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REPORT OF THE OPERATIONS

OF THE

India.

GREAT TRIGONOMETRICAL SURVEY OF INDIA,

DURING 1862-63.



Dehra Doon :

PRINTED AT THE OFFICE OF THE GREAT TRIGONOMETRICAL SURVEY.

T. KEIGHTLEY.

1863.

Office of Superintendent G. T. Surbey,

Dehra Doon, 1st September, 1863.

From

MAJOR J. T. WALKER, R.E.,
Superintendent G. T. Survey,

To

THE OFFICIATING SECRETARY TO THE GOVERNMENT OF INDIA,
Military Department.

SIR,

I have the honor to report the progress of the Trigonometrical Survey during the past official year.

BASE LINE PARTY.

J. HENNESSEY, Esq.,
1st Assistant.
H. TAYLOR, Esq.,
1st Assistant, joined 1st
December, 1862.
Lieut. CAMPBELL, R.E.,
1st Assistant, joined 1st
January, 1863.
Sub-Assistants.
Mr. J. WOOD, 3rd Class.
Mr. J. BURN, ditto.
A. T. W. MITCHELL, ditto.

2. In accordance with the sanction of Government, I proceeded, in the autumn of 1862, with the Officers and Assistants marginally detailed, to Vizagapatam to measure a Base Line. Vizagapatam is situated nearly on the same parallel of latitude as Bombay; and is the point where the Bombay Longitudinal Series, when extended Eastwards to the Madras Coast, will terminate. This series of triangles will form, with the Great Arc Meridional, the Calcutta Longitudinal, and the Coast Series, a vast quadrilateral figure, circumscribing the Meridional Series of triangles which are required as a basis for the interior topographical details. Base Lines had been measured several years ago, by Colonel Everest, at Beder, Seronj, and Calcutta, the S.W., N.W., and N.E. angles of this quadrilateral. One more Base Line remained to be measured, which, for considerations of symmetry, it was desirable to place in the vicinity of Vizagapatam.

3. Captain Basevi, the Officer in charge of the Coast Series, being located at Vizagapatam, was directed to select the site. After several trials, owing to the difficulty of carrying a straight line, several miles in length, so as to avoid the numerous irrigation tanks with which this district is studded, he eventually succeeded in finding a suitable line, on the undulating plain between the Military Stations of Vizagapatam and Vizianagram, at a distance of about fifteen miles to the West of the Port of Bimlipatam. The ground was chosen before the commencement of the rainy season of 1862, when trenches were dug to carry away the expected rain fall during the monsoon, and every precaution was taken to keep the line dry. But when Captain Basevi took the field early in October, he found that the rains had been so heavy, that the surrounding tanks had been converted into lakes, and the line lay submerged under a sheet of water, in some parts as much as sixteen feet deep. By great exertions the water was drained off into adjoining ravines. A portion of the line was ready for measuring on my arrival in December, and the remainder had become fairly dried by the time it was reached, in the course of measurement.

4. The apparatus employed, consisted of a set of Compensating Bars and Microscopes, on the principle of those designed by Colonel Colby, for the Ordnance Survey of Great Britain, which had been constructed under the superintendence of Colonel Everest, by whom they were brought out to India in 1832. This apparatus has been employed in measuring three Base Lines on the Great Arc, two at the North and South extremities of the Calcutta Meridional Series, and two at the extremities of the Indus Series. The length of these bases has, in each instance, been determined in terms of ten foot Standard Bar A, the unit of measure of the Indian Survey.

5. At the time this Standard was constructed, it was believed that the length of a well made iron bar, supported by rollers at its points of least flexure, might be considered invariable for any given temperature. But, of recent years, there has been a growing tendency to doubt the invariability which has hitherto been assumed. Series of comparisons made by the Ordnance Survey show there is much probability that the texture of an iron bar changes gradually in the course of years; for the factors of expansion obtained from groups of comparisons made at intervals a few

years apart, differ from each other by larger quantities than are due to errors of observation. It is preferable, therefore, to employ several Standards, constructed of different metals, than to trust to the integrity of a single bar.

6. To ascertain whether our Standard has altered in length, it would be necessary to remeasure the whole, or part, of one of the Base Lines which were first measured after the arrival of the Bar from England. I wished to obtain some light on this subject, by remeasuring certain short sections of the Calcutta Base Line, the extremities of which were originally indicated by permanent marks. But, on examining the positions of the section markstones, I found that, though concealed from view, there had been a regular thoroughfare over them, for many years, of carts and elephants, as well as foot passengers; consequently, they must, in all probability, have been disturbed, and they cannot be safely referred to, to decide so delicate a matter as the constancy of the Standard.

7. Disappointed at being baffled in my efforts to investigate this matter by any simpler and shorter process than the remeasurement of a whole Base Line, I determined to mark the intermediate section stations of the Vizagapatam Base as permanently as the extremities, in order that any future enquiry regarding the length of the Standard, at the time of the measurement of this Base Line, may be conducted without greater labor than the remeasurement of a short section.

8. It has been well said, by one of the greatest living authorities on scientific matters, that "the ends of a base line should be guarded with religious veneration." In this country they are liable to be viewed with mingled cupidity and dread; the Natives sometimes fancy that money is buried below, or they superstitiously fear that the Englishman's mark will cast a spell over the surrounding district. In either case, the mark is liable to be destroyed, as has already happened at the Seronj Base Line.* To ensure the protection of the ends of the Vizagapatam Base, I have had substantial domes of cut stone masonry built over them, without any openings, so that, before the marks can be reached, the domes must be pulled down, which will be so laborious, that the Police should be able to hear of and arrest the perpetrators, before they have had time to harm the marks.

9. Captain Basevi, and the Assistants of the Coast Series Party, shared in the measurement of the Base Line, which occupied about two months. The length of the line is six and a half miles. It was divided into three verificatory sections, which were subsequently checked by two series of triangles, one on each flank of the base, to test the measure of each section against the others. These tests were satisfactory; for the extreme difference between the measured length of the whole base, and its computed length by triangulation from either section, has been found to be one inch. The comparison of the measured length, with the computed value brought down by triangulation from the Calcutta Base Line, is singularly satisfactory, for the error of the computed value is only a quarter of an inch, though the triangulation embraces a distance of four hundred and eighty miles, much of it passing over flat plains, which are covered with dense forest and jungle, and very difficult to work through.

10. On the completion of the Base Line, Captain Branfill was deputed to connect it with the principal triangles of the Coast Series, and to execute the verificatory triangulation between the sections. Meanwhile, Captain Basevi proceeded, by my instructions, to make a reconnoissance of the neighbouring territories of the Rajah of Jeypore.

COAST SERIES.

Executive Officer.
 Capt. J. P. BASEVI, R.E.,
 1st Assistant.
Assistants.
 Capt. B. R. BRANFILL,
 2nd Assistant.
 Lieut. CAMPBELL, R.E.,
 2nd Assistant.
 R. CLARKSON, Esq.,
 Civil Assistant.
Sub-Assistants.
 Mr. F. RYALL,
 2nd Class.
 Mr. J. O'NEILL,
 3rd Class.

* On this subject, the following extract is taken from a letter by Colonel Sir George Everest, C.B., to the President and Council of the Royal Society, dated 8th April, 1861:—

"The natives of India have a habit, peculiar to human beings in that state of society, of attributing supernatural and miraculous powers to our instruments, and the sites which have been occupied by them. In cases of death, or any other natural visitations, they often offer up prayers to those sites, and if the object of their prayers be not conceded, they proceed to all sorts of acts of destruction and indignity towards them; nay, as in all cases where it was practicable, my station marks were engraved on the solid rock *in situ*, they have been known to proceed in bodies, armed with heavy sledge hammers, and beat out every vestige of the engraving."

I have to acknowledge the great assistance I received from Mr. Hennessey, First Assistant G. T. Survey, in the Base Line operations. For many years the care of the delicate apparatus of Compensating Bars and Microscopes had been his constant object; his familiarity with every part thereof, together with the practical experience he had gained at former Base Lines, measured under the superintendence of Sir Andrew Waugh, enabled me to entrust all practical details to his management, with the certainty that nothing would be forgotten, no refinement omitted, nor any inaccuracy allowed. The apparatus was safely transported from Dehra Doon, *via* Calcutta, to Vizagapatam, a distance of upwards of 1,500 miles. On reaching the Presidency, the party was attacked with cholera; several men died in a few hours, others deserted through panic, and it was only owing to Mr. Hennessey's assiduous exertions, and personal attention to the sick, that a sufficient number of men were kept together. He himself was ill, and had been ordered to Europe by his medical advisers, but no personal considerations would induce him to leave India, until the completion of the operations where his services would be so valuable. Subsequently, he went home on medical certificate, and he is at present employed in the Ordnance Survey Office, at Southampton, in acquiring information which will be of useful application to the operations of the Indian Survey.

Captain Basevi reports that "Captain Branfill took a large share in the preparation of the Base Line. He was in

11. It is a singular fact that, in the vicinity of the British Stations of Vizagapatam and Vizianagram, and within sixty miles of a coast which has been frequented by British traders for upwards of a century, there is an extensive tract of country, subject to a friendly Rajah, of which less is known, than of districts occupied by hostile tribes, along the frontier of our recently acquired Punjab Provinces. A glance at any Map of the Madras Presidency reveals a great blank in our geographical knowledge, in the tract of country which lies parallel to the coast, and North-East of the Godavery River. Its deadly reputation appears to have been a bar alike to the explorations of the curious and scientific, and to the visits of sportsmen. No regular survey of it has ever been attempted; the few places given in the Map seem to have been obtained from Native information, for they are generally exceedingly erroneous.

12. A reconnoissance of this tract was required for our own operations, in the extension of the Bombay Longitudinal Series to Vizagapatam. As any reliable information regarding lands so little known might be expected to be of much value and general interest, I was much gratified when Captain Basevi volunteered to reconnoitre this *terra incognita*; though, at the same time, I could not but feel apprehensive for his safety in a country so deadly, for his route would have to pass through dense jungle, in which it would be necessary for him to preserve his reckoning by the troublesome process of traversing, which, under such circumstances, is very laborious, and entails the necessity of performing the greater part of each day's march on foot. The inevitable exposure to be thus undergone is very great, in a tropical climate, and when the district to be traversed is known to be exceedingly feverish and unhealthy, no small amount of courage is needed, to prompt a man to volunteer for such a task.

13. Captain Basevi took with him one European Assistant, Mr. O'Neill, and a few Natives. He, himself, fortunately escaped with a slight attack of fever, but Mr. O'Neill suffered severely, and has not yet recovered, and the Natives of the party were also, more or less, incapacitated by fever, so that but for the assistance afforded by the Rajah of Jeypore, the operations would have been stopped almost at their very commencement. The results are, a good preliminary Map of Jeypore, which has been forwarded to the Surveyor General, to be lithographed and published; a report by Captain Basevi, giving details of his route, and a general description of the country; several valuable astronomical determinations of latitudes and longitudes, and barometrical determinations of heights; also memoranda of various other routes, the details of which were obtained from Native information. In consideration of the great value of Captain Basevi's services, he has been permitted to proceed to Europe on furlough for one year, during which his appointment will be kept open for him.

14. During the summer of 1862, the Field Season of the Kashmir Survey Party, the triangulation made great progress to the East of Leh, and Stations were fixed on the Chinese Frontier, from which a number of peaks in Tartary were determined. Some of these were more than one hundred miles distant, and will materially aid in the construction, from Native information, of maps of districts into which the Surveyors will probably be unable to penetrate. Several of the Stations observed from were over 20,000 feet in height above the sea, and Mr. Johnson visited one peak of a height of no less than 21,072 feet, but, owing to a very heavy fall of snow, was unable to observe from it.*

charge of a Microscope during the first half of the measurement, and then carried a Line of Levels from South end of Base to the Jetty Station at Vizagapatam, where tidal observations had been previously taken. On the completion of the Base Line he observed an Azimuth, and afterwards conducted the principal observations with the Great Theodolite, and completed them, though laboring under repeated attacks of fever the greater part of the time. The abstract of observations forwarded show that he is fully equal to the management of a large instrument. On all occasions Captain Branfill has rendered me valuable assistance.

* Lieutenant Campbell, R.E., Second Assistant, joined the party early in January. He was present at the latter half of the Base Line, taking one of the Microscopes, and afterwards assisted Captain Branfill in the Principal Triangulation. That Officer reports most favorably of him.

"Mr. R. Clarkson, Civil Assistant, assisted in the Base Line preparations. He was in charge of one of the Microscopes during the measurement, and afterwards executed some minor triangulation, as detailed by Captain Branfill.

"Mr. F. Ryall, Second Class Sub-Assistant, assisted in the Base Line preparations, and superintended the laying of the trestles at the measurement. He afterwards executed a minor triangulation, connecting Ellore with the Main Series, in a satisfactory manner.

"Mr. T. W. Mitchell, Third Class Sub-Assistant, joined the Series on the 1st February, having accompanied the Head-Quarters party from Mussoorie. He had charge of a Microscope at the Base Line, and afterwards acted as Recorder to Captain Branfill, to whom he gave entire satisfaction.

"Mr. J. R. O'Neill, Third Class Sub-Assistant, took a share in preparing the Base Line, and aided Mr. Ryall in laying the trestles. He accompanied me for a short distance into Jeypore, but was obliged to return, owing to repeated attacks of fever, by which he was so much reduced as to be unable to render any assistance in the remaining operations of the season."

* Captain Montgomerie reports as follows of the operations of his party:—"During the recess of 1861-62 the Kashmir Survey Party was employed in computing out the observations taken during the hot weather of 1861, in completing the printing and shading, &c., &c., of the Plane Table Sections, and subsequently in preparing two large charts on the 2-inch=1 mile scale, shewing all the triangulation.

"The area covered during the Field Season of 1862, embraces some very high ground, between the Indus and the

KASHMIR SERIES.

Executive Officer.
Capt. T. G. MONTGOMERIE,
R.E., Astronomical Assistant,
G. T. Survey.

Trigonometrical Assistants.
Lieut. T. T. CARRER, R.E.,
2nd Assistant.

W. H. JOHNSON, Esq.,
Civil 2nd Assistant,
Senior Grade.

W. G. BEVERLEY, Esq.,
Civil 2nd Assistant,
Senior Grade.

Sub-Assistants.
Mr. S. H. CLARKE,
Senior Sub-Assistant.
Mr. C. J. NEVILLE,
Senior Sub-Assistant.

Topographical Assistants.
Capt. H. H. G. AUSTEN,
2nd Assistant.
Capt. A. B. MELVILLE,
2nd Assistant.
Lieut. H. DE PRETT,
Probationary 2nd Assistant.

R. C. RYALL, Esq.,
Civil 2nd Assistant,
Junior Grade.

Sub-Assistants.
Mr. W. TOWN,
Senior Sub-Assistant.
Mr. J. LOW,
1st Class Sub-Assistant.
Mr. C. WOOD,
2nd Class Sub-Assistant.
Mr. C. BRAITHWAITE,
3rd Class Sub-Assistant.

15. A great many points were fixed in the Pangkong District. The whole of Astor was triangulated, and several peaks were fixed to the North of Gilgit; none of these were of any great height, the highest being only a little over 19,000 feet. The natural difficulties of the country were at first much enhanced by bad weather, which came on with the heavy rains in the Southern and outer Himalayan Ranges. Notwithstanding these circumstances the out-turn of work has been good, and the general progress very satisfactory, the total area of the triangulation being about 10,500 square miles, and of topography 10,400 square miles, on the scale of four miles to the inch.

