	0	2	1	14
	1195,	1788-9,	0	31	6	0	36	15	0	15	0	0	10	7	9	6	10	0	16	0	2	0	0
	1196,	1789-10,	1	20	7	1	26	1	0	16	0	0	8	6	10	10	10	0	18	0	2	6	16
	1197,	1790-1,	1	36	2	1	38	11	0	17	0	0	8	0	10	0	0	0	20	0	2	0	0
	1198,	1791-2,	0	25	13	0	31	5	0	14	0	0	8	6	11	7	0	0	15	0	1	14	10
	1199,	1792-3,	1	20	7	1	26	1	0	14	0	0	10	13	10	10	10	0	14	0	1	13	2
Total of 10 years,...			12	10	4	13	28	14	3	32	0	2	5	2	104	4	0	4	8	0	21	5	16
Ditto calculated at 80 Sa. Wt. per Seer,..			11	14	6	12	22	11	2	31	7	1	22	7	142	3	0	3	3	2	29	2	10
Or on an average per annum of 80 Sa. Wt.			1	5	7	1	10	4	0	11	2	0	6	4	14	3	10	0	12	5	2	1	13
	1200,	1793-4,	1	12	10	1	18	2	0	16	0	0	8	6	10	0	0	0	20	0	2	8	0
	1201,	1794 5,	2	4	8	2	10	1	0	15	0	0	9	12	11	7	0	0	9	0	2	3	11
	1202,	1795-6,	1	21	9	1	27	2	0	14	0	0	10	11	9	6	10	0	18	0	2	9	5
	1203,	1796-7,	1	32	12	2	3	15	0	16	0	0	11	13	10	0	0	0	20	0	1	9	12
	1204,	1797-8,	1	32	12	1	36	2	0	16	0	0	9	12	10	0	0	0	18	0	1	6	17
	1205,	1798-9,	2	11	12	2	17	6	0	18	0	0	10	13	10	10	10	0	27	0	2	1	14
	1206,	1799-10,	1	27	2	1	32	12	0	16	0	0	13	10	10	0	0	0	21	0	2	0	0
	1207,	1800-1,	1	10	6	1	38	5	0	16	0	0	14	0	10	0	0	0	20	0	1	13	2
	1208,	1801-2,	1	31	10	1	36	2	0	16	0	0	12	9	8	15	0	0	19	0	1	11	10
	1209,	1802-3,	1	21	9	1	27	2	0	16	0	0	9	12	8	15	0	0	19	0	1	13	2
Total of 10 years,...			17	6	10	19	7	1	3	39	0	2	30	8	99	6	0	5	1	0	19	15	13
Ditto calculated at 80 Sa. Wt. per Seer,..			15	28	12	17	22	6	2	36	10	2	1	2	135	10	0	3	27	5	27	4	5
Or on an average per annum of 80 Sa. Wt.			1	29	4	1	30	3	0	11	11	0	8	1	13	9	0	0	14	11	2	11	16

	Bengal Style.	A. D.	RICE. FINE. Prices in Pús weight 73-4 Sa. Wt. per Rupee. mds.	srs.	chts	RICE. COARSE. Prices in Pús per Rupee. mds.	srs.	chts	Salt 58-10 Sa. Wt. per Seer. Seers per Rupee. mds.	srs.	chts	Oil ditto, Seers per Rupee. mds.	srs.	chts	Ghee ditto, price per Maund. rs.	as.	gs.	Goor as used in Pús Seers of about 22 Pús Seers to a Maund of 58-10. mds.	srs.	chts	Haldi per Maund of 58-10 Sa. Wt. per Seer. rs.	as.	gs.
	1210,	1803 4,	1	16	0	1	21	9	0	16	0	0	7	11	10	0	0	0	16	4	2	1	4
	1211,	1804-5,	1	11	8	1	17	2	0	16	0	0	13	4	10	0	0	0	17	0	1	10	13
	1212,	1805-6,	1	33	5	1	38	14	0	13	0	0	15	0	8	15	0	0	15	12	1	4	0
	1213,	1806-7,	1	28	4	1	33	14	0	14	0	0	9	7	10	0	0	0	12	12	1	11	16
	1214,	1807-8,	0	31	6	0	36	15	0	14	0	0	8	11	10	0	0	0	16	0	2	0	0
	1215,	1808-9,	1	11	2	1	17	2	0	12	0	0	7	11	11	7	0	0	21	4	1	14	10
	1216,	1809-10	1	2	9	1	18	2	0	13	0	0	8	0	11	7	0	0	11	4	1	10	13
	1217,	1810-11,	1	1	6	1	7	0	0	15	0	0	8	0	10	0	0	0	8	0	2	3	11
	1218,	1811-12.	1	3	10	1	9	4	0	16	0	0	8	11	9	6	10	0	20	0	2	0	0
	1219,	1812-13.	1	12	9	1	18	2	0	15	0	0	8	6	10	0	0	0	15	0	2	3	1
Total of 10 years,...			13	1	11	14	18	0	3	24	0	2	14	13	101	3	10	4	3	4	18	11	18
Ditto calculated at 80 Sa. Wt. per Seer,..			11	37	10	13	9	14	2	25	12	1	29	9	138	2	10	2	39	12	25	9	10
Or on an average per annum of 80 Sa. Wt.			1	7	12	1	12	15	0	10	9	0	7	0	13	13	1	0	12	0	2	8	19

No. 6.

AVERAGE Price of fine and coarse Rice at *Elambazár.*

	Bengal Style.	A. D.	FINE. Prices in Pús weight 73-4 Sa. Wt. per Seer per Rupee. mds.	srs.	chts	COARSE. Prices in Pús per Rupee. mds.	srs.	chts	COARSE. Prices in Assar following per Rupee. mds.	srs.	chts
	1190,	1783-4,	0	35	0	0	36	0	0	30	0
	1191,	1784-5,	1	15	0	1	30	0	1	15	0
	1192,	1785-6,	2	9	0	2	16	0	1	18	0
	1193,	1786-7,	1	24	0	1	30	0	1	15	0
	1194,	1787-8,	1	14	0	1	18	0	0	35	0
	1195,	1788-9,	1	2	0	1	5	0	0	32	0
	1196,	1789-90,	1	11	0	1	27	0	1	20	0
	1197,	1790-1,	1	37	0	2	5	0	1	25	0
	1198,	1791-2,	6	37	0	0	38	0	0	27	0
	1199,	1792-3,	1	18	0	1	12	0	1	5	0
Total of 10 years,.....			14	2	0	15	27	0	11	22	0
Ditto calculated at 80 Sa. Wt. per Seer,.....			12	34	9	14	14	0	10	23	1
Or on an average per annum of 80 Sa. Wt.....			1	11	7	1	17	7	1	2	5

	Bengal Style.	A. D.	FINE. Prices in Pús weight 73·4 Sa. Wt. per Seer per Rupee. mds.	srs.	chts	COARSE. Prices in Pús per Rupee. mds.	srs.	chts	COARSE. Prices in Assar following per Rupee. mds.	srs.	chts
	1200,	1793-4,	1	20	0	1	24	0	1	10	0
	1201,	1794-5,	2	10	0	2	20	0	2	0	0
	1202,	1795-6,	2	10	0	2	20	0	2	0	0
	1203,	1796-7,	1	26	0	1	31	0	1	28	0
	1204,	1797-8,	1	27	0	1	33	0	1	20	0
	1205,	1798-9,	2	16	0	2	26	0	1	37	0
	1206,	1799-1800,	1	37	0	2	5	0	1	20	0
	1207,	1800-1,	2	3	0	2	10	0	1	28	0
	1208,	1801-2,	1	33	0	2	0	0	1	25	0
	1209,	1802-3,	1	25	0	1	31	0	1	20	0
Total of 10 years,.....			19	7	0	21	0	0	16	28	0
Ditto calculated at 80 Sa. Wt. per Seer,.....			17	22	5	19	9	2	15	11	10
Or on an average per annum of 80 Sa. Wt.....			1	30	3	1	36	15	1	21	2
	1210,	1803-4,	1	17	0	1	22	0	1	7	0
	1211,	1804-5,	1	12	0	1	17	0	1	5	0
	1212,	1805-6,	1	23	0	2	0	0	1	25	0
	1213,	1806-7,	1	25	0	1	30	0	1	10	0
	1214,	1807-8,	0	34	0	0	35	0	0	30	0
	1215,	1808-9,	1	14	0	1	17	0	1	8	0
	1216,	1809-10,	1	13	0	1	17	0	1	5	0
	1217,	1810-11,	1	0	0	1	3	8	0	32	0
	1218,	1811-12,	1	0	0	1	3	0	1	4	0
	1219,	1812-13,	1	13	0	1	16	0	1	3	0
Total of 10 years,.....			13	0	0	14	0	8	11	19	0
Ditto calculated at 80 Sa. Wt. per Seer,.....			11	36	2	12	33	3	10	20	4
Or on an average per annum of 80 Sa. Wt....			1	7	10	1	11	5	1	2	0

It is difficult to aſcertain a ſtandard for ploughing cattle, but to judge from experience ſince 1793, the prices have riſen gradually to about 75 per cent on the prices of that year. The hire of coolies during the ſame period has not altered, being $4\frac{1}{2}$ and 5 *puns* per day. The riſe in wages paid by natives who cultivate their land by labourers has how-

ever been conſiderable about 1793, an able ſervant received about 4 rupees per annum, with his diet and clothing, whereas they now receive 6 and 8 rupees yearly, and in ſome ſituations even more.

No. 7.

WHOLE SALE Price of coarſe Rice in *Pús* at *Máncaur*, in zillah *Burdwan*.

	Bengal Style.	A. D.	60 Sa. Wt. Seer per Rupee. mds.	srs.	chts	80 Sa. Wt. Seer per Rupee. mds.	srs.	chts
	1190,	1783-4,	1	34	0	1	15	8
	1191,	1784-5,	3	4	0	2	13	0
	1192,	1785-6,	4	28	0	3	21	0
	1193,	1786-7,	3	2	0	2	11	8
	1194,	1787-8,	2	28	0	2	1	0
	1195,	1788-9,	1	30	0	1	12	8
	1196,	1789-90,	3	4	0	2	13	0
	1197,	1790-1,	4	3	0	3	2	4
	1198,	1791-2,	1	17	0	1	2	12
	1199,	1792-3,	2	34	0	2	5	8
Total of 10 years,			28	24	0	21	18	0
Or on an average per annum,			2	35	0	2	5	12
	1200,	1793-4,	2	3	0	1	22	4
	1201,	1794-5,	3	20	0	2	25	0
	1202,	1795-6,	3	5	0	2	13	12
	1203,	1796-7,	2	38	0	2	8	8
	1204,	1797-8,	2	32	0	2	4	0
	1205,	1798-9,	4	22	0	3	16	8
	1206,	1799-10,	3	37	0	2	37	12
	1207,	1800-1,	2	2	0	1	21	8
	1208,	1801-2,	3	12	0	2	19	0
	1209,	1802-3,	3	4	0	2	13	0
Total of 10 years,			31	15	0	23	21	4
Or on an average per annum,			3	5	0	2	14	2
	1210,	1803-4,	3	6	0	2	14	8
	1211,	1804-5,	2	20	0	1	35	0
	1212,	1805-6,	3	27	0	2	30	4
	1213,	1806-7,	2	39	0	2	9	4
	1214,	1807-8,	2	31	0	2	3	4
	1215,	1808-9,	2	7	0	1	25	4
	1216,	1809-10,	3	12	0	2	19	0
	1217,	1810-11,	2	6	0	1	24	8
	1218,	1811-12,	2	2	0	1	21	8
	1219,	1812-13,	2	20	0	1	35	0
Total of 10 years,			27	10	0	20	17	8
Or on an average per annum,			2	29	0	2	1	12

XIV.

Deſcriptions of two new ſpecies of SARCOLOBUS, *and of ſome other Indian Plants.*

BY N. WALLICH.

FEW genera of plants are more difficult to be examined and aſcertained than thoſe which conſtitute the *Aſclepiadeæ:* a family which has lately been eſtabliſhed and moſt excellently deſcribed by the librarian to the Linnean Society, Mr. R. BROWN, in a paper inſerted in the firſt volume of memoirs of the Wernerian Natural Hiſtory Society. This difficulty is owing to the general intricacy and frequent minuteneſs of their ſexual organs and to their ſucculent habit, which often materially affects their appearance after they have undergone the proceſs of drying. It is therefore highly deſirable that as many as poſſible of them ſhould

be examined in a freſh and native ſtate. Under this impreſſion I truſt, that the following deſcriptions and drawings of two plants, belonging to a very intereſting and ſingular genus eſtabliſhed by Mr. Brown, may not be unacceptable to lovers of botany. Both of them were brought to me a ſhort time ago from the Sunderbans, and introduced into the Botanic Garden at Calcutta, where they thrive very well at a place which is daily irrigated by the tides of the brackiſh water of the river Hoogly.

SARCOLOBUS.

Brown in Act. Soc. Wernerianæ I. p. 34.

Pentandria Digynia. Ordo naturalis *Aſclepiadeæ*, a Cl. VIII. Ord XIV *Apocinearum Juſs:* ſeparandæ.

CHARACTER GENERIS.

Calyx qvinquefidus, perſiſtens, baſi extra corollam corpuſculis 5 glandulis quinqve cylindricis minutis laciniis alternantibus.

Corolla rotata, qvinquefida, æſtivatione imbricata. *Tubus* nullus.

Corpus ſtamineum ſubgloboſum, ſeſſile, nudum.

Antheræ ovatæ, obtuſæ, ſtigmati incumbentes, membranaceo-marginatæ, intus cellulis duabus divergentibus.

Maſſæ pollinis decem, cereaceæ, læves, per paria ad latera ſtigmatis approximatæ, incumbentes, divergentes, baſi ſuffultæ proceſſibus corpuſculorum ſtigmatis.

Ovaria duo oblonga, acuta, unilocularia, polyſpora. *Ovula* horizontalia, axi adfixa.

Styli breviſſimi, acuti.

Stigma depreſſum, pentagonum, antheris tectum, angulis baseos porrectis corpuſculiferis. *Corpuſcula* teretia, dorſo ſulco exſculpta, baſi

utrinqve exſerentia proceſſum capillarem horizontalem apice incurva polliniferum.*

Pericarpium. *Folliculus* carnoſus vel coriaceus, ventricoſus.

Receptaculum fungoſum, amplum, futura adfixum, demum liberum.

Semina numeroſa, inverſa, retrorſum imbricata, complanata, hinc leviter convexa, inde concava, margine lato membranaceo integerrimo cincta. *Teſta* membranancea, intus præſertim ad marginem ſeminis ſpongioſa, ad ſuperficiem ventralem inſcripta funiculo umbilicali ramoſo. *Membrana interna* tenuiſſima, albumen arcte veſtiens.

Albumen embryoni conforme, carnoſum, tenuiſſimum, aqueo-album.

Embryo rectus, dicotyledoneus. *Cotyledones* magnæ, foliaceæ. *Plumula* punctiformis. *Radicula* ſupera, cylindrica.

Habitus. *Frutices* volubiles, glabri, ramis copioſis elongatis ſubarticulatis, lacte ſpiſſo glutinoſo ſcatentes. *Folia* oppoſita, glabra, firma, baſi ſupra acervulo glandularum. *Racemi* extrapetiolares, corymboſi, parvi. *Folliculi* ſolitarii (per abortum.)

SARCOLOBUS globoſus Wall.

S. foliis ovato-oblongis, corollis intus villoſis, folliculis magnis carnoſis globoſis utrinqve retuſis muricatis.

Habitat ad littora ſubſalſa fluminis *Hoogly* Bengalæ auſtralis.

Frutex ramoſiſſimus, late ſuper arbuſculas volubilis, cortice pallido glaberrimo calloſo-punctato.

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* Theſe bodies do not belong excluſively to the *Aſclepiadeæ*, but are found likewiſe in the *Apocyneæ*. In Roxburgh's Nerium grandiflorum (Cat. hort. beng.) they are very large, membranaceous, brown, obovate, looſely adhering to the ſomewhat flattened ſides of the ſtigma and covered entirely by the anthers. By a peculiar proceſs iſſuing from their acute baſe and elongated downwards and upwards they are attached to the grooves of the ſtigma, between the projecting angles of its baſe, and to the margins of the correſponding anthers. At the burſting of the cells the granular pollen is forced to remain on the viſcid ſurface of theſe bodies. This ſhrub is not a Nerium, and forms probably a new genus.

Rami graciles, teretes, ad inſertionem foliorum noduloſo-incraſſati; tenelli pubeſcentes.