16. The Topographical operations made good progress, though not so great as would have been the case had all the Assistants retained their health. Unfortunately two of them, on entering the higher ranges, broke down completely, and a third had to leave off work early in the season. The ground sketched was generally very elevated and barren, the Surveyors chief difficulties arising from the want of provisions and firewood, and sometimes even of fresh water. The plane table sketches required for the Map of Little Tibet have been completed, and lodged in the Head-Quarters Office at Dehra. A glacier, about twenty miles in length, was discovered by Mr. Ryall at the head of the Nubra Valley. Some large glaciers were also found in the neighbourhood of the Nanga Parbat.

17. I fully concur in the testimony which is borne by Captain Montgomerie, to the great zeal with which these arduous Survey operations have been carried on by all the Assistants under his orders. The good fortune of success has hitherto attended all undertakings executed under the superintendance of this Officer.

18. There is much reason to expect that, if the snows are not unusually heavy, and if most of the Surveyors keep in good health, the remainder of the country to be surveyed in and around Kashmir and Ladak, will be completed during the next field season. Captain Montgomerie has made every effort to persuade the Maharajah of Kashmir to allow one of our Surveyors to go to Gilgit, and has obtained a half promise to this effect. Possibly the fear of being called to account, should any harm happen to a European in his territories, causes the Maharajah to hesitate to sanction an undertaking which might be somewhat perilous. He informed Captain Montgomerie that, during the late winter, his troops in Gilgit had been sleeping; no exacter information could be elicited than what is suggested by this metaphor. If, as Captain Montgomerie thinks likely, the sleep was that which knows no waking, the Sikh garrison of the Maharajah must have been massacred by the hill tribes, in which case there is little hope of our Surveyors being soon able to penetrate into Gilgit.

Changchenmo Valleys; it also includes the greater part of the Pangkong District, and Astor, or Hirsora. Lieutenant Carter, who joined the party in May, assisted Captain Montgomerie in taking latitude observations, &c., &c., and practised with the Theodolite, and made himself generally acquainted with the work of the G. T. Survey, both in the field and office. Mr. Johnson assisted in the computations during the recess, and in the Field Season took upon a secondary triangulation to the East of Leh, the capital of Ladak. He pushed on this work with energy, and his efforts were, as usual, rewarded with success. The great heights and impracticable nature of the mountains between the Indus and Changchenmo, made that part of the work very difficult, and great credit is due to Mr. Johnson for carrying his triangulation over it. Many peaks were fixed at considerable distances beyond the frontier, and, altogether, Mr. Johnson's progress was very satisfactory, and his out-turn of work first-rate.

"Mr. Beverley assisted in the computations, and in projecting the Chart during the recess. In the field season he took up the Astor triangulation, and carried a secondary series down that valley, fixed a great many points in it, besides several peaks Trans-Indus, both North and South of Gilgit. The ridges between the Dooan plains and Astor are peculiarly rugged, and that portion is more especially troubled with clouds. Nevertheless, Mr. Beverley made good progress, and completed a very satisfactory season's work.

"Mr. Clarke assisted Mr. Johnson for some time, and subsequently worked independently in the Pangkong and Changchenmo Districts, visiting several very high stations, and fixing a great many points. He also made a very fair plane table sketch to the West of the Tsomuglari (or Pangkong) Lake. Altogether, Mr. Clarke made very good progress, and is now quite capable of turning out satisfactory independent work in high ground.

"Mr. Neville assisted Captain Montgomerie in computations, or servatory work, and current duties of the Series. He deserves credit for the good business habits which he applied to the large amount of office work which there necessarily is in such a large party, with so many detached Surveyors working at great distances apart.

"In the Topographical Branch, Captain Austen was employed in Rukshu and Zanskar. The ground, though generally not so difficult as what he sketched during the season of 1861, was very elevated and barren. The want of inhabitants in the South-Eastern portion was in itself a serious obstacle. Nevertheless, in such difficult ground, he was able to delineate on the quarter inch scale no less than 2,700 square miles, including the whole of Southern Laskar. Altogether, Captain Austen deserves great credit for the very excellent season's work which he has turned out, in his usual characteristic and effective style.

"Captain Melville continued during the recess to devote a great deal of his attention to photography, and produced a valuable negative of the quarter inch Map of the Jummoo territories on the same scale as the original. The value of this will be more appreciated as there is small chance of getting engraved copies from London until at least two or three years more have elapsed. Captain Melville marched into Ladak to take up his field work, but, unfortunately, was taken ill on the road, and forced to return. He recovered his health, in a great measure, before the field season was over, but the medical officer at Srinagar did not think it advisable that he should take the field again, and he was, consequently, employed on office work, photography, &c., &c., during the remainder of the season.

"Lieutenant De Brett was employed on office work during the recess. In the field he practised with his plane table, and made such progress that he was to have taken up independent work, had not his health unfortunately failed him. The medical officer thought that he would not be able to stand the exposure, and his health not being reestablished, he resigned his appointment on the 31st October.

"Mr. Ryall was employed in sketching the very difficult ground about the Nubra and Shayok Valleys. He completed the whole of the Nubra Valley, including the large glaciers at its head, and also a portion of the head of the Shayok Valley. His health, which had not been good before taking the field, did not allow of his completing the Shayok Valley. Nevertheless, he was able to finish 1,850 square miles, which, considering the state of his health, was very good progress.

ASTERN FRONTIER SERIES.

Executive Officer.
C. LANE, Esq.,
Chief Civil Assistant.

Assistants.
V. C. ROSSENRODE, Esq.,
Civil Assistant.

Mr. H. BEVERLEY,
Senior Sub-Assistant.

Mr. R. F. SHUTTER,
2nd Class.

19. The Eastern Frontier Party, under the charge of Mr. C. Lane, Chief Civil Assistant, has been employed, throughout the Field Season, in Independent Tipperah. At the end of the preceding season this triangulation had reached a point to the South of Cherra Poonjee, on the confines of Tipperah, where the British Boundary retrogrades Westward to a considerable distance, so that the triangulation would have had to make an extensive circuit, in its onward progress to Chittagong, had the operations been required to be kept within the British Boundary. Fortunately, Mr. Buckland, the Commissioner of Chittagong, had sufficient influence with the Maharajah of Tipperah to induce him to consent to our operations being carried across his territory, on the direct line to Chittagong.

20. Mr. Lane proceeded, in the first instance, to Agartolla, the chief town of Tipperah, where the Maharajah resides; and there he succeeded in securing the friendship and good-will of the Prince and his Court to an extent to justify the expectation, which was subsequently realized, of obtaining their cordial assistance and co-operation. Mr. Lane deserves much credit for the tact he has displayed in cultivating amicable relations with the barbarous races that inhabit the hill country of Tipperah, who have long been a terror to the industrious population of the plains within the British Frontier. Mr. Lane has sent a valuable report on the portion of Independent Tipperah traversed by himself and Assistants during the past Field Season, from which extracts will be given in an appendix to this Report.*

"Mr. Todd was employed on the East of Rukshu, in the Upper Indus Valley, and Humle District. He was at first hindered by the clouds, and, to some extent, by attending to Mr. Wood. Nevertheless he succeeded in sketching 1,950 square miles of very elevated country. His sketch gives a capital idea of this desolate tract, and the delineation generally is very characteristic. Total progress very satisfactory.

"Mr. Low made a capital sketch of the whole of the Astor Valley, with the exception of a small portion done by him during the previous season. He also sketched a large portion of the Indus Valley, West of Skardo. With the assistance of the Thanadar of Astor, he succeeded in ascending the Nildar Peak, across the Indus River, and probably within twenty miles of Gilgit, for which enterprise he deserves credit. His progress was highly satisfactory, covering in all about 2,900 square miles of country, including the glaciers of the Nanga Parbat. His plane table shows great improvement in the shading.

"Mr. Wood joined during the field season, and was trained to the use of the plane table. He made rapid progress, and would, no doubt, have turned out some work, had not his health failed him soon after he got into Ladak. He did not recover in time to resume field work. He has shown himself to be a good computer, and Captain Montgomerie feels sure, from the rapidity with which Mr. Wood made himself acquainted with the use of the plane table, that he will turn out a fair amount of work during the next field season, if his health continues good as it is now.

"Mr. Braithwaite joined later than Mr. Wood. He was trained to the use of the plane table, and accompanied Mr. Ryall into the field, but did not succeed in turning out any independent work. His experience should, however, enable him to do so during the next field season.

"Captain Montgomerie carried on all the usual business, in direct communication with the Maharajah and his higher officials, from whom he received every assistance."

* The duty of selecting stations for the Triangulation devolved on Mr. Rossenrode, than whom the party could not have had a better pioneer. The following simple narrative of his operations is extracted from his letters:—"When the Kookies were apprized of my arrival at Herra, they naturally concluded that I had come to apprehend and punish them for the robberies and murders they had perpetrated on our frontier. They hid themselves in the jungles, and left their villages. With much persuasion the Rajah's people brought them to my camp. They watched all my proceedings, and asked me no end of questions. I always keep a man near me to interpret, and I answer every question they put me; all seem satisfied with my answers, and the confidence I place in them. Of course my movements are slow, because my work has the greatest difficulties to contend with; the inhabitants must be conciliated, the site to be fixed upon must be traced and found, and cleared of jungle. To fix on sites at all in this dense and almost uninhabited forest, in which the sun can seldom be seen, is a feat any man may be proud of, especially when the inhabitants try to mislead. I hope to get on faster, when I divest the minds of these savages of all suspicion. I am all day long climbing or descending hills, or wading through water. Wild elephants and buffaloes are numerous, and may be come upon suddenly, when wading through the watercourses. Whenever you see a bamboo signal, avoid the direction it points to, because an unerring arrow is placed there, with a bow strongly enough to give an elephant his death blow. The Kookies think of nothing but eating and drinking. Feeding them occasionally is a good plan, and they would become very much attached to you, and follow you like dogs, and, no doubt, prove faithful, and work well, if well fed. Last year I had to deal with the Nagas and Kookies of Cachar, as well as those on the Manipoor frontier. They are the same filthy, naked savages as their brethren in Independent Tipperah. They frequently enquired whether I knew of Captain Guthrie, who made the road from Cachar to Manipur, over the hills, and they said so was the best sahib they had ever met with, and gave them buffaloes, cows, pigs, and goats to eat daily, and grog to drink, so that, even now, they think of his feast.

"I must notice one peculiarity among the Kookies. They all assemble from adjoining villages of the same tribe, and perform the work allotted to them, and share the hire. If you want twenty men from a village, and there are sixty carry loads, they will divide the twenty loads into sixty, and each man will carry something. One man will never act as a guide, or do any work singly; he must have a companion, and both must be paid. I have tried to break through this habit, but have been told that, if all are not allowed to work, they will not come at all. One might suppose that sixty men would finish the work sooner than twenty, but this is not the case; they eat three times a day, will not away two hours, cooking and eating, and then return and work till an hour before sunset. During the working hours, some are smoking, some mulling drinking mugs from the bamboo, and others amusing themselves; buff are thus occupied, while sticks, or otherwise amuse themselves. The Rajah's agents have no control over them, and they do not always obey their own Sirdars.

"A Kossyah coolie is really worth four Kookies. When a Kossyah carries a light load, or is lazy, he is called a Kookie by his companions, which annoys him so that he will carry the heaviest load, or tuck up his sleeves, and work in a right good earnest. I attribute the Kookie's want of energy and inability to carry loads to the excessive use of spirits, which are distilled in every hut, and partaken freely by every member of the family. There are many Chiefs among the Kookies in the Tipperah Raj. These are all called Rajahs; they have their Wuzzeers, Nazirs, and Sirdars, and a number of servants of both sexes. The Kookies have no written language. The Rajahs never pay visits, and to the Maharajah, and their Wuzzeers and Nazirs are sent to the Court only on very important occasions."

Mr. Lane reports that—"Mr. Senior Sub-Assistant H. Beverley was employed at first, for about a week, on the Approximate Series, under Mr. Rossenrode; next, in clearing and making passable roads for the large Theodolite, till the 9th April, from which date again on the Approximate Series till the 4th June, and on the 17th idem he reached Chittagong."

Mr. Sub-Assistant R. F. Shutter accompanied Mr. Lane to Agartolla, and assisted in the observatory, in desultory secondary observations, and in all current office work to the end.

21. The East Calcutta Longitudinal Series Party was formed on the 1st September, 1862, and placed under the charge of Lieutenant Thuillier. The object of this Series is to become the basis for the surveys of the Districts of Nuddeah, Jessore, and on, *viâ* Dacca, to the Eastern Frontier, along a parallel of latitude slightly North of Calcutta. The publication of the sheets of the Indian Atlas, which embrace these districts, has long been delayed for want of this triangulation.

22. The party proceeded from Dehra Doon, by steamer and railway, to Calcutta, where they took the field in November, on the termination of the rainy season. Operations were commenced at Chinsura, on a side of the Calcutta Meridional Series. Much assistance was derived from a carefully executed Map, prepared in the Surveyor-General's Office, by which Lieutenant Thuillier was enabled to lay out his lines so as to pass through a minimum amount of property. In working through forests and jungle, it is usual, in the first instance, to cut a narrow glade, in a perfectly straight line, through all intermediate obstacles, in the direction of the required station; when this trial line has been carried over a distance of eight to ten miles, the ground beyond is carefully reconnoitered for a suitable site, to which a line is cut from a convenient point in the trial line; thus two sides and the included angle of a triangle are given, with which data it is easy to ascertain the direct line between the two stations, which is then cleared to obtain mutual visibility. Owing, however, to the valuable nature of the property through which the triangles were carried, it was necessary to run a traverse along each line, with numerous intermediate bends, to avoid houses and orchards. In clearing the final line, great caution was requisite to prevent any tree from being cut down needlessly, a matter of some importance in Bengal, where every tree is more or less valuable, and has to be paid for. These circumstances greatly increased the labor of the preliminary operations, and protracted them over a longer period than is usual.

23. Further delay was caused in building the principal stations. These are usually, towers, with a central pillar, four feet in diameter, of burnt brick and lime masonry, surrounded by a platform of unburnt bricks and mud, fourteen to sixteen feet square, the whole raised to a height of twenty to forty feet, according to the nature of the obstacles to be overlooked. This structure has been adopted on account of its cheapness, and the rapidity with which it can be constructed; it has hitherto been found to be well adapted for our requirements. But it appears to be inapplicable for the rainy and moist climate of Eastern Bengal, where unburnt bricks rarely have an opportunity of drying sufficiently to be safely used, in raising a structure of such necessarily large dimensions. At one of Lieutenant Thuillier's stations, in consequence of the employment of damp materials in the unburnt brick work, and constant and heavy falls of rain during the construction, the building gave way, under the weight of the instruments and observatory tent. Fortunately, the large Theodolite was packed in its case, and received no injury, but the season was too far advanced for the tower to be rebuilt before the setting in of the monsoon, and as the mishap occurred in the first polygon of the principal triangulation, and there were no more towers ready in advance, the out-turn of work, as measured by the area triangulated, is unusually small, though much valuable experience has been gained, and there is every reason to hope that there will be a full out-turn of work next season. The design of the tower stations will have to be altered to suit the climate of Eastern Bengal; in lieu of the present solid mass of earthwork, it will be necessary to build a masonry wall around the central pillar, to support the observer's platform.