Folia petiolata, oppoſita, remota, patentia, ovato-oblonga, juniora ovato-cordata, acuta cum cuſpidula, integerrima, baſi rotundata s: leviter emarginata, ſupra ad inſertionem petioli ſetis aliqvot carnoſis ætate nigricantibus, coriacea, laevia, tri-qvadripollicaria, ſubtus glauca coſta elevata nerviſqve puberulis verſus marginem arcuatim anaſtomoſantibus, ſiccitate reticulata.

Petioli teretes, graciles, ſupra ſulcati, foliis triplo breviores.

Racemi extraaxillares, corymboſi, multiflori, longitudine petiolorum, raro diviſi.

Pedunculus pubeſcens. *Pedicelli* clavati, ſpiraliter rachi incraſſatæ inſerti, baſi bracteolis tribus carnoſis triangularibus.

Flores parvi, extus albicantes, puberuli.

Calyx qvinqvefidus. Laciniæ acutæ, ciliatæ. *Granula* qvinqve in fundo.

Corolla rotata, qvinqvifida. Laciniæ ovatæ, acutæ, ſupra villoſæ, punctulis ſeriatis purpureis.

Corpus ſtamineum aurantiacum. *Antheræ* obtuſæ, membranula nivea marginatæ. *Maſſæ pollinis* reſpectu paris divergentes.

Ovaria et *Styli* ut in genere.

Stigma omnino occultum antheris.

Folliculus globoſus, hinc leviter carinatus obliqvus, carnoſus, diametri qvadripollicaris, vertice baſiqve retuſus. *Cortex* cinereus, aſper a punctis innumeris elevatis calloſis farinoſis. *Caro* fungoſus, albus, admodum lacteſcens. *Tunica interna* chartacea, laeviſſima.

Receptaculum album, fungoſum, cultriforme, dorſo convexum, vertice, ſubgloboſum et notatum ſeriebus cicatricularum longitudinalibus, qvibus inſeruntur ſemina, baſi laeve.

Semina numeroſiſſima, retrorſum imbricata, globum formantia exactiſſime cavitatem folliculi replentem, obovata, pollicaria, leviter con-

vexo-concava, laeviſſima, ferruginea, diſco dilutiora, a preſſura lineata, margine acutiſſima.

Cotyledones obovatæ, baſi leviter retuſæ.

SARCOLOBUS carinatus Wall.

S. foliis ovalibus oblongiſqve, ſubcarnoſis, corollis laevibus, folliculis oblongis laevibus acutis ſubtus carinatis.

Habitat cum antecedente.

Frutex præcedenti ſimilis ſed minor.

Rami longiſſimi, gracillimi, laxi, penduli, articulis inferoribus ſape repentibus.

Folia breve petiolata, lato-ovata, utrinqve acuta, vel obovata ſubretuſa, adultiora oblonga, pollicaria ad tripollicaria, craſſa, carnoſa, utrinqve laevia, baſi papilloſo-glanduloſa, avenia, ſubtus incana.

Petioli teretes, ſupra ſulcati, ungviculares, pubeſcentes.

Racemi extraaxillares parvi.

Bracteolæ ad baſin pedicellorum triangulares.

Flores parvi, glaberrimi.

Calyx qvinqvepartitus. Laciniæ oblongæ. *Granula* qvinqve exigua.

Corolla rotata, plana, laevis, ex viridi lutea, ſupra punctis ſeriatis purpuraſcentibus, verſus faucem tuberculis qvinqve minutis.

Corpus ſtamineum *Ovaria* et *Styli* ut in genere.

Stigma vertice nudum.

Folliculus oblongus, utrinqve attenuatus, leviter arcuatus, acutus, ſubventricoſus, coriaceus, laevis, ſupra planiuſculus, carinis duabus qvatuorve lateralibus ſinuoſis anguſtis, pollices tres longus, maturitate flavus viridi-maculatus. *Loculamentum* ovatum, acutum.

Receptaculum ſubcylindricum, arcuatum, acuminatum, ſeriebus octo cicatricularum, totidemqve foveolis notatum.

Semina retrorſum imbricata, ungvicularia.

Obſervation. Though both theſe plants grow abundantly every where in the jungles of the extenſive Sunderdans, I have not been able to aſcertain ſatisfactorily their native names; nor have I ſucceeded in tracing any ſynonymes of them. They ſeem even to have eſcaped the notice of that moſt acute obſerver and botaniſt Doctor Roxburgh. They are very diſtinct by their flowers and fruits. Their leaves are leſs different, and vary much in the laſt ſpecies from oval to almoſt linear. *S. carinatus* is althogether a ſlenderer and ſmaller ſhrub. The ſpongy fleſh of its receptacles is of a mild milky taſte, and uſed by the natives in their curries.

Flowering time, the hot and rainy ſeaſons. The fruits ripen towards the cloſe of the rains.

CAMPANULA dehiſcens.

Roxburgh, Cat. hort. beng. p. 85.

C. annua piloſula, baſi ramoſa, foliis linearibus denticulatis, floribus terminalibus, capſulis apice poris tribus dehiſcentibus.

Habitat in agris Bengalæ freqventer.

Planta erecta, pedalis, annua, adſperſa pilis paucis brevibus; baſi ramoſa.

Rami ſubſimplices, adſcendents, faſtigiati.

Folia alterna, ſeſſilia, patentia, linearia, remote denticulata, baſi attenuata, bipollicaria, margine coſtaqve leviter piloſa, ſuperiora et floralia integerrima.

Flores parvi, glabri, dilute coerulei, ad apicem caulis et ramorum pauci, alterni.

Pedunculi filiformes, practeolis aliqvot lenearibus.

Calyx ſuperus qvinqvepartitus. Laciniæ lineares, acutæ, erectiuſculæ.

Corolla campanulata, qvinqvefida, calyce duplo longior. Laciniæ ovatæ acutæ.

Stamina corolla breviora.

Filamenta capillaria, erecta, e basi dilatata ciliata conniventia.

Antheræ lineares, erectæ.

Ovarium laeve, oblongum, trisulcatum, intra calycem leviter elevatum, subtrilobum, triloculare polysporum. *Ovula* axi inserta.

Stylus longitudine staminum, pubescens.

Stigma trilobum, villosum.

Capsula membranacea, subcylindrica, fusca, calycis laciniis erectuiusculis coronata, trilocularis, apice poris tribus dehiscens. *Dissepimenta* apice prominula.

Semina minuta, numerosissima.

Observation among the few genera which this country has in common with *Europe* that of campanulu holds a place. This species has however only a faint resemblance to our lovely bell-flowers, and nothing of their beauty. It is a simple small plant, which flowers in *February* and *March*.

BAUHINIA RACEMOSA.

Bauhinia foliis subrotundo-cordatis, lobis semi-orbiculatis, subtus tomentosis, staminibus barbato-plumosis. *Lamarck Encycl* I. 390.

Bauhinia floribus triandris, extus staminibusque basi hirsutis, foliis subtus sericeis, lobis rotundatis. *Vahl. Symb* III. 56. *tab* 62.

Habitat in montibus Bengalæ orientalis ad *Monghyr Gualpara, Nepal*, alibiqve super arbores altissimos scandens.

Truncus arboreus, robustus, cortice, cinereo rimoso.

Rami longissimi, teretes, fusci, superne vestiti tomento denso molli; juniores ferruginei, striati.

Folia alterna, petiolata, patentia, rotundato-cordata, subreniformia, ampliſſima, palmaria ad pedalia, integerrima, biloba: lobis rotundatis subdivaricatis; dum juniora molliſſima, supra laete viridia pubescentia, subtus nerviqve ferrugineo-tomentosa, adultiora glabriora,

coriacea, tredecimnervia, venosa, nervo costali inter lobos in setam lineari-lanceolatam semipollicarem excurrente.

Stipulæ oblongæ, subfalcatæ, recurvatæ, ungviculares, deciduæ.

Petioli tri-ad sexpollicares, teretes, ferrugineo-tomentosi, utrinqve intumescentes, ad insertionem folii subbilobi.

Cirrhi duo oppositi, crassi, plani, integri, sexpollicares et ultra, revoluti, tomentosi, demum lignosi.

Racemi tuminales, pedunculati, ampli, ovati, corymbosi, multiflori, incano-tomentosi.

Pedunculus crassus, sursum floriferus, and basin singulorum pedicellorum *bracteis* patentibus lanceolatis acutis persistentibus.

Pedicelli sparsi, patentissimi, teretes, bipollicares, apice bracteola una vel duabus subulatis, superiores sensim breviores.

Flores magni, candidi, demum lutescentes.

Calyx tubulosus, ad dimidium qvinqvefidus, limbo reflexo. Laciniæ lanceolatæ, concavæ, unqviculares, membranula tenui alba in duos lobos connexæ.

Corolla pentapetala, patentissima. *Petala* pollicaria, ovata, crenata, undulata, basi in unqvem linearem longitudine laciniarum calycis attenuata, sericeo-barbata, margine intusqve glabriora.

Stamina octo, fauci calycis inserta. Qvinqve sterilia capillaria petalorum unqvibus breviora: qvorum duo instructa rudimentis antherarum.

Filamenta fertilium cylindrica, carnosa, arcuata, petalis longiora, basi pilosa.

Antheræ magnæ luteæ oblongæ, incumbentes.

Ovarium tubo calycis hinc adnatum, oblongum, dense lanatum.

Stylus adscendens, staminibus longior, sangvineus, pilosus.

Stigma capitatum, viride, laeve.

Legumen oblongum, lignosum, pedale, digitos tres latum, compressum,

apice rotundatum cum ſtylo obliqvo brevi, baſi parum anguſtatum, marginibus rectilineis, tomento ferrugineo denſo molliſſimo veſtitum, ſex-ad octoloculare. *Diſſepimenta* lignoſa, brevia. *Loculamenta* laeviſſima, polita, vix ultra tertiam latitudinis partem occupantia.

Receptaculum. *Funiculi* magni, triangulares, valde complanati, coriacei, e ſutura externa deſcendentes, apice ſemilunari truncata.

Semina ſolitaria, ſubrotunda tranſverſaliter parum oblongata, pollicaria, compreſſa, utrinqve planiuscula, laeviſſima, nitida, ſtria ocellari obſoleta ſubmarginali. *Umbilici feneſtra* in parte exteriore ſuperiore excavata ſemilunaris.

Integumentum ſimplex, durum, coriaceum.

Albumen durum, tenue, aqveo-album.

Embryo rectus, luteſcens. *Cotyledones* magæ, amygdalinæ, flaveſcentes, planæ, baſi leviter ſigmoideæ, obſolete nervoſæ, laeviſſimæ. *Plumula* minima. *Radicula* conica, centrifuga.

Obſervation. This is one of the moſt ſtately and gigantic climbers in the world; its ſtem often meaſuring eighteen inches in diameter and its branches covering, and at laſt ſuffocating the largeſt trees. The flowers are beautifully white, becoming yellowiſh before they decay. Its profuſe and elegant foliage is employed by the natives to cover their huts, umbrellas etc; uſes for which the ſtrong and leathery texture of the leaves renders them exceedingly well qualified. The cotyledons are not unpleaſant to the taſte, and are eat by the natives.

Hinduſtani name Maula. A man who has ſeen the tree at both places tells me it is called *Latá Kanchanà* at Monghyr, in Nepal *Bhurla.*

Flowering time, the hot and rainy ſeaſons. The pods take nine months to ripen.

SARCOLOBUS globoſus.

Fig. a. a. Front and back view of a flower.
b. Calyx opened exhibiting its ſmall glandular bodies and the ovaria.
c. Corpus ſtamineum.
d. The ſame with the anthers removed, more magnified.
i. Fruit, natural ſize.
k. The ſame opened.
e. e. Seeds viewed from both ſides.
f. The ſame tranſverſally divided.
g. The ſame longitudinally divided, ſhowing the albumen,
h. Embryo, natural ſize.

SARCOLOBUS carinatus.

Fig. a. a. Flower.
b. Corpus ſtamineum.
c. Internal ſide of the anther, ſhewing the cells.
d. Fruit.
e. The ſame longitudinally divided.
f. Seeds attached to the receptacle.
g. Receptacle.
h. h. Seeds.

CAMPANULA dehiſcens.

Fig. a. Corol.
b. Calyx and ſtamens.
c. A detached ſtamen.
d. Piſtil.

Fig. e. Tranſverſal ſection of the ovarium.

f. Capſule.

g. The ſame divided tranſverſally.

h. The ſame opened ſo as to ſhew a loculament.

BAUHINIA racemoſa.

Fig. a. b. Calyx and ſexual organs.

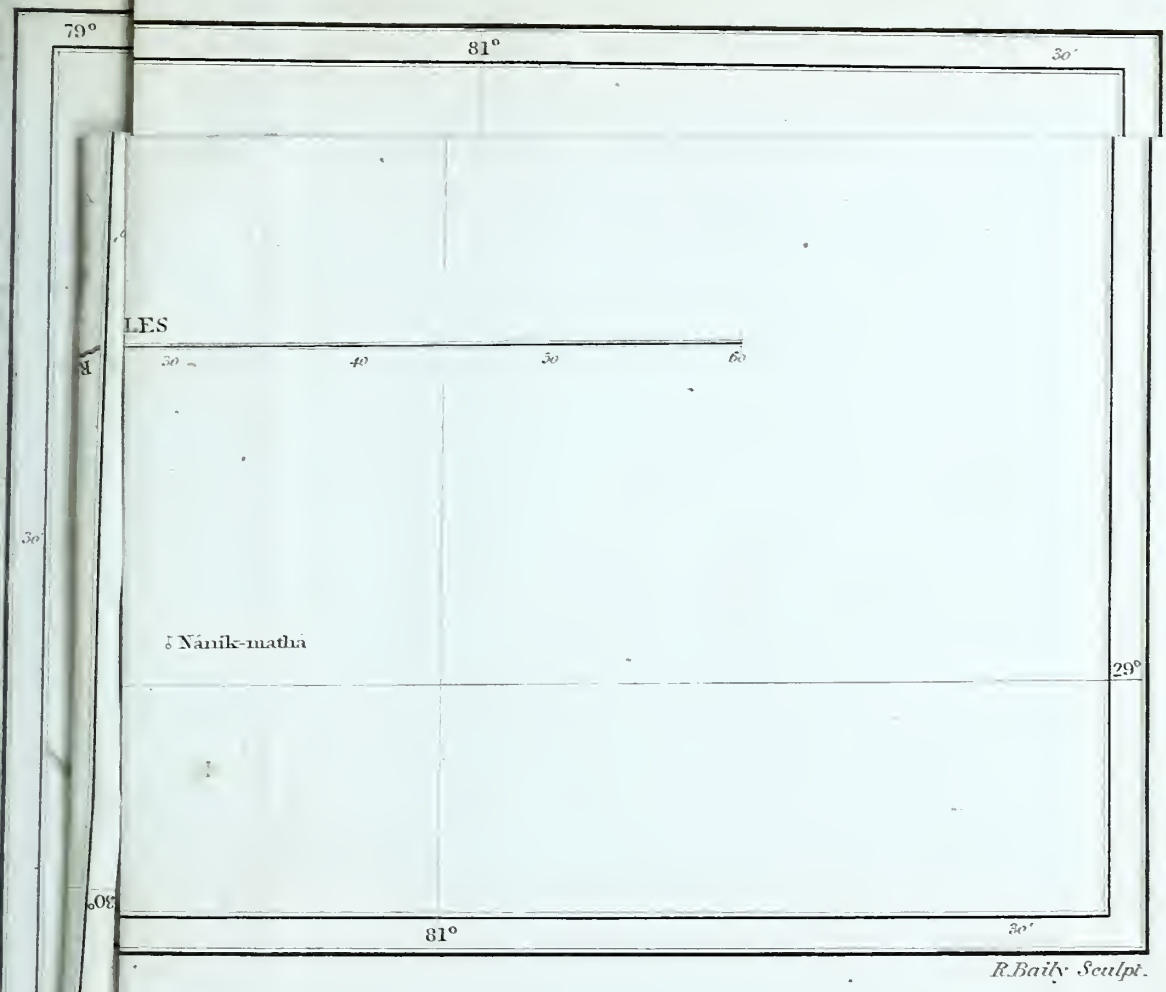
c. c. Petals.

d. Legume.

e. Seed with its funiculus.

f. g. The ſame in a germinating ſtate.