Mr. J. W. Armstrong selected eight stations, extending over a distance of thirty-six miles, tracing the diagonal rays of the Series. He reports that, in consequence of the heavy rain during April, he was much delayed in carrying on the ray traces, and met with great difficulty in driving the perambulator over the low ploughed fields and jheels, which had been filled by the continued rain.

Mr. C. J. Carty, an Assistant, who had done excellent work in other parts of India, made very unsatisfactory progress last season; as this was, in a great measure, owing to ill-health and hypochondriasis, and as Mr. Carty has, subsequently, resigned his appointment in the Survey, further comment on his work is unnecessary.

Mr. H. W. C. Williams has shown himself to be unfitted for the field duties of a Surveyor; an application has been made to Government for his transfer from the field operations of the Survey to the Head-Quarters Computing Office, for the sedentary duties of which he is better qualified.

Mr. G. A. Harris assisted in the selection of stations, and subsequently acted as Observatory Recorder. Lieutenant Thuillier reports that he gave entire satisfaction in all he did.

EAST CALCUTTA LONGI-
TUDINAL SERIES.

Lieut. THUILLIER, R.E.
1st Assistant G. T. Sur.
In Charge.

Assistants.
J. W. ARMSTRONG, Esq.
Civil Assistant.

C. J. CARTY, Esq.
Civil 2nd Assistant.

Sub-Assistants.
Mr. H. WILLIAMS,
2nd Class.

Mr. G. HARRIS,
3rd Class.

RAHOON MERIDIONAL SERIES.

Executive Officer.
H. KEELAN, Esq.,
1st Assistant.
Sub-Assistants.
Mr. H. E. KEELAN,
1st Class.
Mr. H. PEYCHERS,
3rd Class.

24. The Rahoan Meridional Series, under the superintendence of Mr. H. Keelan,* First Assistant G. T. Survey, was brought to a termination during the last Field Season, by being extended Southwards until it joined the Great Longitudinal Series of Triangles, connecting Calcutta and Karachi. The meridional distance triangulated is sixty-nine miles, by thirteen principal triangles, arranged in polygons, for mutual verification, and covering an area of 1,603 square miles.

25. This Series has taken six years to accomplish. It was commenced by Mr. Logan, late First Assistant G. T. Survey, but has been chiefly executed by Mr. Keelan. It is double throughout, the triangles being arranged in successive quadrilaterals and polygons of remarkable symmetry. Its meridional length is 457 miles; the principal and secondary triangles cover an area of 23,620 square miles. The computations and maps connected therewith will be completed by the 1st October, when the party will be transferred to the districts on the meridian of 84° , between Sumbulpoor and the East Coast. The total cost of the operations, up to 1st October, will be about Rupees 2,01,609, which gives a rate of Rupees 8-8-6, or about 17 shillings per square mile.

GURHAGURH SERIES.

Executive Officer.
G. SHELVERTON, Esq.,
Civil Assistant.

26. The field operations of the Gurhagurh Series, on the meridian of Umritsur, were brought to a termination at the end of season 1861-62, when it formed a junction with the series of triangles on the same meridian which had been brought up by Captain Rivers as far as Ajmerc, from the Great Longitudinal Series. By the 1st October, 1862, the recess computations and charts were completed, and the party was available for transfer elsewhere. This Series has taken five years to complete; the greater portion has been executed by Mr. George Shelverton. Its meridional length is 557 miles; the area covered by the principal and secondary triangles, 19,096 square miles; the cost, Rupees 1,08,212, which gives a rate of Rupees 5-10-8, or about 11 shillings per square mile.

SUTLEJ SERIES.

Executive Officer.
G. SHELVERTON, Esq.,
Civil Assistant.
Sub-Assistants.
Mr. G. RYALL,
Senior Sub-Assistant.
Mr. M. C. HICKIE,
1st Class.
Mr. F. BELL,
1st Class.

27. The Sutlej Series follows the left bank of the Sutlej from its junction with the Indus, near Mithunkote, to a side of the Gurhagurh Series, near Ferozepoor. It was commenced towards the close of Field Season 1860-61, by Lieutenant Herschel, and was completed last season by Mr. Shelverton.† It is single throughout. The recess computations will be completed by 1st October, when the party will be transferred to the meridian of 80° , to execute the required triangulation between Jubbulpoor and Madras. During the past Field Season the triangulation extended over a distance of 112 miles, covering an area of 1,366 square miles. A very creditable amount of secondary triangulation was also executed. The total cost of the Series, up to 1st October, the date of its completion, will be about Rupees 80,743; the total area covered by the triangulation is 8,142 square miles, thus giving a rate of Rupees 9-14-8, or nearly 20 shillings per mile.

* Mr. Keelan reports that—"Mr. Sub-Assistant H. E. T. Keelan was detached with a party to continue the Boondi Minor Triangulation Southward to lay down the position of the Palace and Town of Kotah.

† Mr. Sub-Assistant G. W. E. Atkinson was detached at the same time with a second party to carry on a Minor Triangulation on the Eastward to lay down the foot of Nuhargah and the Town of Chapra, with instructions to measure all three angles of the triangles, and in no case (unless under peculiarly difficult circumstances) to have angles greater than 90° , or less than 30° . The object with which this triangulation was undertaken has been attained, but, I regret to say, several of the angles are to be found below 10° .

"Messrs. H. E. T. Keelan, G. W. E. Atkinson, and H. Peychers have, throughout the season, been most zealous in the performance of their duties."

† Mr. Shelverton reports that—"Mr. George J. Ryall was directed to clear rays, make all preliminary arrangements for the building of towers at the principal stations, and to triangulate on the Northern and Southern flanks of the Main Series, with the object of fixing the positions of several towns of importance on both banks of the River Sutlej. Mr. Ryall cleared 300 miles of rays, chiefly through thick low jungle, collected materials for the building of ten towers, constructed fifty pucca platforms on his own triangulation, observed angles at fifty secondary stations, and fixed sixty-five points of intersection,—twenty-three of these are first and second class towns. Mr. Ryall's progress was highly satisfactory; his triangles which were most judiciously selected, covered a large extent of country.

"Mr. M. C. Hickie was retained by me as Observatory Assistant, in which capacity he was of great service. Near the close of the Field Season he was detached on Minor Triangulation, when he observed angles at thirteen secondary stations; his triangles embrace an area of 400 square miles.

"Mr. F. Bell was detached to continue the Minor Triangulation begun by Mr. J. W. Armstrong during the previous Field Season. He was directed to conduct this work along the banks of the River Chenab, till he verified it by connection with the Jogi Tila Meridional Series. His progress, at first, was not rapid, and as he was delayed a good deal subsequently by bad weather, he was compelled to remain longer in the field than the rest of the party. I am glad, however to report that he carried out all that was assigned to him. His triangulation, which is 140 miles in length, embracing an area of about 1,200 square miles, closes on the side Chiniout H. S. to Hoojan T. S. of the Jogi Tila Series, and consists of forty-three stations of observation, from which the positions of all places of importance on the banks of the Chenab River have been determined."

28. The Bombay Party, under the superintendence of Captain Haig, Royal (Bombay) Engineers, having completed the triangulation in Northern Bombay, was deputed to execute a series of triangles to the South of the parallel of Bombay, on the meridian of Mangalore. While the preliminary operations and selection of stations were proceeding, Captain Haig marched to the origin of the Bombay Longitudinal Series, with a view to making this Series double throughout, by adding flank stations, so as to form polygons in parts where there were only single triangles. On reaching the ground, it was found that the ends of the Beder Base Line were, fortunately, in good preservation. Three of the advanced stations had, however, been completely destroyed. Captain Haig judiciously determined to triangulate the Series anew, as far West as the Mangalore meridian. The revision having been executed with a much superior instrument to that employed in the original triangulation, the value of this portion of the Bombay Longitudinal Series is very greatly enhanced.

29. Having completed this revision, Captain Haig was proceeding with the principal triangulation on the meridian of Mangalore, when an untoward accident brought his operations to an abrupt termination. The large Theodolite was set up for observation on the tower station of Palwan, when, without any previous warning, the tower gave way on one side, causing the fall of the instrument and observatory tent, whereby the instrument was so seriously injured that it is incapable of being again used, until it has been repaired by the makers in England. Fortunately, the horizontal circle, the most valuable portion, appears to have escaped injury, but the vertical circle was destroyed, and the injuries are such that the instrument cannot be repaired in this country. Captain Haig convened a Court of Enquiry to report on the circumstances; the proceedings of the Court have already been submitted to Government. The Court came to the opinion, in which I entirely concur, that the fall of the tower was occasioned by the sudden and unexpected sinking of the ground below, and that no blame is attributable to Captain Haig, or any other person, for the mishap.

30. Captain Haig had already turned out a very excellent season's work, comprising thirty-two principal triangles, covering an area of 6,625 square miles, and extending over a length of 260 miles, whereof 66 appertain to the Mangalore meridian, and 194 to the parallel of Bombay.

31. The Spirit-Leveling Operations were carried on by Mr. Donnelly, Civil Second Assistant, under the superintendence of Lieutenant Thuillier. The party accompanied me to Calcutta, to receive the necessary instructions regarding the programme of the season's operations, which could not be decided on until I had obtained reliable information regarding the Railway levels between Calcutta and Agra. I had hoped to be able to incorporate these into our work, so as to avoid the labor and expense of carrying a line of levels all that distance. During the previous Field Season, a connection had been made, at Agra, with the Railway levels brought up from Calcutta, and the Trigonometrical Survey levels, brought up from the mean sea at Karachi. The two sets of results differed by about twenty-four feet, and it was hoped that all difference would disappear, on connecting the Railway datum, the site of Howrah Dock, with the mean sea level of the Bay of Bengal.

BOMBAY PARTY

Executive Officer.
 Captain C. T. HAIG,
 1st Assistant.
Assistants.
 J. DA COSTA, Esq.
 Civil 2nd Assistant.
 J. M'GILL, Esq.
 Civil 2nd Assistant.
Sub-Assistant.
 Mr. G. A. ANSBY,
 2nd Class.
 Mr. DONOHUE,
 3rd Class.

SPIRIT-LEVELING PARTY

Executive Officer.
 Lieut. H. R. THUILLIER
 R.E., 1st Assistant.
Assistants.
 A. W. DONNELLY, Esq.
 Civil 2nd Assistant.
 RAMCHAND,
 Native Leveler.

The work allotted to Mr. Civil Second Assistant Da Costa was to carry out the final work of the secondary Guzerat Const. Series from Surat to Cambay, the Stations of which he had selected during the previous Field Season. The Series comprises twenty-eight first-class triangles, it determines the geographical positions of Surat, Baroche, and Cambay, and ten minor towns and ports; it crosses the large Rivers Tapti, Nerbuddah and Mbye, also two small ones, the Keem and the Dandur, and embraces about 1,200 square miles of country triangulated. Mr. Da Costa's out-turn of work is most creditable.

Mr. Civil Second Assistant M'Gill was appointed to select some fresh stations on the Bombay Longitudinal Series and then to proceed to Dharwar, and select stations for a short Longitudinal Series, connecting the termination of the South Konkan Series with the Mangalore Meridional Series. On the completion of this work he went to Belgaum, and laid out a Series to Goa. After this, Mr. M'Gill continued the selection of the stations of the Mangalore Series on the meridian of 75°, South of Dharwar, which he advanced to within thirty miles of Mangalore. On this work Mr. M'Gill next met with many difficulties, the surface of the country being covered with dense teak jungle, and the tops of all the hills with high trees; a malignant epidemic fever was also then prevalent, from which nearly the whole party suffered more or less. Mr. M'Gill's progress, under these circumstances, was most satisfactory.

Mr. Ansdg had charge of the building parties on the Mangalore Meridional Series, and was also employed in observing secondary triangles.

Mr. Donohue throughout the season was employed in the observatory and in the office, on current work.

tions had reached the vicinity of Bhagulpore, when Mr. Donnelly was compelled, by severe illness, to close work.

MEAN LEVELS OF THE RIVER'S MOUTH AT KEJIRI, AT NEAP TIDES, FOR THE YEARS 1850 AND 1851, EXCLUDING THE SOUTH-WEST MONSOON.

MONTHS.	Highest Low Water.		Lowest High Water.		MEAN.	
	Feet.	Inches.	Feet.	Inches.	Feet.	Inches.
1850.						
January,	5 4	0 0	11 11	9 9	8 7	4½ 10½
February,	5 4	6 9	11 11	0 6	8 8	3 1½
March,	6 4	0 9	11 12	0 0	8 8	0 4½
April,	6 4	9 9	11 12	0 6	8 8	10½ 7½
May,	6 5	9 3	12 13	0 0	9 9	4½ 1½
June,	6 6	6 0	13 14	3 9	9 10	10½ 4½
November,	7 4	0 9	12 13	3 0	9 8	7½ 10½
December,	5 4	9 6	11 12	9 3	8 9	9 4½
1851.						
January,	4 4	6 3	11 11	9 0	8 7	1½ 7½
February,	4 5	3 0	11 10	3 3	7 7	9 7½
March,	4 6	9 3	11 11	0 9	7 9	10½ 0
April,	5 7	3 0	12 10	9 6	9 8	0 9
May,	5 7	6 0	12 12	9 6	9 9	1½ 9
June,	6 6	0 9	14 13	6 3	10 10	3 0

" Mean Height of Sea Level above the Datum Line at Kejiri, feet. inches.
 " Datum Line at Kejiri above that of Kydd's Gunge, 8 9.75
 " Sea Level above the Datum Line of Kydd's Gunge, 9 0.63

" Which reduced to decimals of a foot becomes, 9.053

" Which differs from my determination by half a foot; but, if the tides at Kejiri for February and March be alone taken into account, at which period the inland waters flowing seaward are lowest, the result would agree with that derived from my discussion of the tides at Calcutta to about one inch."

His tenant Thullier rendered very valuable assistance in reducing the field work of the Leveling Operations, and preparing the Tables of Heights for publication.

Mr. Donnelly reports that he was much delayed by the discrepancies which were found between his levels and those of the Railway. They entailed the re-measurement of two sections, one fifteen, the other twenty-six, miles in length. In the first, the discrepancy was five feet; in the second, seventeen and a-half feet. Mr. Donnelly and his Assistant re-measured both these sections, and obtained results differing from their first results by only .032 of a foot in the first instance, and .043 in the second, clearly showing that the error did not lie in their work.

In the course of the Field Season, Mr. Donnelly laid down nine G. T. S. Bench Marks, fixed two G. T. S. Trigonometrical Stations, and connected one hundred and forty-one points, principally Railway Mile-stones, Bridges, Bench Marks, and Station Platforms.

COMPARISON OF RAILWAY AND G. T. SURVEY LEVELED HEIGHTS.