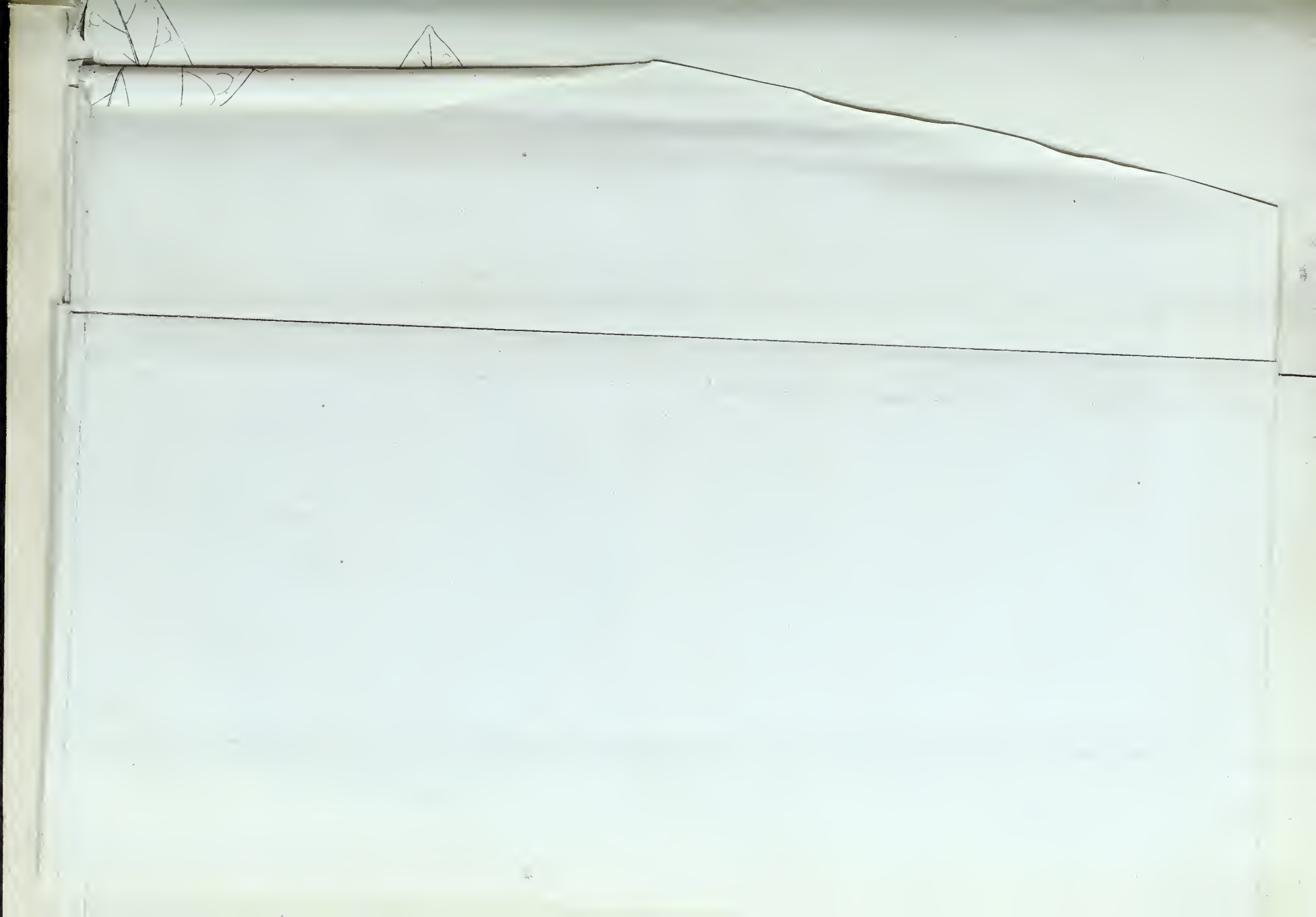
THE END OF THE TWELFTH VOLUME.



R.Baily Sculpt.


Plan of A Tour to Chinese Tatary. &c. &c. &c.
By William Moorcroft Esqr. in 1812
British Miles
This River runs from hence N.W. under Latakh the Capital of independant Tatary distant 12 days journey.
Indus R.
Valley of Gortope
Gortope
Heaps of Stones
Tamarisk Brushwood on both sides of the River
These Mts. have little vegetation upon them and contain much Gold & mineral matter
Springs
Rivulet
Thin Furze
High Table Land
Defile of Frozen Snow
Mountn. containing Gold
Dry bed of a Lake
Mts. totally covered with recent Snow
Cailás Mts.
Table Land with fine Grass
Extensive beds of Snow
Satlaj R.
Satadru
Urna Desa or Un-Dés
Gold Mines
Plains dug in many places for gold in grains
Mehal
a Poplar Tree
Country producing the Shawl wool
Himáchal Mts.
Petrefying Rivulet
Kienlung
Hot Springs
Sulphureous Gas & Hot Springs
Satlaj R.
Tirthapuri
Tirthapuri R.
Double Snowy Point
Mt. Cailása
Heap of Stones
Gravel Plain
Dry bed of a Jeel
Niti Ghati
Lake Rawan Hrad
Lamas House
Lake Mápáng or Manas-Sarowar
Mr. Moorcroft's Route on the 6th August to examine if this Lake had any communication with Rawan Hrad and found none
Two Men sent on the 7th to examine this spot whose report agreed with our perspective glasses, there Streams falling into the Lake.
Grishna R.
Uninhabited Tracts of Mts. covered with perpetual Snow
Bed of Snow
Mts. very craggy & bold
Gooseberry & wild Rose Bushes
Niti or Liti
Bhutant
Forests of Firs Cedars & Rhododendrons
Natural Bridge of Rock
Badrinath
Mana
Malari
Himáchal Mountains covered with perpetual snow
Kedarnath
Mandakini R.
Vishnu prayaga
Painkhandi
Hot Springs
Mountains of Marble
Boundary between Painkhandi and Bhutant
Trisula or Tirsul Mountains
Karna-prayaga
Pindar R.
Chand pur or Chandra pura
Gandiyal Mt.
branch of the Ram-ganga R.
Summits of Mts. covered with Firs
Pali
Budhakedar
Khoh Valley
Kaklasiyon Valley
Ram-ganga R.
Almora
Kosila R.
Chilkiya
Ramuri
Rudrapur
Ram Pur
Nanik matha
R. Baily Sculpt.

Published at London 10th April 1818 by the Asiatic Society of Calcutta



Sarcolobus globosus

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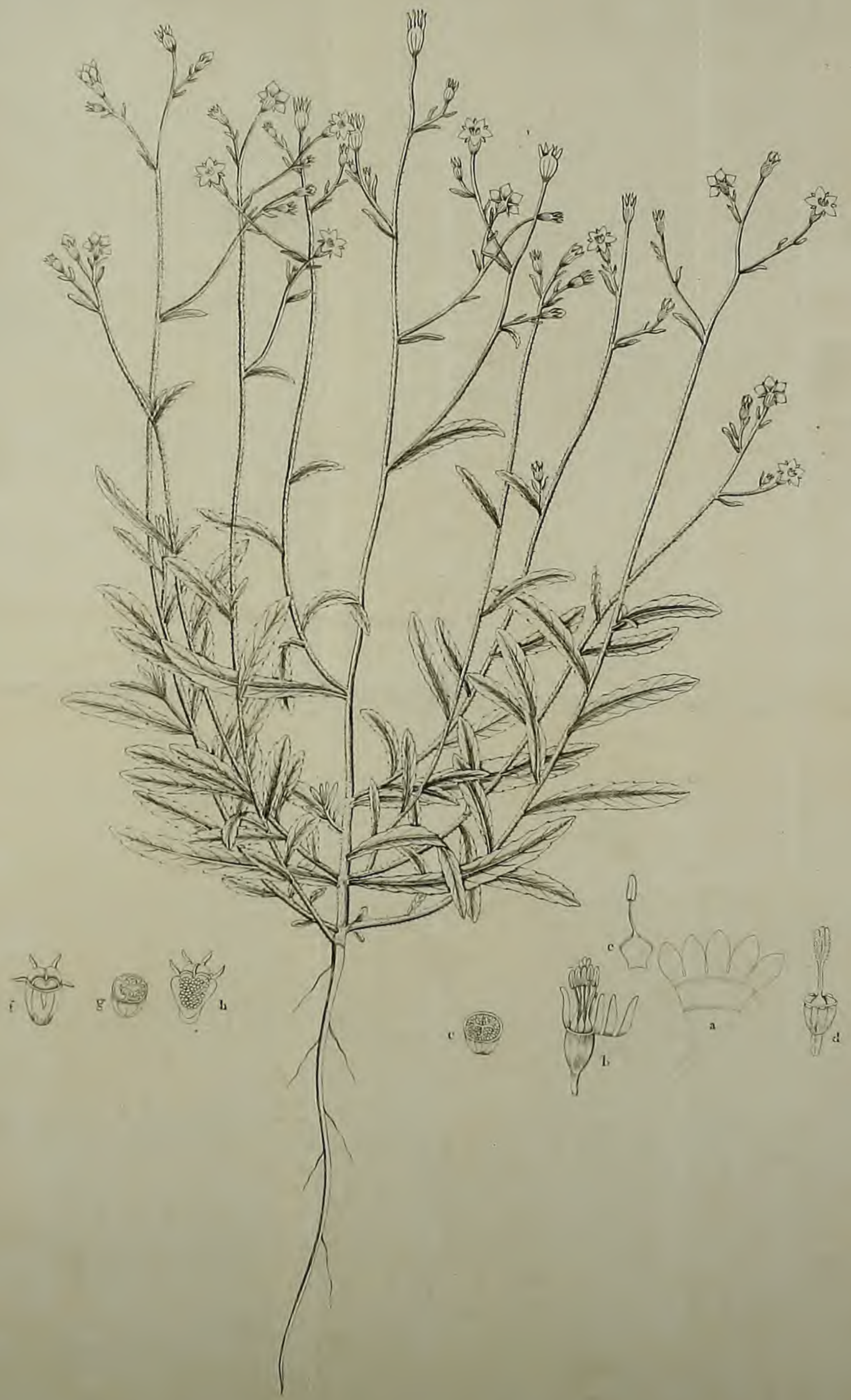
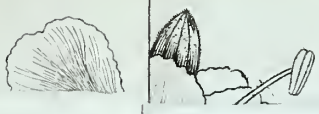
Sambucus carinatus