NAMES OF RAILWAY STATIONS AND BENCH MARKS.	G. T. SURVEY.		RAILWAY.	G. T. S. Railway.	REMARKS.
	Height above Mean Sea Level.	Height above Howrah Dock Sill.	Height above Howrah Dock Sill.		
Serampoor,	+ 20.919	+ 32.552	+ 32.230	+ 0.322	Level of Rails.
Pundooa,	+ 42.398	+ 54.031	+ 54.110	- 0.109	Do.
Mymaree,	+ 66.697	+ 78.330	+ 78.260	+ 5.070	Do.
Burdwan,	+ 100.325	+ 111.958	+ 107.260	+ 4.698	Do.
Kanoo Junction,	+ 121.533	+ 133.172	+ 128.250	+ 4.922	Do.
Gooskarrah,	+ 110.504	+ 122.137	+ 118.250	+ 3.887	Do.
Beddiah,	+ 132.270	+ 143.903	+ 140.250	+ 3.653	Do.
Bulpoor,	+ 159.635	+ 171.268	+ 167.250	+ 4.018	Do.
Almasdpoor,	+ 184.213	+ 145.816	+ 142.250	+ 3.566	Do.
Cynthea,	+ 168.330	+ 179.963	+ 176.250	+ 3.713	Do.
Mullarpoor,	+ 143.709	+ 155.342	+ 151.230	+ 4.112	N. W. Plinth of Station-house.
Rampoor Haut, B. M.,	+ 116.810	+ 128.443	+ 124.960	+ 3.483	Square Pillar in centr. of Line, opposite Booking-office.
Pakowr,	+ 104.392	+ 116.025	+ 112.250	+ 3.775	Level of Rails.
Teenpahar,	+ 108.779	+ 115.412	+ 129.260	- 18.838	Do.
Tillighursee, B. M.,	+ 110.800	+ 122.533	+ 135.340	- 12.807	Square Pillar on Line to E., marked +.
Do.	+ 96.638	+ 108.271	+ 121.090	- 12.819	Heel Stone of Gateway, W. Gate of Fort, N. side, original B. M.

34. During the year under review, I was called upon to collect all the available data of levels, existing in the Public Works, Railway, and Survey Offices, all over India, in order to reduce them to a common datum. As a first step towards this desirable measure, I have published a volume of Tables of Levels, based on the Spirit-Leveling Operations of this Survey, and reduced to the mean sea level of Karachi Harbour, as their datum. Additional volumes will be published as soon as possible. They will enable Officers of the Public Works and Railway Departments to reduce their levels to the mean sea, by connecting them with the nearest Bench Mark, or Station, of the Trigonometrical Survey. In most instances, however, the business of connecting will probably devolve on the Survey Department. At present, we have only one Leveling Party, which is employed in Bengal; I therefore submitted a project for the formation of other parties, to carry on operations, simultaneously, in the Madras and Bombay Presidencies, as the only means of speedily accomplishing an operation, of which the practical value will be greatly enhanced by early completion. Unfortunately, financial reasons have interfered to prevent this proposal from being sanctioned.

ASTRONOMICAL PARTY.

J. NICOLSON, Esq.,
Asst. Surveyor-General.

H. TAYLOR, Esq.,
2nd Assistant G. T. S.

Mr. A. DE SOUZA,
1st Class Sub-Assistant.

35. I now proceed to report on the Astronomical Observations for the determination of the Latitude and Longitude of the Andaman Islands, which were instituted on a representation by the Superintendent of Port Blair, that the erroneous positions assigned to some of these Islands, in the published Charts, endangered the safety of ships sailing between Calcutta and Singapore. Under the orders of Government, in the Home Department, the Surveyor General had deputed a Surveyor, Mr. Nicolson, to conduct the necessary observations, the superintendence of which was subsequently transferred to the Trigonometrical branch of the Survey.

36. Mr. Nicolson started from Calcutta early in December, 1861, to reconnoitre the Coco and Andaman Islands. He found that, in order to take a complete Series of Astronomical Observations at the Great Coco, it would be necessary to have a steamer placed at his disposal for some weeks, to keep up his communication with Port Blair, and bring the necessary supplies for his party.

37. About this time, a communication was received from the Bombay Government, representing that there was as much doubt about the accuracy of the position of Port Blair, as of that of the Coco Islands. Under these circumstances, it seemed advisable that Mr. Nicolson should begin operations by fixing Port Blair, in order that the proposed operations might be commenced at the place where the greatest facilities for their execution existed.

Bombay Government Letter, No. 25, dated 11th January, 1862, to the Secretary to Government of Bengal.

38. The inaccuracy of the present Charts of the islands lying between Sumatra and Burma being admitted on all sides, it appeared necessary, in the absence of any regular survey of those islands, to fix, by astronomical observations, the positions of Acheen Head, Port Blair, the Great Coco, or the Preparis Island, and an island in each of the other groups, intermediate between Acheen Head and Cape Negrais. It is believed that the relative positions of the mutually visible islands of each group are already correctly shown on the Charts; consequently, by determining the absolute position of a point in each group, it would be possible to rectify the existing Charts, without making a general re-survey.

39. Mr. Nicolson, having completed his reconnoissance, returned to Calcutta in February, 1862, by which time one of the large 3-foot astronomical circles of the Trigonometrical Survey had been got ready, and a portable observatory, with rotating dome, constructed for the observations. There was no good astronomical telescope available in the stores of the Mathematical Instrument Department; consequently, Mr. Nicolson was directed to take all his observations, whether of occultations, eclipses, or moon culminations, with the telescope of the astronomical circle, which he could point to any part of the sky, through the aperture in the rotating dome of the observatory. Owing, however, to the small number of occultations and culminations which occur monthly, and the risk of losing some of them in cloudy weather, Mr. Nicolson was directed to base his observations for Longitude chiefly on the measurement of lunar zenith distances, for which the astronomical circle is well adapted. He was supplied with an astronomical clock, and all other necessary instruments, from the Calcutta Observatory.

40. In May, 1862, Mr. Nicolson had set up his observatory at Port Blair, and was ready to commence observations. Unfortunately, the season of fine

weather had then nearly terminated; the Monsoon set in with unusual severity, nights favorable for observing were few and far between, and, consequently, several months elapsed before the whole of the necessary observations for Latitude and Longitude were completed. The work was further impeded by the delays attendant on postal communication between Calcutta and Port Blair, making it very difficult for me to exercise that degree of supervision over the operations, which their delicate and difficult nature required.

41. By the end of 1862, Mr. Nicolson reported that he had taken a sufficient number of observations to fix the position of Port Blair; he, therefore, applied for a vessel to be placed at his disposal to enable him to proceed to fix the positions of the Great Coco, and other islands. Owing to postal and other delays, it was not until the end of February, 1863, on my return from Vizagapatam, that I learnt from the Marine Department that no vessel was available, nor could one be got ready before the fine weather season would have terminated.

Memo. of Secretary to Government of India, Marine Department, No. 189, dated 18th Feb., 1863.

42. From the same communication I also learnt that the Secretary of State for India had ordered a complete Maritime Survey of the Andaman Islands to be executed. Being then in Calcutta, I went to Captain Rennie, the Secretary to Government of India, Marine Department, and was informed that, under instructions from the Admiralty Hydrographer, it had been determined to find the differences of Longitude between the various groups of islands, chronometrically, by a battery of thirteen or fourteen chronometers.

43. The circumstances under which it was originally proposed to fix a series of positions by astronomical observations had thus entirely altered. The complete Maritime Survey, which has been ordered by the Right Hon. the Secretary of State for India, renders further astronomical observations unnecessary. The determinations of differences of Longitude, which are the only really difficult portion of the work, can be done chronometrically by the Marine Surveyors, with much greater rapidity and economy, and, probably, even with greater accuracy, than by the best astronomical observations for absolute Longitude.

44. Consequently, in March last I desired Mr. Nicolson to restrict his operations to taking as many more observations for the determination of the Longitude of Port Blair as could be obtained before the setting in of the Monsoon, and then to return to Calcutta. He reached the Presidency in June, and has ever since been employed in reducing his observations. They consist of 32 lunar culminations, 136 lunar zenith distances, 130 transits of clock stars, and 162 meridional zenith distances of stars for Latitude, observed up to the 12th March, when the astronomical clock met with an accident, and Mr. Nicolson was afterwards obliged to employ a chronometer. His subsequent observations are, consequently, not as valuable as the earlier ones; they consist of 9 culminations, 64 lunar zenith distances, and 36 clock stars. The whole of the Latitude observations have been reduced, and found exceedingly satisfactory. There has not yet been leisure to reduce more than a few of the observations for Longitude, but the results obtained hitherto are satisfactory. The final resulting Longitude will be communicated for publication in the *Calcutta Gazette* as soon as ascertained. It should serve as an excellent datum for the proposed Maritime Surveys, and save the expense of a series of voyages between Madras and Port Blair, which would otherwise have to be incurred to obtain a good chronometric determination of the Longitude of Port Blair.

Mr. Nicolson reports as follows:—

"In June I kept up every night, in the hope of obtaining observations, but although there was not much rain, clouds always hung over the island, nearly all night, and, consequently, very little could be done. In July, August, and September, very heavy weather prevailed, and squalls were frequent, and came on so suddenly that it became necessary to tie down the observatory with large ropes to posts buried in the ground; even with this precaution the roof was nearly carried off two or three times. In October, when the weather moderated, I opened the observatory, and made preparations to observe, but neither during that month, nor the following November and December, had we much clear sky, in consequence of which, very few observations were taken. In January, the weather was better, and some observations were made, both for Latitude and Longitude, but the passing clouds, as usual, caused a good deal of interruption to the progress of the work. In February, most of the observations for Latitude and Longitude were made, and I believe the results of these observations will be found the best. Again, in March, except for a few days, there were much rain and clouds, which put a stop to observations for a time. I was also obliged to go away for a fortnight, to Ross Island, for change of air, as I was suffering from fever. In April, the South-West Monsoon having set in, very few observations were made.

"Mr. Second Assistant Taylor joined on the 14th April, but, unfortunately, too late to take part in the observations. During the whole time he was on the island, not a single favorable night for observation occurred.

"Finding the South-West Monsoon had set in, and there was no further chance of fine weather, and Mr. Taylor being satisfied with the observations taken by me, I took down the instruments, and quitted Port Blair, with my party, on the 8th of May.

"The climate of Cintham Island, where we were located, proved very detrimental to our health. I suffered much from repeated attacks of fever, and Mr. De Souza latterly became seriously ill. We are still suffering, more or less, from the effects of the climate, although since we left Port Blair, we have had the benefit of a sea voyage.

"Previous to leaving Port Blair, a masonry platform, four feet square and two and a-half high, was erected over the pillar on which the instrument stood. I could not procure assistance from the Superintendent to build a larger one. In the

45. THE OUT-TURN OF WORK EXECUTED BY EACH PARTY DURING THE FIELD OPERATIONS OF THE OFFICIAL YEAR 1862-63 IS SHOWN IN THE FOLLOWING ABSTRACT:—

STATISTICS.	Kashmir Series.	Coast Series.	Sutlej Series.	East Coelestia Longitudinal Series.	Railroad Meridional Series.	Eastern Frontier Series.	Bombay Party.	Total Out-turn of Work.
Principal Triangles,	19	29	1	13	16	32	113	
Average error of Principal Triangles in seconds,	0.94	0.43	0.11	0.46	0.43	0.89	0.65 average.	
Observed Azimuths,	1	1	1	2	1	1	5	
Secondary Triangles with all 3 Angles observed,	10	132	1	16	32	32	190	
Area of Principal Triangulation, square miles,	256	1366	220	1603	881	6625	10,954	
" Secondary Triangulation,	10,500	4816	1	950	263	1510	18,139	
" Topographically Surveyed, scale 4 inches = 1 inch, square miles,	10,400	1	1	1	1	1	10,400	
Intersected Points,	12	112	1	18	22	110	274	
Length of Principal Triangulation in miles,	112	69	20	69	49	260	490	
" Secondary do.,	310	72	100	72	100	100	512	
Miles of Rays cleared between Principal Stations,	300	253	159	159	159	159	712	
Towers built for Principal Stations,	11	5	5	5	5	2	23	
Platforms do.,	12	6	17	6	17	44	79	
Platforms built for Secondary Stations,	95	95	95	95	95	95	95	
Length of Triangulation laid out in advance in miles,	45	77	150	77	77	150	272	
Principal Stations selected in advance,	8	17	36	17	17	36	61	

COMPUTING OFFICE.

- Lieut. HERSCHEL,
Assistant G. T. Survey,
In Charge.
- Deputy.
Baboo BHOLANATH.
- Computers.
CHETUR MULL,
GUNGA PERSHAD.
- six Native Assistants
recently appointed.
- Sub-Assistants,
under training.
Mr. J. WOOD,
Mr. J. T. BURT,
Mr. J. TROTTER,
Mr. BELCHAM.

46. The Computing Office has been employed in a variety of preliminary operations, which are necessary to form the basis of a general reduction of the whole of the principal triangulation of this Survey, which will shortly become necessary, now that almost the whole of the triangulation of the tracts of country comprised in the great quadrilateral figure connecting Calcutta, Karachi, Attok, and Purnea, is completed. Though the triangulation has been executed with the very best instruments, and though the system of observation which was introduced into this Department by Colonel Everest, is more rigorous and accurate than that of any European Survey, it is evident that, in consequence of the vast length of each Series, and the imperfections which necessarily attend whatever is the work of human hands, each Series generates a certain amount of error, which becomes apparent as linear error on the termination of the Series on a measured base line, while on the close of a circuit formed by two Meridional Series, and the portions of the connecting Longitudinal Series at their extremities, it produces errors of Latitude, Longitude, and Azimuth. The dispersion of these errors in such a manner as to obtain the most probable results of the whole, giving its due weight to each fact of observation, and taking into consideration the bearing of every such fact on all the rest, is a matter of great intricacy and difficulty, on which it will be necessary for me to consult with the ablest mathematicians of the present day in Europe, before deciding on the system to be finally adopted. Meanwhile, the necessary preliminaries for the eventual calculations are being carefully elaborated by Lieutenant Herschel, to whom I am indebted for numerous very valuable suggestions, and for co-operation as cordial as it has been unintermittent.

47. While the practical operations of this Department may be confidently pronounced to be of a superior order to similar operations in any other part of the globe, it must, on the other hand, be admitted, that the theoretical applications, for the reduction of the triangulation, have not kept pace with recent improvements in geodetical science, which have been introduced into some European Surveys. The method which has hitherto been employed for reducing the observed angles, so as to satisfy all the equations of condition of each figure, though a great improvement on any previous method, has had, in its turn, to give way to the subsequently discovered method of minimum squares. The algebraical solution of the equations necessary to satisfy the condition that the sum of the squares of the errors shall be a minimum, is by no means difficult, but hitherto there has been no practical adaptation of it in this Survey, chiefly owing to the pressure of other and more urgent business, on those alone capable of dealing with the subject. Much progress has however been recently made in this direction, and I am indebted to Lieutenant

pillar below are buried three mark-stones, each with a circle and dot engraved on it; and also on the platform there is a large stone, in the centre of which is let in a copper plate, with a dot and circle engraved on it."

Mr. Taylor, late of the Greenwich Observatory, has rendered valuable assistance in the reduction of the observations, for which duty his mathematical talents and training render him well qualified.

Mr. De Souza did good service in recording the observations, and otherwise assisting Mr. Nicolson.

Herschel for devising methods of calculation, which will enable the reduction of our figures to be effected, according to the new and rigorous system, by Native Computers possessing little more than a knowledge of arithmetic, with even greater facility than the less refined methods of reduction, which have hitherto been employed.

48. The Drawing Office has been chiefly employed in compiling Maps of the dominions subject to the Maharajah of Kashmir, from the plane table sheets sent in by Captain Montgomerie. A new Chart of the Triangulation of this Survey, up to date, has also been prepared, and a Chart to illustrate the volume of Tables of Heights recently published; both these Charts were lithographed in the Office of the Surveyor General, Calcutta. Nine original preliminary Charts of the triangulation, in various parts of India, have been prepared, in duplicate, for the use of the Surveyor General's Office, and the Geographer to the Right Hon. the Secretary of State for India. The Photographic apparatus is also being usefully employed in copying and reducing Maps, and in furnishing preliminary copies for current use, until the originals are engraved and published. Owing, however, to the small establishments at my disposal, the photography is necessarily restricted to the short period of the recess of the Kashmir Party, three to four months, when the services of our best Photographer, Captain Melville, are available for their management.

49. In the Instrumental Department, great advantages may be expected by the appointment recently made by the Right Hon. the Secretary of State for India, of an Officer, Colonel Strange, to superintend the construction of the new Great Theodolite, and various astronomical instruments, which are being prepared in England for this Department. When they are received in India, we shall be in a position to undertake the necessary operations for ascertaining our Longitudes, in connection with the Observatory at Greenwich, by means of the Electric Telegraph, which is now brought across from the Mediterranean to India.

I have the honor to be,

Sir,

Your most Obedient Servant,

J. T. WALKER, *Major, R.E.*,

Superintendent Great Trigonometrical Survey.

DRAWING OFFICE

W. H. SCOTT, Esq.
Civil Assistant
G. T. SURVEY,
In Charge.

J. PEYTON, Esq.
Civil 2nd Assistant
G. T. SURVEY.

I am much indebted to Mr. W. Scott for the ability and assiduity with which he has turned out a large amount of work from his small office, and also for the excellent training which he gives to the probationary draftsmen.

Mr. Peyton has rendered excellent service in the Drawing Office, and has made a series of very characteristic sketches of Himalayan scenery, which I hope shortly to see published.

Mr. H. Duhan has been of much assistance in managing the Corresponding Office. On the departure of Mr. Hennessey to Europe, Mr. Duhan was entrusted with the charge of the Base Line Apparatus and Party, and his arrangements for bringing them from Calcutta to Dehra were entirely to my satisfaction.

Mr. R. Scott has been most useful and zealous in the discharge of his multifarious duties, in connection with the Corresponding Office, and as keeper of the instruments and stores.

EXTRACTS FROM A REPORT BY C. LANE, ESQ.,

Chief Civil Assistant, Great Trigonometrical Survey,

ON A PORTION OF INDEPENDENT TIPPERAH, TRIANGULATED DURING 1862-63.

(1.) Independent Tipperah was entered from the North side, in the vicinity of Koileshar, a large village with a Thana belonging to the Rajah, in Lat. $24^{\circ} 19'$, and Long. $92^{\circ} 3'$. The River Munnoo flows under the Haut, or Market-place, of Koileshar, and is here about thirty yards in width. From the South, or left, bank of this stream the territory begins. It consists of an immense block of earth hills, intersected by innumerable watercourses and a few streams, covered with the densest possible reed, or "makla" bamboo, jungle, from thirty to eighty feet high, with trees from eighty to one hundred and twenty feet high. Excepting in beds of streams, and on land contiguous to one or two jheels, there was not a single plot of ground up to twelve square feet met with that was free from jungle.

(2.) The principal Rivers crossed in the course of the operations within Lat. $23^{\circ} 50'$ to $24^{\circ} 26'$ and Long. $91^{\circ} 20'$ to $92^{\circ} 8'$ were the Munnoo, Deo-gang, Kwabee, or Kohee, and the Dolai-gang. The Munnoo flows from South to North, within the hills, and afterwards towards the West, falling into the Koosecara near Badarpur (a corruption of Bahadurpur), in Zillah Sylhet. The Deo-gang, which comes from the East, crossing the extensive range on which the Trigonometrical Stations of Harargaj and Komuntah are situated, falls at a point some three miles North of Komuntah, into the Munnoo River. The width of the Deo-gang was about forty yards, where it was crossed by means of a bridge constructed of bamboos, at about five miles direct distance North-West of Komuntah. The superficial velocity in the middle of February was 1.16 miles per hour. It must, however, be a powerful torrent during the rains. The word "Deo" signifies a giant, and "Deb," a Hindoo divinity; so, either way, Deo or Deb-gang would seem to imply a mighty stream, in the estimation of the Kookies. The Kwalie, or Kolie, which had a remarkably strong current, flows from South to North, and falls into the Borak, near Hubbeegurij, a large village in the District of Sylhet. And the Dolai flows from South to North, and falls into the Munnoo River at some three miles North-East of Laorago Hill Station, which is in Lat. $24^{\circ} 26' 30''$, and Long. $91^{\circ} 49' 14''$. It will be seen, from what has been said, that three out of the four principal rivers specified have their sources among these hills, whilst the Deo-gang comes from a country further East, of which nothing is known, save that at the present time it is inhabited by the Kochak Kookies, and other wild tribes.

(3.) Within the limits of the final operations of last field season there are four parallel ranges of hills. The first in order from the West is that on which Champamura, Bormura, and Saisum Trigonometrical Stations are situated; it is about thirty miles in length; the next, on which Atar Mura Station is situated, is about forty-three miles long; then comes the Langturai Range, about fifty-six miles in length, on which the Station of Batchia is situated; and, East of this again is a range, about forty-one miles long, on which our Stations of Harargaj and Komuntah are situated.* The three last named ranges stand on a plateau of two to four miles in breadth on either side, which again are the summits of hills distinctly elevated above the rest of the contiguous hills. The ranges run nearly North and South, excepting at their extremities, which curve towards the West.

* From Harargaj and Komuntah Hill Stations, and the East, are several high hills and great gorges.

(4.) Our principal Stations of Komuntah, Batchia and Atar Mura are elevated above the beds of the adjacent rivers about 871, 1,071 and 1,276 feet respectively, as determined approximately with a Mountain Barometer. Throughout this country the marching was for distances through water six to eighteen inches deep, across bogs, and over numerous ascents and descents, many of which were very steep and tough, and after the least fall of rain extremely slippery, and often not a little dangerous from deep chasms and abrupt precipices. Roads were made for the large Theodolite by cutting and removing the bamboo jungle to a width of

six to eight feet. They were constantly choked by bamboos and trees falling across from the dense jungle on either side. Travelling from one Station to another, from 8.3 to 18.5 miles direct distance, generally occupied three or four days. The water at the different stages was frequently extremely bad, sometimes of a reddish hue, at others of a milky color, or greenish and greasy.

(5.) It has been stated that the general mass of these hills is composed of earth. Occasionally clay slate and granite have been met with in the beds of some of the streams. On the march between our principal Stations—Champamura and Lambu Sara—a deep and narrow gorge, or chasm, with perpendicular sides of granite, from about one hundred and fifty to two hundred feet high, was passed through. Within this was a watercourse abounding with blocks of petrified wood* of various sizes up to four feet in length and ten inches thickness. These were most beautiful and perfect specimens of petrifications.

* Of the Awal tree, to petrify in these hills about five years. This is used in the Sylhet district for construction boats, as well as for huts.

(6.) The country of Independent Tipperah, as far as our final operations extended last season, was for the most part a perfect wilderness, particularly in the neighbourhood of our Stations of Komuntah, Batchia and Atar Mura. In fact, it is only very thinly inhabited for a few miles in the interior, along the Northern and Western frontiers, by Kookies, Tipperahs, and some Munneepoories. The country further East and South-East of Haragaj and Komuntah Stations is, as already mentioned, occupied by Kochak Kookies, and other wild and hostile tribes. These people, in former years, by their repeated depredations caused the desertion, and eventual abandonment, of a populous town, situated in the rich and fertile valley East of Haragaj Station.

(7.) The Kookies are divided into five tribes, viz.,—Umroi, Chutlang, Halam, Baipai and Kochak. The Baipais in former days were dependents and slaves of the Kochaks, who are the most formidable of these races. For many years past they have been separated, and, such is the hatred of the Kochaks for the Baipais, that the latter will never mention or dare to meet their former masters, but will fly on the least signs of their approach, and if ever taken by any chance they are sure to be butchered as ingrates. The Umrois and Chutlangs intermarry, and are on friendly terms with the Baipais. The Halams are the only tribe who dress, and that somewhat after the style of Bengalis. The Kookies of both sexes marry when they attain puberty, or about that time. On the marriage of an orphan Kookie girl the Rajah of the tribe receives Rupees 40 from the bridegroom, or Rupees 30 if the bridegroom is very poor. If a girl's parents be living, they receive Rupees 77 or 57, according to the ability of the bridegroom, while the Rajah receives only Rupees 13 as his right. If the bridegroom be unable to pay the money at once, he must do so by instalments. Should he, however, die before this is done, his descendants must, in course, liquidate the balance due to the Rajah.

(8.) The Kookies bury their dead. When a Rajah dies his household place the corpse on a platform of wood, not bamboo, elevated about four and a-half feet above the ground; a moderate fire is kept up underneath, in order to dry up all the humours. After the corpse has been kept in this wise for three months it is interred, in the usual horizontal position, in a grave seven or eight feet deep.

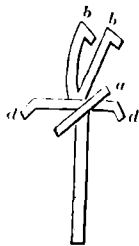
(9.) The Kookies worship a deity they call Lachee, and no other. The worship consists in fixing in the ground perpendicular strips of bamboo, about two feet long, in a rude circle, and one in the centre, with a crude and very coarse basket suspended from its head. Within this basket are placed a little cotton, thread, paddy, chillies, and other produce of the soil, as offerings of propitiation, and petitions for plenty. At times, a low circular *chevaux-de-frise* is constructed, with the view to keep off wild animals, and within this the offerings are left. The neck and head of a cock is often offered, whilst the body of the bird is eaten by the people, as a treat; but, of all offerings, a young monkey, killed with one dash against the ground, and left on the spot, is considered the most acceptable that can be made. There appear to be no priests among the Kookies.

(10.) There are four petty Kookie Rajahs in the district of our last season's operations, viz.,—Lalhulian, Murchailal, Rangbung, and Thoma, also called Mor-Thoma. Among them the best in pedigree is Rangbung; the two wealthiest, Murchailal and Lalhulian, and the latter has the most subjects, altogether between two hundred and two hundred and fifty. These Rajahs are subject to the Maha Rajah of Independent Tipperah, but they pay no tribute, beyond nuzzurana, such as tusks of elephants, gings, or gongs, of Burman manufacture, buck goats and khasis, gobois, large animals supposed to be the bison domesticated, and cotton fabrics, white and black, of Kookie manufacture. Some of these articles are occasionally presented by

each Rajah, according to his ability, to the Maha Rajah. When this is neglected to be done for four or five years, and such instances are said to be not uncommon, the Maha Rajah issues orders to his Jenadar and Dubashia (interpreter) to proceed to the Kookie Rajah's place, and see to the matter, and the customary nuzzurana is forthwith tendered. About some sixteen or twenty years ago there was a Kookie Rajah, named Lalchukda, a notorious freebooter, dreaded by the Kochak Kookies, and the scourge of the country. His followers numbered 1,500, and in one of their last raids in Cachar killed ten or twelve persons, and carried off three Munneepooree women captive. They lived in a long straggling village called Komuntah, after which the adjoining Trigonometrical Station is called, the name literally signifying an assemblage of good dwelling houses.

(11.) After the raid in Cachar this petty Rajah was taken captive by British troops, and the common belief is that he was eventually transported for life. Murchailal, one of the present Rajahs, is the only surviving son of this notorious freebooter, of whose exploits much mention is made by the Kookies of the present day. Murchailal is said to be married to a daughter of a Kochak Chief. He was recently summoned to Sylhet, per roobakaree addressed to the Maha Rajah, to answer to a charge of holding captive several Bengalis, British subjects, in his village. It appears that two women who were among the captives, hearing of our approach, believed that British troops were coming to operate against the Kookies. Being naturally discontented with their confinement, they watched for the first favorable opportunity, and made their escape in the hope of joining my camp, and so securing their personal safety, but we had moved on. After wandering in the jungles for some three days, they found themselves, fortunately, in a village on the British side of the frontier, and having given their izhar, or statement, to some of the Police, it led to the above mentioned requisition by the Magistrate of Sylhet for Rajah Murchailal.

(12.) Kookie messages, or orders, are communicated in this wise: A "Puroi" is made out of peeled strips of bamboo, about eight and a quarter or eight and a half inches long, of the shape in annexed figure. The two prongs of the fork, *b b*, are formed by splitting the upper portion of the central rod, to which a cross piece, *d d*, is tied at right angles. If the prongs, *b b*, be aligned, by holding the "Puroi" so that the two shall appear as one, the missive will be seen to resemble a cross. The tips of the prongs and cross piece being turned in breaks, indicate black mail to be levied—a rupee for every such break. If an additional piece, *a*, having its ends charred, be attached, this implies that the people to whom the "Puroi" is sent are to come on, even at night, with torches. If a chilli is fixed at the intersection of the cross, it signifies, literally, that disobedience to the summons will meet with punishment, as severe as the chilli is hot. If both the burnt bit of bamboo and piece of chilli are attached, the indication is that the requisition is extremely urgent and imperative, and must be forthwith complied with; whilst, if a piece of plain bamboo, or stick, is added to the cross, it means that disobedience of the order will entail corporal punishment.



(13.) When a Kookie Rajah desires to have a piece of land cultivated, his subjects are bound to provide laborers, one from each hut or family. If the Rajah wants a new hut constructed, laborers are similarly furnished to execute the work. If a Kookie commits murder, he immediately becomes the personal property of the Rajah, and is then by the people called the Rajah's Sepoy. When he dies, should he leave no issue, the whole of his effects become the Rajah's. If the man should have a son, he will be allowed possession of half the property, but a daughter, or wife, is not considered entitled, of right, to any portion beyond whatever the Rajah chooses to bestow of his own free will or gift.

(14.) The Kookies eat all kinds of meat, except human flesh, and that of cats, kites, crows and monkeys. Elephant flesh is highly esteemed, and is devoured even in a state of decomposition. Snakes, the *goh*, and the *ghikú*, species of the lizard tribe, are also eaten, as well as carcasses of dogs and cattle, if not actually putrid. When a Kookie kills a male elephant, his Rajah is entitled to a tusk, and a fourth of the body for meat. If any game, such as a deer, or pig, be killed by a Kookie, the Rajah is, in like manner, entitled to a fourth part. On occasion of a Kookie Rajah leaving his residence to go out anywhere, either on business or pleasure, it becomes incumbent on his subjects to provide him with a pig, and liquor, for himself and his household.

(15.) The Kookies cultivate paddy, cotton, katchú, a species of wild yam, Indian corn, indigo, some kinds of pumpkin, including vegetable marrow, sém, a sort of bean, kulant, a kind of pulse resembling mung, chillies, and til, or sesamum, an oil plant. All these are used for their own consumption, except sesamum and cotton, which, after reserving a sufficiency for household purposes (2), are exported into other districts, through the agency of Bengalis, by sales and barter (3) effected at the marts of Koilesbar, Adampur and Kamalpur. A large quantity of the cotton is also taken to the bazar at Agartalla, where it is purchased by the banias and others. Of all products, cotton is the most extensively grown in these hills. During the month of March the bamboo jungle is felled, and allowed to dry by the sun, which takes ten to fifteen, or twenty, days; it is then fired, and the stumps are after that removed. After the first good shower of rain, men, women and children proceed with tools and seed to these plots, which are frequently at long distances from their hamlets; their chief tools are dows, with which instrument oblique cuts are made by single strokes, and in the pits so formed, which rarely exceed a depth of three to three and a half inches, the seeds are dropped; either paddy, by itself, or paddy, cotton, indigo, sesamum, and Indian corn, all together, or any two or three of these together, in the same pit, just as the cultivators feel disposed, or may happen to require.