Campanula dehiscens Roxb.



Bauhinia racemosa.

ADDITIONS.

NOTE *to an* ESSAY *on the* NOTIONS *of the* HINDU ASTRONOMERS, *concerning the* PRECESSION *of the* EQUINOXES; *by* H. T. C. *late President.*

HAVING reconsidered the passage of VISHŃU CHANDRA quoted by the scholiast of BRAHMEGUPTA,* I am satisfied that the corrupt part of the text does not relate to the number, which appears complete without it; and I venture with confidence on an emendation, which the defect of one syllable in the verse shows to be necessary, and which perfects the sense. The passage so restored is as follows: the syllable, which I conjecturally re-establish, (and no other correction is attempted nor required,) being distinguished by Italics.

'Tasya chátra *bha*-chid rudra-crĭta-nandáshṭacéndavah Ayanasya yugam próctam Brahmárcádi-matam purá.'

'Its revolutions *through the asterisms* are here [in the *calpa*] a hundred and eighty-nine thousand, four hundred and eleven. This is termed a *yuga* of the solstice, as of old admitted by BRAHMA, ARCA, and the rest.'

The number of 189411 complete revolutions, in a *calpa* of 4320000000 years, gives an annual precession of $56'' \; 49\frac{1}{2}'''$.

The age of VISHŃU CHANDRA must be placed between those of ÁRYABHAṬṬA and BRAHMEGUPTA: for a passage of the last mentioned author affirms, that both he and ŚRÍSHÉŃA compiled their *Vasishṫ'ha* and *Rómaca siddhántas* from ÁRYABHAṬṬA, and VIJAYANANDI, &c. taking the mean motions of the sun and moon, with the lunar apogee and nodes, and other specified particulars, from the first of these authorities. To determine the period when this original author flourished is a material and interesting object of research; not only as he was founder of a sect in

* See page 215.

astronomy, as PULÍŚA was of another; both of which are noticed by BRAHMEGUPTA with their distinctive appellations, but because he is the earliest Hindu writer known to have treated of Algebra. I shall resume the inquiry in another place.

I shall here only observe, that BRAHMEGUPTA is placed by the Astronomers of *Ujjayaní* in 550 *Śaca* (A. D. 628); and that ÁRYABHAŤŤA is considerably more ancient. MUNJÁLA, so frequently mentioned for the doctrine maintained by him concerning the revolution of the equinoxes,* is stated by the Astronomers of *Ujjayani*, to have written in the year 854 of the *Śaca* era (A. D. 932), as BRAHMEGUPTA is in 550 *Śaca*. These dates are furnished in a list of astronomical authorities, which was communicated to the late Dr. WILLIAM HUNTER by Hindu Astronomers, who assisted his studies, when he was residing at that ancient seat of Hindu astronomy. It appears deserving of some confidence, as several of the dates which it contains, particularly those of BHÓJA-RÁJ and BHÁSCARA, have been verified. The rest, it may fairly be presumed, are likely to be equally correct; and VISHŃU CHANDRA, being anterior to BRAHMEGUPTA, must have preceded MUNJÁLA by more than three centuries, as the latter did BHÁSCARA by more than two. It is not the only instance, among the Hindu astronomers, where the older author has made a nearer approach to the truth, than his successor.

When the conclusion of the note at page 250 was written, a quotation from ÁRYABHAŤŤA in MUNÍŚWARA's commentary on BHÁSCARA was overlooked. It is the beginning of a passage in the abridgment of ÁRYABHAŤŤA, specifying the revolutions of the planets. The quotation unfortunately stops after those of the moon; which are 57753334000, answering to 4320000000 of the sun. His numbers then come between those of the *Súryasidd'hánta* and BRAHMEGUPTA, in the instances which admit of comparison: and the diurnal motions, concluded from them, differ from theirs but at fourth minutes.

* See page 210.

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Dryobalanops Camphora.

London Publ.d April 7 1826 by the Asiatic Society of Calcutta

NOTE ON PAGE 248.

To obviate misapprehension, it is necessary to observe, that the number of elapsed years of the *Śaca* era subjoined to ĀRYABHAṬṬA's computation of past time, is an addition by the scholiast of BRAHMEGUPTA, in course of comparing elapsed time, as reckoned by the two authors. For the passage, which he twice quotes from the *Daśa-giticá* of ĀRYABHAṬṬA, reckons from the beginning of the *Calpa* to the *Bhárata*, which is the era of *Yudhishṭ'hira*, and the epoch employed by him, without any notice either of *Śaca* or *Sambat*.

NOTE *to an* ESSAY *on the* CAMPHOR TREE *of* SUMATRA; *by* H. T. C. *late President*.

SINCE my return to England, I have had the opportunity, by the indulgence of Sir JOSEPH BANKS, to inspect the specimen in his collection from which the younger GŒRTNER, to whom it was communicated, described his Dryobalanops aromatica; and I find that the leaves entirely agree, and that it is unquestionably the same species with the Camphor tree of Sumatra. This information actually accompanied the specimen seen by Dr. C. F. GŒRTNER, though he have inadvertently referred it to Ceylon for a habitation, and as erroneously alleged, that the bark of the tree is cinnamon.

The fruit has been also figured and described by M. CORRÉA DE SERRA, (Ann. du Mus. d'Hist. nat. 10. 159,) under the name of Pterygium teres; equally without any intimation of the tree affording the Sumatran camphor.

As the Pterygium costatum of the same author is the Dipterocarpus costatus of the younger GŒRTNER, whose publication on both that and the Dryobalanops preceded by a year the earliest of CORRÉA DE SERRA's concerning these fruits, it is presumed, that GŒRTNER's names of both genera will be retained. Whether his name of the species now in question shall also be preserved, others must determine. It is, however, to be remarked, that the name, which was given to it in India, before the identity of species could be ascertained, is the most appropriate.

The flowers of this plant in Sir Joseph Banks's collection, are in too imperfect a state for description. It appears, however, as was to be expected from analogy of congeners, that the petals are five, and the stamina numerous. It belongs then, as most of the plants of the same natural order do, to the class and order Polyandria Monogynia. The essential generic character is:—Calyx, one-leaved, permanent; enlarged into a gibbous cup, with five ligulate, long, scariose wings. Corol. five-petalled. Capsule, three-valved, one-celled. Seed solitary. Embryo inverse, without perisperm.

CORRECTIONS.

Page 219, in a note, for 'octavœ sphœrœ,' read 'octavæ sphæræ.'
220, in a note, for 'regulos,' read 'regulas.'
229, line 8, for 'whether,' read 'whither.'
230, line 14, for 'perfect,' read 'imperfect.'
232, for 'Chaturvída,' read 'Chaturvéda.'
240, line 9, for 'ecliptic,' read 'equator.'
.... in a note, for 'of planet,' read 'or planet.'

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APPENDIX.

RULES

OF THE

ASIATICK SOCIETY.

THE following is an abſtract of the Rules of this Inſtitution, which are now in force; including thoſe printed in the Appendix to the ſixth and ſubſequent Volumes of the Society's Tranſactions:

Original Rules adopted from the Founder's diſcourſe, 15th February 1784.