(16.) The tea tree is said to be indigenous to this country. A tea planter has declared that he collected about two maunds of the seed from the jungles of Independent Tipperah, in the vicinity of the Cachar District. It is also said to exist along the borders of the hills near Agartalla. Such may, partially, be the case, and I have no doubt that the tea tree is growing in wild luxuriance along both the Southern and South-Western confines of Cachar, simply because it is found in many of the jungly parts of that district, and the features of the country, soil, and climates near the frontier, on both sides, are similar. It may also exist, not only in the immediate neighbourhood of Agartalla, but throughout the hill border, from this place to the Phneebee, and to Molhong, on the South-Eastern limits of Cachar; but, in the course of all our travels during last field season, neither myself nor the Assistants ever saw tea trees in any part of the country, although I had search made for it expressly along the marches, and in the vicinity of our hill stations. The block of hills about our Station of Laoraga, on the Sylhet frontier, would answer perfectly for the culture of tea.

(17.) No limestone has yet been met with, nor is any believed to exist here. The whole of this country is admirably adapted for the growth of cotton. The thousands of acres at present lying waste might, with English capital and energy, be converted into an immense cotton field. Mr. Huxham, formerly a grower of cotton at Travancore, recommends the "New Orleans" variety to be cultivated, as being the quality best suited for the European market. He also observes that the best quality, next to "Sea Island," cotton could be raised in India, by due attention to the preparation of soil. In this wilderness the soil is in itself so well adapted for the growth, that ploughing or manuring is hardly necessary. The ashes of the jungle bamboo answer as a good substitute for manure, whilst simple dow pits, as previously described, at proper distances apart, are all that are required. On the occasion of my last interviews with the ruling Maha Rajah, at Agartalla, I suggested the advisability of leasing, or setting, in fee-simple, to Europeans and Christians, some of the waste lands of his vast domain, under concurrence of Her Majesty's Government, as a means of replenishing his treasury, as well as, from thus creating apprehensions of resistance from the new class of land owners, of preventing the Koelak Kookies from continuing their present periodical visitations of rapine and wholesale murder. The Maha Rajah, Birchandro Bahadoor, being in the presence of his courtiers, made no reply. He is not yet confirmed in the Raj by the British Government, and he appears indisposed to undertake any great measures for improvement or reform in the internal administration of his State, until he is actually installed in due form. At the same time it may be as well to remark that proofs are not wanting, in matters of lesser moment, of his eagerness and solicitude to promote the welfare and security of his subjects in general.

(18.) The Kookies wear little clothing about their persons. Some of the men wear a piece of cloth, about eighteen inches deep, girth round their waists. A few have jackets also, which are generally dyed blue. Others use only a sheet, and nothing else. The women wear simply a cloth fastened round the waist, like the men. Perhaps, in the cold weather, they may wear the sheet also. Both men and women part their back hair, and tie it in a knot behind the head, like native women in Bengal. From their general appearance it is difficult for a stranger to distinguish one sex from the other. The Koelak Kookies wear their hair with the knot tied in front, across the forehead.

(2.) Out of cotton Kookies manufacture sheets and pieces for wearing apparel, and with it they make oil on a scale for anointing their heads and for their use. They are also said to eat seed.

(3.) Cotton undressed is sold by the Kookies at Koilesbar at 1 Rupee Rupee 6 annas, and 2 ppees per long basket, according to its size. It is also bartered for fowls, deer fish, tobacco, rice, arr, betel nut, betel leaf, and cotton fabrics, especially chintzes. Cleaned cotton used to sell at 10 ppees, but now fetches Rupees the maund. 1 duty levied by the Maha Rajah is 14 Annas to 1 ppee on the purchases effected by banias and not traders, and 1 Rupee 2 annas per maund on re-transactions.

(19.) The weapons used by the Kookies are dows, bows and arrows, guns, old flint muskets, and some percussion muskets are also said to have been carried to them by native traders. The Kochaks use dows, takawars, spears and muskets. The takawar is a straight blade, like that of a sword, with a handle at one end of it, without any joining.

(20.) Most of the Kookies I have yet seen are more or less infected with leprosy, elephantiasis, secondary symptoms, cancers, or some inveterate skin disease. The elephantiasis is often found accompanied with grapes at the angle between the foot and leg. Some have issues which, in general, are expressly made, as vents for bad and superfluous humours, to ward off diseases. Others have incipient elephantiasis clearly discernible. In all my travels through various parts of India, I have never yet seen so much disease, nor even a tenth of it, among any class or community of natives, as among these poor Kookies. The want of cleanliness, the bad water, as well as the feeding on dog's and elephant's flesh, snakes, the goh, and poisoned fish and water, must be the principal causes of much of their diseased condition. There is a certain tree in the jungles, branches of which are cut down and thrown into the first pool of water, natural or artificial, having fish; these, in a little time die, and both the fish and the stagnant water, which is of course rendered more or less deleterious, are used by the Kookies and Tipperahs. The proportion of the diseased to the apparently healthy among the Kookies is fully eight to two. In their hamlets, which are few, and frequently far apart, and are shifted from one locality to another every two to five, and six, years, there are from twenty to one hundred souls, and of these eight to thirty, but seldom as much as thirty-five, are adult males. The huts of both Kookies and Tipperahs are constructed on platforms elevated about four to seven feet above the ground. Some of these are thatched with grass, others with bamboo leaves, and some with a description of date leaf* found in the jungles, whichever, in fact, happens to be procurable in the vicinity of the locality; whilst the walls are generally made of a coarse kind of bamboo mat. The contrivance of having the huts well raised above the ground is most excellent; but, like the Cossyas, all these people keep their pigs, and also fowls, underneath their habitations, which of course creates noxious gases, and must be the cause, more or less, of sickness. There are no cows in the hill districts of Independent Tipperah, owing to want of pasture for cattle.

* There is besides a
date leaf which is used,
only for covering huts
erected for temporary
her.

(21.) The Munneepoories are settled in hamlets along the skirts of these hills. They are a clean race; and, judging from those met with, appear to enjoy immunity from bad diseases. They are particular with their diet, abstain from all flesh, and live on vegetables and fish, and take their meals at regulated periods of the day.

(22.) The Tipperahs are a stronger built race than the Kookies, but less industrious and energetic. The majority live on almost the same diet, and labor under similar diseases, but in less proportion where their hamlets are situated far away from the Kookies. There are fourteen castes among the Tipperahs, two of which were formerly Kookies. Further particulars regarding these people will, it is hoped, be furnished next year, at the close of Field Season 1863-64.

(23.) Independent Tipperah extends Eastward, as far as the territories of the Burmese, to West of Ava; but, excepting the Kochak races, and other wild tribes, of whom scarcely anything is known, the country is at present utterly waste and useless, and must continue so as long as there is no population forthcoming to occupy it. * * * * *

(Signed)

C. LANE, *Chief Civil Assistant,*

Great Trigonometrical Survey.

Dated Chittagong, 4th August, 1863.

REPORT

By Capt. J. P. BASEVI, R. E., 1st. Assist. G T. Survey of India,

IN CHARGE COAST SERIES,

ON A RECONNOISSANCE OF A PORTION

of the Jeypore Territory:

ALUSOOTIC :

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MAHOMED SHUFFER.

From CAPTAIN J. P. BASEVI, R. E.
1st Asst. G. T. Survey of India,
In charge Coast Series,
Great Trigonometrical Survey,

To MAJOR J. T. WALKER, R. E.,
Superintendent G. T. Survey of India.

Sir,

I have the honor to submit my report, on a reconnoissance of a portion of the Jeypore territory, executed, in accordance with your instructions, during the latter part of the past field season.

2. On the completion of the measurement of the Vizagapatam Base Line, I left the main party of the Series, on the 10th of February, taking with me, Mr. J. O'Neill as Assistant, a small detachment of classies and berkanazes, twelve in all, and the Instruments

1-7 Inch Theodolite by Troughton and Simms.

1 Perambulator

2 Chronometers mean Time, } No. 3569, Parkinsen and Erodsham.

1 Mountain Barometer by Troughton and Simms. } No. 472, McCabe.

1 Aneroid, Do. " Dent.

1 Thermometer " Newman.

1 Prismatic Compass " Troughton and Simms.

noted in the margin. With

the compass and perambulator, I kept up a traverse

from Kasipuram at the

foot of the hills to Jeypore

city, and from Jeypore to

Bhadrachellum, on the Godaveri. I took observations with the Theodolite for time and Latitude, whenever the weather permitted, in order to correct my traverse, which after Jeypore could not be carried on very rigorously, owing to the dense character of the jungle. I recorded regularly the readings of the Barometers and Thermometers, to obtain data for computing the heights above the Sea Level.—The Chronometers were compared daily.

3. I first visited two of our Principal Stations, viz., Jerakonda and Kap. Hill Stations near Madagula, and made a rough survey of a small portion of the country to the west, which is not given in the published atlas sheets. Then marching to Singvarapukota, and on to Kasipuram, I entered the Jeypore district on the 24th of February, and proceeded towards Jeypore, by the new road over the Galikonda hills.

4. At Padawah, five marches from Kasipuram, Mr. O'Neill became so ill that I was obliged to send him back; he had suffered daily from fever ever since entering the hills. Here too fever commenced among my men, and henceforward my small camp was never perfectly free from it, every one, not excepting myself, suffering more or less.

5. I reached Jeypore city on the 8th of March: here I was detained ten days. Lieut. Smith the Assistant Agent, was out in the District, and I was anxious to see him before proceeding further.—My men however were so weak, that I could not have moved earlier than I did. My original plan had been to take a Southwesterly course from Jeypore, until I gained the parallel of 18° and then to strike off Westwards to Sironcha; but I was obliged to give this up, my men were all ailing and the Jeypore Rajah objected to send his men or Elephants out of his own territory. With the Elephants I might have dispensed, but without the men I could have got neither coolies nor supplies. So, rather reluctantly, I decided on limiting my trip, to making for the Godaveri at Bhadrachellum or Dumogujan.

At Lieut. Smith's request, the Rajah lent me a Jemadar and two peons to get supplies &c., and three Elephants, one for riding, and two for my tents. I paid the men batta and defrayed the keep of the Elephants; these though undoubtedly the best description of carriage for the country, were in such bad condition, that they rather hampered me: the riding Elephant was so lame that I was obliged to send it back the second day, and neither of the other two carried even a camel's load. I loaded my own bullocks with rice, a very necessary precaution, for though supplies are procurable at the large villages, and at the smaller ones, almost always, a little rice and "biri" grain can be got, they were always of inferior quality. Indeed, a party travelling in these districts, should, if possible, bring rice from the plains, as the hill rice, generally disagrees with the natives from the Coast.

6. I left Jeypore on the 20th of March, and marched via Ramgir, Malkagiri, (or Malkangiri), Isunkom Poreh, and Mont to Rakapili, and thence up the Godaveri to Bhadrachellum, where I arrived on the 9th of April. The river was unluckily too low to

permit my going down to Rajahmundry by boat, as I had planned. To do so, would have taken at least ten days—so I marched to Ellore, where I took the canal boat to Rajahmundry, and thence dawked to Waltair, where I arrived on the 28rd of April.

7. My route in detail, and some general observations on the country passed over, together with a tabular statement of the marches, heights above Sea Level, &c., are given in a separate memorandum. A route map is also appended, and I have added a memo of routes obtained from native information. The route from Malagula to Sogara is compiled from reports by Captain Vertue R. E., and Captain Owen, Principal Assistant Agent.

8. The Latitude of Jeypore, I have deduced from ten pairs of observations to Polaris, and one pair to Canopus, each consisting of one observation, Face right, and one Face left. Observations for Latitude were also taken at 14 other places.

9. The Longitude of Jeypore, I have deduced from observations for time, compared with transits taken at the North end of the Vizagapatam Base Line, using a rate obtained from these latter observations, and observations taken to the sun immediately on arrival at Waltair. I took observations for time also at 19 other places.

10. The heights have been computed from observations taken as nearly as possible at the same hours of the day, those previous to Jeypore being referred to the South end of the Vizagapatam Base, where observations were taken for several days early in December, and those after Jeypore, with Jeypore itself—this course was compulsory, as the Mountain Barometer got out of order on the march between Kasaram and Nellipaka.

I have used the formula given in *Cape*, Vol ii, viz.

$$\text{Diff. in height, in feet} = 60345 \left\{ 1 + \frac{t+t'-64}{900} \right\} \log \frac{H}{h \{1 + 0.001(t-t')\}} + 0.002695 \cos 2\lambda$$

in which H , t , T , are the readings of barometer, attached and detached thermometer at the lower station, and h , t' , T' , the same quantities at the upper; λ the mean latitude. I adopted this formula being more convenient for computation than Table xviii of *Boiteau's Tables*, and Table xvi was useless, the quantity $(t+t')$ being only tabulated up to 162°.

11. I hope to despatch to you my map early in July.

I have the honor to be, Sir,

Your most obedient servant,

JAMES P. BASEVI, *Captain R. E.*,

1st Asst. G. T. Survey of India,

In charge Coast Series.

WALTAIR, VIZAGAPATAM,
26th June 1863.

MEMORANDUM OF ROUTE.

1. *Kasipuram to Roywalsa, 9.08 miles.* For the first five miles, the road is fair, and tolerably level, passing along the bottom of a narrow valley, after which, about 1 mile beyond the small village of Kottur, is a long zigzag ascent of $2\frac{1}{2}$ miles, to a watershed called Damoku, where there are some coolie sheds. Thence on to Roywalsa the road is very good. The new track leaves the present track at Kottur, and rejoins it again at Damoku, making a considerable circuit to the South, but necessarily has a much easier gradient. Roywalsa is a small village; plenty of wood and good water near, and fair encamping ground—but supplies are not procurable.

2. *Roywalsa to Galikonda, 5.96 miles.* A good road all the way, keeping along the watershed. About $2\frac{1}{2}$ miles from Roywalsa the road passes by the hill village of Anantagiri, near which the Maharaja of Vizianagram has recently commenced a coffee plantation. Galikonda was recommended some years ago as a sanitarium, and three houses have been built here by the officers of Waltair. It is situated on the west face of a narrow valley, at a height of 4,250 feet above the sea. There is no village or encamping ground. The best place for a camp is at "Harris'" valley, $1\frac{1}{2}$ miles further on, where a Detachment of H. M. 105th Regiment was quartered for a short time. In the neighbourhood of the houses, the hills are rather bare of trees, except in the ravines, where wood and water are plentiful, and a beautiful tree-fern grows. The new road will avoid Galikonda, passing to the east of it through a village called Bondam.

3. *Galikonda to Aruku, 12.09 miles.* The road passes along the East side of the valley, and after half a mile, reaches a watershed called the "Salle," standing at an elevation of * 4,352 feet above the sea. It then winds down a deep ravine, gradient easy, to Harris' valley, about 690 feet below "the saddle." This part of the road is infested with tigers, many people having been killed quite lately: one man was carried off two days before our arrival. Leaving Harris' valley, on the right, the road descends another five hundred feet, into an open valley, about $1\frac{1}{2}$ miles broad, and covered with cultivation (chiefly jowar) which extends for nearly 8 miles in a N. West direction. Through the centre of the valley runs a large nullah, which is one of the sources of the Sileru. From the foot of the ghat, where a track branches off to the large village of Madagada, 2 miles distant, the road is excellent to Aruku, except in four places where nullahs are crossed, which are unbridged, and have very steep banks. Aruku is a large place situated near the northern extremity of the valley; a Deputy Magistrate is stationed here. There are several other large villages near; Padenapuram, 2 miles to East, Tsompi $1\frac{1}{2}$ miles to South, and Khurdeh $1\frac{1}{2}$ miles to South West, all in the Paneh-Pentah estate. Coolies and supplies are to be got here, and there is good encamping ground. Bison are found on the high range of Turram Konda, 7 miles to the East.