1. THAT the inſtitution be denominated the *Aſiatick Society*: that the bounds of its inveſtigations be the geographical limits of *Aſia*; and that within theſe limits, its enquiries be extended to whatever is performed by man or produced by nature.

2. THAT weekly meetings be held for the purpoſe of hearing original papers read, on ſuch ſubjects as fall within the circle of the Society's enquiries.

3. THAT all curious and learned men be invited to ſend their tracts to the Secretary; for which they ſhall immediately receive the thanks of the Society.

4. That the Society's reſearches be publiſhed annually, if a ſufficiency of valuable materials be received.

5. That mere tranſlations of conſiderable length be not admitted, except of ſuch unpubliſhed eſſays or treatiſes as may be tranſmitted to the Society, by native authors.

6. That all queſtions be decided on a ballot, by a majority of two-thirds, and that nine Members be required to conſtitute a Board for ſuch deciſions.

7. That no new Member be admitted who has not expreſſed a voluntary deſire to become ſo; and in that caſe, that no other qualification be required, than a love of knowledge, and a zeal for the promotion of it.

Subſequent reſolutions of the Society, which are in force.

8. That the future meetings of the Society be held on the firſt *Wedneſday* of each alternate month; viz. in the months of *February*, *April*, *June*, *Auguſt*, *October*, and *December*, at nine o'clock in the evening.

9. That if any buſineſs ſhould occur to require intermediate meetings, they may be convened by the Preſident; who may alſo, when neceſſary, appoint any other day of the week, inſtead of *Wedneſday*, for the ſtated meetings of the Society.

10. That as it may not always be convenient for the Preſident

to attend the meetings of the Society, a certain number of Vice Presidents be elected annually.

11. That in case the President and the Vice Presidents should be absent at any meeting, a quarter of an hour after the fixed time, the Senior Member present shall take the chair for the evening.

12. That every Member of the Society have the privilege of introducing, as a visitor, any gentleman who is not usually resident in *Calcutta*.

13. That with a view to provide funds for the necessary expences of the Society, an admission fee be established, to consist of two gold mohurs, payable by every Member on his election; and that each Member of the Society, resident in India, (honorary Members excepted,) do also contribute a gold mohur quarterly, in the first week of *January*, *April*, *July*, and *October*. Any Member neglecting to pay his subscription, for half a year after it becomes due, to be considered as no longer a Member of the Society.

14. That a Treasurer be appointed.

15. That in addition to the Secretary, an assistant Secretary, and a Librarian, be also appointed.

16. That a Committee of Papers be appointed, to consist of the President, Vice Presidents, Secretary, and nine other Members, to be elected annually; and that any number not less than five, be competent to form a Committee.

17. That this Committee ſelect from the papers communicated to the Society ſuch as may appear proper for publication; and ſuperintend the printing of the Society's tranſactions.

18. That the Committee of Papers be authorized to draw upon the Treaſurer for any ſums requiſite to defray the expence of publiſhing the tranſactions; and that an order, ſigned by a majority of the Committee, be a ſufficient warrant to the Treaſurer for paying the ſame.

19. That the Committee of Papers be authorized to defray any ſmall contingent expences on account of the Society, which they may deem indiſpenſable.

20. That the agents of the Society in *England* be deſired to purchaſe and forward for the Society's Library, books of ſcience and oriental literature publiſhed in *Europe*, taking care, that thoſe purchaſes at no time exceed the funds ariſing from the ſale of the Society's publications.

21. That the Committee of Papers be requeſted to furniſh the Agents in *Europe*, with ſuch further inſtructions as may appear requiſite for their guidance in the ſelection of books proper to be placed in the Library of the Society.

22. That it will be proper to publiſh, with each volume of the reſearches, a liſt of ſuch oriental ſubjects as may be conſidered in the light of *deſiderata*; to be prepared by the Committee, from liſts, ſubmitted to the Society, by the Members or others.

23. That as a teſtimonial to the merit of the beſt papers, commu-

nicated to the Society, on the ſubjects propoſed as *deſiderata*, the author, when not a Member of the Society, be preſented with the volume of Reſearches, wherein ſuch paper is contained; accompanied with a complimentary letter, from the Secretary in the name of the Society.

24. That every ſubſcribing Member of the Society be, on application, furniſhed with a copy of the 12th volume, as well as of any future volumes of the Society's Tranſactions, in return for his contributions, without any further payment.

25. That with a view to the more general circulation of the *Aſiatick* Reſearches in *India*, the price of the 12th and future volumes, to non-ſubſcribers, be fixed at a gold mohur; and that if ſeveral volumes of different years be purchaſed together, they be ſold at ten rupees each.

MUSEUM.

26. On the 2d *February* 1814, the Society determined "upon forming a Muſeum for the reception of all articles that may tend to illuſtrate oriental manners, and hiſtory; or to elucidate the particularities of nature or art in the Eaſt." The following reſolutions were at the ſame time paſſed upon the ſubject.

27. That this intention be made known to the public, and that contributions be ſolicited of the undermentioned nature:

1. Inſcriptions on ſtone or braſs.
2. Ancient monuments, *Mohammedan* or *Hindu*.
3. Figures of the *Hindu* deities.
4. Ancient coins.

5. Ancient manuſcripts.
6. Inſtruments of war peculiar to the Eaſt.
7. Inſtruments of muſic.
8. The veſſels employed in religious ceremonies.
9. Implements of native art and manufacture, &c. &c.
10. Animals peculiar to *India*, dried or preſerved.
11. Skeletons or particular bones of animals peculiar to *India*.
12. Birds peculiar to *India*, ſtuffed or preſerved.
13. Dried plants, fruits, &c.
14. Mineral or vegetable preparations in Eaſtern pharmacy.
15. Ores of metals.
16. Native alloys of metals.
17. Minerals of every deſcription, &c. &c.

28. That the names of perſons contributing to the Muſeum or Library of the Society be hereafter publiſhed at the end of each volume of the *Aſiatick* Reſearches.

29. That the hall on the ground floor of the Society's houſe be fitted up for the reception of the articles that may be procured. The plan and expences of ſo doing to be regulated by the Committee of Papers and Secretary; and the perſon under whoſe Superintendance the Muſeum may be placed.

30. That the expence which may be incurred in preparing materials, furniſhed in a ſtate unfit for preſervation, be defrayed by the Society, within a certain and fixed extent.

31. That the thanks of the Society be given to Doctor Wallich for the tender of his ſervices; and that he be appointed Superintendent of the Oriental Muſeum of the *Aſiatick* Society.

32. On the 5th *April* 1815, in conſequence of Doctor WALLICH's being obliged to reſide at ſome diſtance from *Calcutta*, it was reſolved, at his ſuggeſtion, to appoint a joint Superintendent of the Society's Muſeum, and Mr. WILLIAM LLOYD GIBBONS, who is alſo Aſſiſtant Secretary and Librarian to the Society, was accordingly requeſted to act as joint Superintendent with Doctor WALLICH.

33. On the 7th *June* 1815, the Superintendents of the Muſeum were requeſted "to return the thanks of the Society to the perſon from whom any donation to the Muſeum has been received, and to make ſimilar acknowledgments for any contribution which may be hereafter made to the Muſeum.

BIBLIOTHECA ASIATICA.

THE following reſolutions were paſſed, on the recommendation of the Committee of Papers, under date the 2d *July* 1806. But materials have not yet been received for publiſhing a volume of the work therein propoſed.

34. THAT the Society publiſh, from time to time, as their funds will admit of it, in volumes diſtinct from the *Aſiatick* Reſearches, tranſlations of ſhort works in the *Sunſcrit* and other *Aſiatick* languages, or extracts and deſcriptive accounts of books of greater length in thoſe languages, which may be offered to the Society, and appear deſerving of publication.

35. THAT as this publication may be expected gradually to extend to all *Aſiatick* books, of which copies may be depoſited in the Library of the Society, and even to all works extant in the learned languages of *Aſia*,

the ſeries of the volumes be entitled *Bibliotheca Aſiatica*, or a deſcriptive catalogue of *Aſiatick* books, with extracts and tranſlations.

36. That the Committee of Papers, adopt ſuch means as may appear proper, for making the intentions of the Society in this reſpect generally known.

Phyſical and Literary Committees.

37. At the ſuggeſtion of one of the Members of the Society, it was reſolved, on the 7th *September* 1808; *Firſt*. That a Committee be formed to propoſe ſuch plans and carry on ſuch correſpondence as may ſeem beſt ſuited to promote the knowledge of natural hiſtory, philoſophy, medicine, improvements of the arts, and whatever is comprehended in the general term of *phyſics;* to conſiſt of ſuch Members as may voluntarily undertake to meet for that purpoſe. *Secondly*. That a Committee be formed in like manner, for literature, philology, hiſtory, antiquities, and whatever is comprehended under the general term of *literature*.

38. The following Rules for the two Committees were alſo adopted by the Society, on the 5th *October* 1808.

1ſt. That the meetings of the Literary Committee be held at the houſe belonging to the *Aſiatick* Society, on the firſt and third *Wedneſdays*, and the meetings of the Phyſical Committee on the ſecond and fourth *Wedneſdays* of each month, at the hour of nine o'clock in the evening: whenever a general meeting of the *Aſiatick* Society may be held on the ſame evening, and at the ſame hour, the meeting of the Committee to be ſuſpended. 2d. That each Committee be open

to all Members of the *Aſiatick* Society, who may chuſe to attend the meetings. 3d. That if the Preſident of the Society be preſent at a meeting of either Committee he ſhall preſide; in his abſence one of the Vice Preſidents, and in their abſence the eldeſt Member of the Society preſent at each meeting ſhall be conſidered as Preſident at ſuch meeting. 4th. That the Secretary to the *Aſiatick* Society be requeſted to act as Secretary to the Literary Committee, and the Aſſiſtant Secretary to the Society be requeſted to act as Secretary to the Phyſical Committee, as far as their time and avocations may admit. 5th. That a Deputy Secretary be alſo appointed for each Committee to be elected at the next meeting of the two Committees reſpectively. 6th. That regular books of proceedings be kept by the Secretaries for each Committee, in which minutes ſhall be entered of all papers, communications, and acts done by the Committee; that ſuch books be at all times open to the inſpection of the Members of the *Aſiatick* Society; and that ſuch papers be laid before the Society as the Committee may judge proper to be ſubmitted. 7th. That the correſpondence of each Committee be in general carried on through its Secretary or Deputy; but that it be at the diſcretion of the Committees to employ any one of their Members to correſpond with any individual.

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	Specimens of coal from *Sylhet*.

DONORS.	DONATIONS.
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	Three sets of horns of the hog-deer.
	Eight horns of different species of deer.
	Specimens of the beak of a species of Buceros.
	Ditto of another ditto.
	Six beaks of different birds.
	A beak of the Spoon-bill.
	Two ostrich eggs.
	Some teeth of a small shark.

DONORS.	*DONATIONS.*
	The tail of a rattlesnake, dried.
	A hairy concretion from the stomach of a cow.
	A small harpoon.
	Part of the skull of a musk deer.
	Two dried fishes.
	Some tiger claws.
	Claws of the *Amboyna* pigeon and other birds.
	A brass standish and pen-case.
	An iron style.
	A brass mirror.
	A silver pedestal.
	A brass figure of BHAVÁNI.
	Five brass casts of BUDDHAS.
	One ditto of GANÉŚA.
	One small ditto uncertain.
	One ditto of PARVATI,
	Another ditto ditto.
	One ditto of the infant CRĬISHN'A.
	One ditto of DURGÁ, mounted.
	One ditto of SÉSHA resting on the tortoise.
	A wooden medallion of a BUDDHA, with surrounding inscription.
	A brass BHAVÁNI, with a lion's head and canopied by *S'ésha Nága*.
	A brass vessel.
	A ditto lamp.
	A crystal *Mála*.

DONORS.	DONATIONS.
	An egg.
	Specimens of native sulphur.
	Ditto of opal.
	Ditto of benzoin.
	Ditto of crystal.
	Ditto of quartz.
	Ditto of lapis lazuli.
	Ditto of gold ore.
	Ditto of variegated marble.
	Ditto of mica.
	A small stone cut with the figure of a head.
	Three conch shells.
	Some tusks of a boar.
	Some tigers' teeth.
	A small model of a boat, from the Eastern islands.
	Necklaces and bracelets of shells &c. from the Eastern islands.
	Fishing tackle, from ditto.
	A piece of honeycomb.
	Various eggs.
	Bracelets of boar's tusks, from the Eastern islands.
	An *Egyptian* lock.
	A dried sea-horse.
	A *China* flute.
	A set of *China* chopsticks.

DONORS.	DONATIONS.
	A *China* steelyard.
	Burmah dominos and dice.
	Ditto chessmen.
	The ornamented prow of a *Pegu* boat.
	A sling from the Eastern islands.
	The bowl of *Chinese* pipe.
	Fishing-tackle from the Eastward.
	Two trumpets or pipes.
	Two *China* compasses.
	A large elephant's tusk.
	A buffalo's horn.
	Two *khargas* or *Hindu* sacrificial knives.
	Two specimens of *Hindustani* mosaic, in coloured chunam from *Golconda*.
	A tail of the unicorn.
	A model of a *Pegu* boat.
	Another ditto ditto.
	Ditto of a *Pegu* bathing tub.
	Two *China* pipes.
	Various *Hindustani* arrows.
	A brass *Hindustani* trumpet.
	A *Mameluke* saddle.
	A stone figure of CALI.
	An elephant's molar tooth.
Colonel C. MACKENZIE,	—Two horns of the Antelope Orcas of LINNÆUS, from *Africa*.
	Eight statues of BUDDHA, from the upper provinces.

DONORS.	DONATIONS.
	Nine silver coins from ditto.
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H. Maseyk, Esq.	—Some rhinoceros hoofs.
Lieutenant W. Price,....	—A *Hindu* marble image of Súrya, or the sun.
R. Richardson, Esq.	—Three alligator eggs.
Captain Taylor, ...	—Two [Spears from islands in the South sea.
Doctor Wallich,.....	—A large skull of an elephant.
	A smaller ditto, divided by a vertical section.
	A ditto, together with a scapula, and the four first vertibra colli of a young elephant.
	Three buffalo skulls.
	Five rhinoceros ditto.
	A skull of the large river alligator.
	Three ditto of the small tank ditto.
	A ditto of a delphinus gangeticus.
	A ditto of a dolphin found near the Isle of *France*.
	Two sets of shark jaws.
	Some fossil bones and teeth, probably of an elephant, from the neighbourhood of *Serampore*.
	A skull of the boar.
	Two large and one smaller tiger skulls.
	A skull of a bear.
	A skull of the babyrussa.
	A ditto of a porcupine from *Pegu*.
	A ditto of the large river turtle.
	Two smaller ditto.

DONORS.	DONATIONS.
	A ditto of a large *Indian* monkey.
	A skull of a smaller ditto.
	A ditto of a cangaroo from *New Holland*.
	The head of a pelican stuffed and a lower jaw of a ditto.
	Several very large horns of the common deer.
	The skull of an Ardea.
	Ditto of a Scolopax.
	Ditto of an Alcedo.
	A monstrous skull of a goose.
	A number of skulls of animals not specified.
	An entire panicle of the prickly bamboo (*bambusa spinosa*, ROXB.)
	A ditto of the common bamboo (*bambusa arundinacea.*)
	Some large inflorescences, together with ripe fruits of the *Madagascar* raffia-tree (*sagus ruffia.*)
	A ditto of Urania speciosa.
	A large crystal from *Madagascar*.
	A variety of shells and corals from the Isle of *France*.
	A young lacerta gangetica in spirits of wine.
	Some abdominal viscera of a cangaroo in ditto.
	A funiculus umbilicalis of a *Bengalee* child, with large appendices, injected with mercury.

DONORS.	DONATIONS.
	A specimen of a Tænia solium expelled by the bark of pomegranate root.
	Another ditto of a native woman.
	Some flowering branches of Loranthus bicolor in spirits of wine.
	Specimens of various resinous productions from the Island of *Madagascar*.
	Some stems of the singular Bauhinia anguina ROXB.
Captain H. WILKINSON,..	—Four silver coins from *Hindustan*.
H. H. WILSON, Esq.....	—A *Salegram*.
	A SIVA LINGA.
	A *Rudrácsha Mala*.
	Specimens of lead ore from *Monghyr*.
	Ditto copper ore from *Nellore*.
	Ditto of four species of corundum or currun stone.
	Ditto of the *Pacheet* stone.
	Ditto of coal from *Burdwan*.
	Ditto of *Sone* pebbles.
	Ditto of sand supposed to contain gold dust, from *Pontiana*.
	Ditto of Santa Clara copper highly arseniated.