4. *Aruku to Durbah, 6.84 miles.* The road follows the course of a large nullah (the Sileru) nearly the whole way, crossing it in two places, near together, where it is about 50 feet wide, bank to bank, and about a foot deep; the new road will eventually avoid crossing this nullah altogether, keeping throughout on its right bank. Near Durbah, the road passes through a defile, the boundary of Paneh-Pentah and Jeypore, into a more wooded country. Two other smaller nullahs are crossed, but the road is generally good. Durbah is only a small village, and we could get no coolies or supplies here. The encamping ground is good, being about half a mile East of the village, and there is abundance of good water close by.

5. *Durbah to Padawah, 7.99 miles.* The first mile or two of this march is through a rather jungly country, but it soon enters a fine valley, well cultivated; thence it follows the course of the same large nullah the rest of the way, keeping on its right bank. Only one stream of any size is crossed, and that close to Durbah. About 2 miles from Padawah, the road, still following the course of the nullah, turns round abruptly into a narrow valley, and comes out very suddenly on the broad plain, on the East side of which Padawah is situated. This plain, or rather valley, is about two miles in breadth, and six or seven miles in length, having a direction nearly North and South. The soil is reddish in color, and appears good; very little however is cultivated. Padawah is rather a large village. About 2 miles West of it on the opposite side of the nullah (the Sileru) here called "Pattal-gedda," is a large village named Auwaradah (Owarah in Scott's map), from which is a road to Madagala, passing through Wandragedda and Ugampett; there is also a route from Auwaradah to Malkagiri, passing through Kondakamru, and following most probably, the course of the Sileru, but I could not ascertain anything about this route, but the fact of its existence.

* By Major Strange's observations with Aneroid, in 1859.

6. *Padawah to Kuntor, 6-40 miles.* The regular march is to Sogaru, but I broke it in two on account of the sickness of some of my men. The road crosses a small nullah coming down from the village of Barli, and then takes a northerly direction, up the valley, past the villages of Subalar and Maliput, about one mile beyond which it crosses a low water shed, and then descends gradually into a broad valley, through the centre of which runs one of the principal sources of the Kolab (Saveri). The road is good throughout. Near Subalar another rather large nullah is crossed. Kuntor is only a very small village, but there are a number of villages all round, from which we got supplies;—a little rice, and "biri," grain.

7. *Kuntor to Sogaru, 6-58 miles.* General direction North West. The road is very good, passing over an open country, covered with dwarf date,—but partly cultivated with jowar. Sogaru consists of two villages of about 30 houses each, situated half a mile apart, on rising ground, near the head of a broad valley, which drains northwards into the Kolab. One or two small watercourses have to be crossed on this march, but their banks are not steep. The road passes near several large villages, Bodzar, Kanti, Barell, Musiri. Supplies and coolies were furnished, but not willingly.

8. *Sogaru to Lamtarput, 8-31 miles.* Direction North. Road very good, and free from obstacles, country open. Lamtarput is only a small village, but near it are two larger ones, Komur (pronounced Quomur) and Sankhai, from whence we obtained coolies and supplies. Several villages are passed on the road, viz, Kanchaua, Boramput, Dadhparao, and Tuswah—none large.

9. *Lamtarput to Pettah, 9-04 miles.* Direction North. For the first five miles, the road passes over an open country, similar to the preceding, but after a large village called Dabaguda, situated in a hollow on a deep ravine, the country becomes less open, and more hilly and wooded. Two ridges are crossed, down the first of which, the descent is considerable, though rendered easy by the windings of the road. There are two rather large nullahs to be crossed, which contain little water, but have very steep banks; the Dabaguda one, is the larger of the two. Pettah is situated in a narrow valley, and is but a small village. Supplies and coolies are obtainable, but to a limited extent only.

10. *Pettah to Kottah 5-02 miles.* About a mile beyond Pettah, commences the ghat leading down into the low country; on the Pettah side there is scarcely any ascent, and that little very easy. The first mile and a half of the descent is good, the new road having been so far completed, but the remainder is bad, and very steep in parts, passing through tall forest the whole way; there is also a good deal of bamboo jungle. There are tigers about this ghat, and the people will not travel until broad daylight. Kottah is situated immediately at the foot of the ghat, and nearly surrounded with hills; it consists of two villages, half a mile apart, separated by the river Ko'ab, which enters the plains close by. The Sappers and Miners were encamped here when employed on the road, but were removed shortly before my arrival, having lost their European Officer, and a large proportion of men from fever. Coolies and supplies were furnished here without any difficulty. The made portion of the road ends at this ghat, the roads beyond consist of mere village tracks.

11. *Kottah to Jeypore, 7-01 miles.* We crossed the river Kolab, which is here 30 yards broad, and 3 to 4 feet deep, by a raft, formed of two hollowed trees, joined by a bamboo framework. This is the only description of boat to be met with in the country. The first two miles from the river, are through thick jungle, but after passing between two low ranges of hills, the road enters upon a rather open country, and skirts along rice fields, nearly the whole way into Jeypore. Jeypore, although the chief place in the country, and the residence of the Rajah, is a miserable town, consisting of about 1000 houses, of mud and thatch—there are no paka houses (brick or stone), and a few only are tiled. There is, I was informed, no lime in the country. The town, which is about 2000 feet above the sea, is close to, and partly surrounded by hills, the country being open only to the West. Northward of the town, and about 4 miles distant, is a large flat-topped hill, called Rangurh rising abruptly about 1000 feet above the plain, on the summit of which, are the ruins of an extensive stone fort. On the West side of the town, there is a large tank, more than a mile long, and nearly half a mile in breadth, with fine mangoo tops on its banks. There is a second, and much smaller tank, to the North of the town. The Assistant Agent and Assistant Superintendent of Police, who have been recently appointed, live here: there is also a small police force located here.

12. *Jeypore to Gosella, 7-15 Miles.* Direction South West. The road or rather track, passes along a low ridge for the first four miles, when it crosses a large plain, covered with rice cultivation, in the middle of which a large nullah (a feeder of the Kolab,) is crossed, at a village called Baliar. Thence it passes over more cultivation to the Kolab, about 2 miles on, which is also crossed by a ford. The stream is here of the same breadth and depth, as at Kottah, but has steeper banks. There were no boats here. Gosella is a small village; however a few coolies and supplies were obtained, as there were other villages near. Along the first part of the road, there were a good many Mhowa trees and a few Sal.

13. *Gosella to Sonteput, 9-28 miles.* Direction W. S. W. Our route for the first two miles was over open ground, mostly covered with rice cultivation, flanked on either side by low hills covered with brushwood. Passing by the villages of Khurpi and Gumar, we crossed a low watershed, and entered an undulating country covered with tall forest, chiefly Sal, which lasted the rest of the way. Sonteput is a small village containing 15 or 20 houses. We encamped a short distance beyond it, on the bank of a small stream, the Kurlugara, which runs from a large village, named Dasinatput, and enters the Kolab or Saveri at a place called Bukderi. There is a good deal of rice cultivation here, dependent, as is generally the case in Jeypore, on the rains, and not on irrigation. Supplies are not procurable except in small quantities. In most villages, however, a little rice and dry grain, "biri," can be got.

14. *Sântepût to Rângîr, 11·00 miles.* Direction W. and a little North. The road passes for the first $2\frac{1}{2}$ miles through rice fields, on each side of which is tall Sâl forest, to a village named Mindalwâl containing about 20 houses. Thence on to Rângîr there is not a village to be seen, nor a drop of water to be got, the road lying through tall Sâl forest the whole way. The track is however broad and well cleared. Rângîr, the chief place of the District named after it, is situated on gently rising ground, and contains 50 or 60 houses, almost all of bamboo matting plastered over with mud, and thatched with grass. What is called the Fort is merely a rather large mud building, in which the head man lives. There is a broad sheet of cultivation in front of the village, which is irrigated from a large tank to the South—there is a small tank for drinking water rather nearer, between which and the village are some young mango groves. There is a road from Rângîr to Bustar passing through Bâkdêri. Supplies and coolies are procurable, but neither are plentiful.

15. *Rângîr to bank of Kirchigâra near Kutenapâli, 11·55 miles.* Direction South. Road winds through dense Sâl jungle, up to the top of the ghat, a distance of nearly seven miles. At about a mile from the ghat there is a cluster of small villages Phonaspût, Bezapodora, Raçthpût; here the ascent commences, it is slight, but the ground is broken. Around these villages there is a good deal of rice cultivation. The descent beyond is very steep, and the road is bad, though practicable for laden cattle. The Sâl tree entirely ceases on the ghat, being replaced by bamboo jungle. Kutenapâli is a large village containing about 40 houses, it is distant about one mile from the foot of the hills. The encamping ground is $1\frac{1}{2}$ miles South of the village, on the left bank of a small stream called Kirchigâra, which, joining a larger, called Rôngapani, enters the Savêri at Timispût. The water here was brackish, probably owing to its being stagnant, and only procurable from holes in the bed of the nullah. There is a good deal of cultivation about, generally of rice, but not irrigated. We got supplies and coolies here without difficulty.

16. *Manjigûda, 11·46 miles.* Direction S. S. W. The Sâl tree, which had disappeared on and below the ghât, again reappeared close to our camp, and the road was again through Sâl forest all the way. For the first two miles it pursued a course nearly due East, to a large village called Bimanapâli, situated under some low hills; it then turned round abruptly to the South. Two large nullahs are crossed, one the Rôngapani, at 2 miles from Bimanapâli, where its bed is about 40 yards broad, and very rocky, though not deep—the breadth of the stream being 10 paces, with a depth of a foot of water. The other nullah, the Gariagûra, is crossed near Manjigûda; it is rather the larger of the two, its bed is broader and deeper, but contained less water; both would be very serious obstacles in the rains. The Rôngapani is the boundary of the Rângîr and Malkagiri Districts; the village of Nanlipili, containing 20 or 30 houses, is on its South bank, surrounded by rice cultivation, as usual not irrigated. A rather smaller village, called Matoli, is passed “en route” about $2\frac{1}{2}$ miles further on; from it there is a road to Jeypore, which is more direct than the Rângîr one, but being nearer the hills, is probably much more difficult. It passes through a village named Kôler—said to be large. Manjigûda is a small village containing 10 or 12 houses. We were encamped on the South side of the Gariagûra but the best ground is on the North bank. The water here is good.

17. *Manjigûda to Kotameta, 8·41 miles.* Direction South West. For the first $3\frac{1}{2}$ miles, the road passed through Sâl forest, but on reaching a rising ground, the Sâl suddenly disappeared, and the jungle became much lower and thinner, consisting principally of a tree called, in Uriah, “Saj” (Tel Jâbira.) One or two small villages were passed. Near one, called Salangûda, there was some rice cultivation. Kotameta is a very small village, containing only 3 or 4 log huts; nothing whatever was procurable here, but as there is no village on the road to Malkagiri within 10 miles, I was obliged to encamp here. The water is not very good, coming from a small nullah not running, but dammed up at every fifty yards, or so, and probably partly artificial.

18. *Kotameta to Malkagiri, 14·86 miles.* Direction S. W. After passing over about 4 miles of tolerably level ground, covered with jungle not very dense or tall, the road descends for a mile, and is rather steep and bad, passing through some low hills, the sides of which were covered with tall trees and bamboo jungle. After this descent the road became better, but the jungle was very dense for another five miles, as far as a small village called Sampakari, situated close under a range of hills. Here there is a rather large tank. From thence the route wound along under the hills for a mile or two, and then, crossing them through a low narrow pass, descended into the broad valley in which Malkagiri is situated. Water is only found in one place between Kotameta and Sumpakari—about 9 miles from the former; it is however good, and is apparently stored up by a dam in the Saligâra, a small nullah which runs into the Potêru. Malkagiri is a large and important village, containing over 100 houses; it is the residence of a Rajah subordinate to the Jeypore Chief. It is situated at the head of a fine valley, in the re-entering angle of a range of hills, which rise 800 or 900 feet above the country, at the distance of about a mile. It is surrounded with cultivation, chiefly rice, has some fine mango groves, and is supplied with water from two tanks, of which the largest is South of the village, and appears to be natural. There is a route from this to Rajahmundry, passing through Kondahkamru, Dârakonda, and Kôtah in Rampali, said to be impracticable for laden bullocks. From Darakonda there is a route to Guddam and Nursipatam.

19. *Malkagiri to Tsunkom, 18·71 miles.* Direction South West. Tsunkom is a large zemindari, on the right bank of the Savêri, in the Bastar territory. The road passes over an undulating country, covered with tall jungle; there is not a single village between Malkagiri and the river, a distance of 15 miles. On the bank of the Savêri the “Kism” tree grows to a great size. The River here is about 100 yards broad, from bank to bank, and is crossed by a ford, water scarcely knee deep, near a village named Tsapanah; it is fordable however in but

few places, and only in the dry season. "Old Tsunkom" is situated five miles lower down, but is now almost deserted, and contains but one small hut. The present village is in two portions, about $\frac{3}{4}$ mile apart, each containing 50 or 60 houses: between them is a large natural tank. Thence there are roads to Bastar, Chintaluar, Beji, and Dumogadam—one also to Dantiwara used by the Brinjaries going to Malkagiri, and thence to Cocanada, via Moat and Rakapili. The upper classes are Telugu, but the common people are Koels, who speak a language called "Ulevi." Supplies and coolies were willingly furnished here. There is a good encamping ground near the tank, with several mango groves around.

20. *Tsunkom to Jirapili, 10.49 miles.* Direction South East. For the first 7 miles, as far as Ramaram, a rather large village in the Tsunkom District, the road follows the course of the Saveri, at a distance of about a mile from its bank, and is generally good, except in one place where it passes through a low rocky range of hills. At Ramaram we crossed the river, which is not fordable, by a raft similar to the one already described at Kottah. The rest of the march was along the left bank. The bed of the river at Ramaram is very broad, and covered with large rocks: there are rapids the whole way from Tsunkom. The country throughout the march was, as usual, covered with dense jungle. Near Gongel, a village 2 miles from Tsunkom, there were a few teak trees, but very small, stunted, and worthless as timber. Palmyra trees are common now about the villages. Jirapili is a very small village containing only two or three wretched log huts—it is close to the river.

21. *Jirapili to Poréh, 8.90 miles.* Direction South. Road fair, through tall jungle all the way; one low range of hills is crossed. Only two small villages, Pagarapili and Chingangadam were passed. Poréh, called also Porwah, is a large village, in the Malkagiri District, situated a few miles west of a long low range of hills, and about $1\frac{1}{2}$ miles distant (east) from the Saveri. It is supplied with water from two tanks north of the village. The inhabitants are all Telugu. Supplies and coolies were procurable. I met here a Soucar from Yerugadam, a village near Rajahmundry in the Ellooro District, who had come to receive money lent by him to the village; he had also brought with him a little merchandise in the shape of cotton cloths.

22. *Poréh to Murwápili, 18.04 miles.* The direct distance is about 10 miles—direction S. E. By a mistake of the guide a considerable circuit was made, for we went along the Moat road for about 9 miles as far as a small village named Kúrti, and there finding out our error, turned back to Murwápili, by a mere village track. As far as Kúrti the road was good, though circuitous, and for a considerable distance from Poréh the country was cleared and cultivated. Kúrti is a small village, on the bank of the Saveri, containing 4 or 5 houses. I noticed some rapids in the river a little above. The path from Kúrti to Murwápili was bad, passing between some low hills. Murwápili is a small village, containing 10 log huts; water comes from the Potéru, a rather large nullah which joins the Saveri 5 or 6 miles below Kúrti. At this season (April) there was very little water in it, and that stagnant and brackish. The nullah bed is fifty or sixty yards broad and very stony.

23. *Murwápili to Tárowah, 10.63 miles.* Direction S. E. The road first crosses the Potéru, and then traverses a wild jungly country to Pindibai, a small village on the left bank of the Potéru, containing about 10 log houses, thatched with grass. It is about 7 miles from Murwápili; there is no other village between them. There is a good deal of dry cultivation, chiefly jowar—the water here is indifferent. Tárowah or Tarnowai contains about 15 houses, is situated on rather high ground under a low hill covered with scrub jungle, has good water, but no supplies.

24. *Tárowah to Pettah, 7.11 miles.* Direction S. W. The road makes direct for two low hills about 9 miles distant, between which it passes, with a slight ascent over broken ground. Thence to Pettah the road is good, crossing one rather large dry sandy nullah. Country covered with jungle all the way, dense but not tall. Pettah is a very small village containing four or five houses, log and thatch, on the edge of the Saveri, which here has a much narrower bed, barely 50 yards wide, and has scarcely any current, being a succession of deep pools, separated by rocks dipping at a very high angle. The villagers make a neat kind of grass mat; nothing in the shape of supplies can be got here.

25. *Pettah to Moat, 8.67 miles.* Direction S. S. W. The route follows the course of the river the greater part of the way; the first two miles are through jungle, but the remainder is tolerably open. Two villages are passed, one very small, called Murligadam, about 2 miles from Pettah, and the second named Tuipiram, situated at a sudden turn in the Saveri, about 5 miles from Pettah, and containing about 15 houses. Several small watercourses are crossed, but none of any size. Around Tuipiram there is a great deal of cultivation, rice chiefly. Moat, though a small village, is rather important from its position. It is the last village in the Jeypore territory, and is situated between the rivers Saveri and Siléru, about 1 mile from their junction. A market is held here weekly (?) which appears to be attended from considerable distances, as I met some villagers in their way to it with rice from a village several miles North of Malkagiri. The Brinjaries pass through on their way to Cocanada, and hence routes diverge to Dumogadam and Bhadrachellum, and to Beji: there is also a route into Rampah, passing through a village named Lakwaram (Rakapili District) and crossing a very steep ghát said to be impracticable for laden cattle. The river Saveri is here very broad, probably 200 yards from bank to bank, and is at this season fordable, being about 4 feet deep; its banks are 30 feet in height. About the village there is a considerable patch of cultivation on which jowar is raised. Supplies are procurable to a small extent, but coolies are scarce, the few I required, only five, were obtained with difficulty, and after much delay. Throughout the Malkagiri District, although I was everywhere treated with civility, the Rajah's authority appeared to be somewhat limited.

26. *Moat to Umanaru, 10.98 miles.* Direction a little West of South. We crossed

the Sileru in a Catamaran near its junction with the Saveri; there was a ford, but passable for elephants only, being about 5 feet deep. An island has been formed here; the deeper of the two channels is on the right bank, but is only 20 to 30 yards broad. The breadth of the bed from bank to bank measured 200 yards. The current is strong, running at least 4 miles an hour. Immediately across is a large village called Kuler, between which and Ulumuru there are several large villages. The river formed by the junction of the Saveri and the Sileru is known as the Saveri; we followed its left bank, down to its junction with the Godaveri. Several large and deep ravines were crossed, two only contained water. The largest, called the Sokaleru, runs from a considerable distance in the hills past a large village called Lukwaram; its bed when crossed was about 20 yards broad, and banks 30 feet high. It enters the Saveri beside a village called Mukunur. The other stream runs into the Saveri a little above the former, and is much smaller, but had very steep banks. Neither contained more than a few inches of water. Ulumuru contains about 30 houses, built in one long street along the river bank, which is here more than 40 feet high. There are several other large villages near one; Kodur is about 1 mile to East. Supplies and coolies are easily procurable. East of, and about 7 miles distant is a high hill, part of the main range called Baudardé Dargam; there is said to be an old fort on the summit. Immediately opposite to Ulumuru is a rather high range here known as Kottalghatu; this name is however not general. The best known peak, though not the highest, is about 7 miles to the S. W., and called Manchellam Konla. The Saveri is 300 to 400 yards in breadth, bank to bank.

27. *Ulumuru to Rakupili, 11.74 miles.* Direction nearly South. For the first six miles the path lies along the Saveri, passing through several large villages, and over open country extensively cultivated with jowar. At a village named Raigudam the road leaves the river bank, and traverses a jungly country to Rakupili, passing through two small villages Patipaka and Gundagudam. Between them and Rakupili, for a distance of 4 miles there is not a drop of water to be got. Rakupili is a large village containing over a 100 houses, chiefly of bamboo matting, a few of mud and all thatched with grass. It is surrounded on all sides with jungle, and there is no cultivation to be seen near the village. It is situated a little North west of a prominent conical peak called Kookonla, and is about $1\frac{1}{2}$ miles from the junction of the Godaveri and Saveri. It is the chief place in the Rakupili District, which is a zaminidari under the control of the Deputy Commissioner of Sironcha. Water is supplied here from two tanks on opposite sides of the village, and is not good. The Brinjaries come down by this place in tolerable numbers on their way to Cocanada, bringing grain which they exchange for salt. There are two roads to Rajahmundry, along either bank of the Godaveri, both said to be very hilly and bad, especially that on the left bank.

28. *Rakupili to Kasaram, 10.10 miles.* Due West. Until close to the Saveri, the road was through dense jungle, but south of the road, in the direction of a large village called Wudagudam, there was a great deal of cultivation. The Saveri is crossed just above its junction with the Godaveri, opposite to Konarem. At this season (April) the river is fordable, about $3\frac{1}{2}$ feet deep; my baggage however crossed in catamarans. The banks are at least 40 feet high and $\frac{1}{4}$ mile apart, the breadth of the stream was however only 110 or 120 yards. The road up and down the banks is steep and bad. Konarem is a large village situated at the salient angle between the Saveri and Godaveri; to the North on a low hill, is a small paka temple. Immediately opposite Konarem on the right bank of the Godaveri is a large place named Budram Kottab. From Konarem to Kasaram the road is along the left bank of the Godaveri the whole way, generally a few hundred yards distant from it, except in one place, where it passes round a low hill, descending into the river bed. There are several large villages on the route, and the country is open and cultivated for a mile or more from the river. Jowar, a little oil, cotton and tobacco are almost the only articles of produce. Kasaram consists of two villages $\frac{1}{2}$ of a mile apart, situated on rather high ground, 100 feet or more above the river. Coolies and supplies are procurable here.

29. *Kasaram to Nellipaka, 15.32 miles.* Direction West and a little North. The first two miles were rather jungly, but thence to a large village named Kompella, 4 miles on, the country was open, and similar to that passed over on the preceding march. The road is good, but repeatedly obstructed by large deep ravines, which though generally dry, and extending probably but a short distance into the country, are very troublesome. From Kompella to Nellipaka there are two roads; one, winding along the river's bank, crosses a little stony ridge between the villages of Gogupaka and Daveripili and is rather circuitous; the other road is more direct, and avoids the ridge, and is the better of the two, but passes only one village. Both roads are rather jungly, except near Nellipaka where the country is open. The villages along this march are built, like those before described on the Saveri, in one long street overlooking the river. The houses are generally of bamboo mats and thatched. Nellipaka is a large village situated on high ground nearly half a mile from the river. A number of spacious sheds, of bamboo frame-work, covered with grass, have been built here for the coolies employed on the Godaveri works. A tramway from Dumogudam strikes the river, at the neighbouring village of Golagudam.

30. *Nellipaka to Bhadrachellum, 8.66 miles.* Direction West and a little North. The road is good the whole way, and the country open and tolerably free from jungle. A few villages are passed, two large ones close together, called Pimpili and Gundalla, situated near the river. Bhadrachellum is not a very large place, but is well built, containing several paka houses, and two or three temples on a small hill in the middle of the town. There is a police station, and a post office in charge of the Police. A large canal is in course of construction, which commences at Dumogudam, where an ancient is being built, and enters the Godaveri a short distance below Bhadrachellum. This will turn what is called the 1st barrier of the Godaveri. The river opposite here is fordable now (April.)

81. *Bhadrachellum to Ellore, 77 miles.* There is a good bandy road the whole way. The marches are Pogalapili 8 miles, Kōi Gangáram 10 miles, Jaggavaram 9 miles, Mustimunda 10 miles, Chintalapūdi 12 miles, Durmājeegudam 14, and Ellore 14 miles. At the first four, which are in the Hyderabad territory, the water is not good, the villages are very small, and no supplies procurable. The other two are in the Godavari District, and are large villages.

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GENERAL REMARKS.

The country visited on this tour is divided naturally into two districts. *First*, the hilly tract between the Vizianagram plain, and the low country of Jeypore, comprising parts of the Pauchpentak estate, and of the Nandapur district of Jeypore; and *Secondly*, the plain country containing Jeypore proper, the Districts of Rāngir and Malkagiri, and parts of the Rākapili and Bhadrachellum Zemindāries.

2. The first consists of an elevated plateau, about 40 miles in breadth, separated from the populous districts of the coast by a range of hills, which extend in a direction generally paral-
 lled to the Coast line, from a considerable distance Northwards, down to the Godaveri. The higher peaks of this range reach an elevation of more than 5000 feet above the sea; the Eastern and Western slopes are clothed with tall tree jungle, while the bamboo grows luxuriantly in the valleys. This range forms as it were the backbone of the country, all the drainage on the East side being carried off into the sea, by numerous nullahs between Calingapatam and Cocanada, while the drainage to the West falls into the Godaveri, either by the Indrawati, or by the Savēri and Silēru rivers. The course followed by the new road from Vizagapatam to Jeypore, crosses one of the highest parts of this range, where it is known as Galikonda or Gāliparvatham, meaning the "Hill of the Winds;" the highest peak is, by Trigonometrical measurement, 5398 feet above the sea. West of the Galikonda hills, which rise above it like a wall, is the plateau above mentioned, itself 9000 feet above the sea, with a slight fall to the North West. The country is open, rather populous, the villages being numerous, though small, and tolerably well cultivated; but owing to the red color of the soil, it has a desolate appearance. High hills do occasionally rise up in it, but usually the hills are little above the general level, having a rounded outline, and being frequently covered with low jungle. The valleys, when not cultivated, are covered with long grass and dwarf date. Jowar is the cereal chiefly grown; rice is also raised, generally in the beds of the smaller water courses, which are widened and terraced for the purpose. Near the ghāts leading into the low country, the valleys are much narrower and the hills higher and more thickly wooded, but the plateau generally is very bare of trees; mango trees are most rare, the tamarind is a little more common, and on the hill sides near villages there are often a few sago palms. Some of the principal villages are Mālagada, Arukū where a Deputy Magistrate is stationed, Auwaradah, Wādragedda, Sōgaru, and Nandapur, said to be as large as Jeypore. The houses are built chiefly of mud, or of brushwood plastered over with mud; they are invariably thatched with grass. The people are Uriahs, and are strong and muscular, but not tall. They appear well off.

3. The lowlands of Jeypore, which are separated from the coast by the elevated plateau above mentioned, and further South, by the hill districts of Golagonda or Guddam, and Rampah, are divided into two parts by a range of hills running East and West from the main range; which extends across the Savēri, and is known by the Bustar people as the Toolsee Dūngri; its highest peak is 4,188 feet above the sea. These plains extend northwards to the Indrawati, and westwards to Bustar, comprising the districts of Kotepāl, Jeypore proper, and part of Rāngir, the average elevation being about 2000 feet above the sea; the immediate vicinity of the Indrawati is said to be very fertile, but the rest is a perfect wilderness, having an undulating surface, covered with tall dense jungle. For several marches North and South of Rāngir, our road lay through tall Sāl forest, through which the sun scarcely penetrates. There is a very abrupt descent of nearly 1200 feet from the plains North of the Toolsee Dūngri to the Southern plains; the latter are of vast extent, 100 miles in length, and 30 in breadth, having a south westerly direction, and sloping from a height of more than 800 feet (above the sea) under the ghāts, to a height of about 320 feet at the Godaveri. They comprise part of Rāngir and the Malkagiri Districts lying between the Savēri and Silēru, the Tsūnkom and Beji Districts, on the West of the Silēru, and South of these, the Districts of Rākapili and Bhadrachellum. The river Savēri runs through the plain, forming the boundary of the Jeypore and Bustar territories, save between the Toolsee Dūngri hills and the river, where a small tract is under Rāngir. The whole country is undulating and covered with dense jungle. Near Malkagiri it is hilly, where an off-shoot from the main range juts out into the plains; there is also rather a high range of hills in the Rākapili district, West of the Savēri. On both banks of the river in the Rākapili district, and along the Godaveri, villages are numerous, but with this exception the whole low country, from Jeypore to the Godaveri, is very thinly populated, the villages small, far apart and of the most wretched description. The houses are built of bamboo matting often plastered with mud, or of logs, and always thatched with grass. In the Jeypore and Rāngir districts the people are Uriahs, in the hilly country about Malkagiri, Gonds, and

South of that, Telugu. They are generally miserably poor, and wear a minimum of clothing. They are much given to drinking a liquor made from the Mhowa berry; at more than one village a sober man could not be got to answer questions; this was at the end of March when the Mhowa berry ripens. The people have no idea of distance; they can only say that the sun will be at such a height on arrival at a place; consequently it is not easy to obtain information about places off the road. Weekly markets are held at many of the principal villages, generally in a neighbouring mango tops; rice, liquor, tobacco &c. are the staple articles of commerce. Rice, and a kind of vetch called "Biri," are chiefly cultivated; they are grown in hollows between the low ridges, often at considerable distances from the villages, the crops being generally dependent on the rains, very rarely on irrigation. In the Southern part of the Malkagiri district, and throughout Rákapi and Bhadrachellum, jowar is chiefly grown, and but little rice; the rice for the coolies employed on the Godaveri works is brought from Ellore. Supplies consequently are very scarce. In most of the villages, a little rice, and biri grain, can be got, and the people keep a few fowls, but there are no sheep, and scarcely any goats in the country; any large party travelling through would be obliged to make its own commissariat arrangements. Carriage is not easily procurable, if at all—the people keep a good many bullocks and buffaloes, but are averse to their being hired, and do not appear to use them themselves for purposes of carriage. No cart of any description is to be seen in the country, indeed the roads are quite unsuited to them. There are no Komtis (bunneahs) between Jeypore and Bhadrachellum. The principal villages in the country are, to the North of Jeypore, Kotepád and Nowrangpur, and South of it, Ramgir, Malkagiri, Poreh; on the west of the Savéri, Tsúnkom, Beji; and near the Godaveri, Rákapi and Bhadrachellum.

4. The principal rivers are the Savéri and Siléru, which drain the whole country. The Savéri, called by the Uriahs "Kolih," has one of its main sources near Padawah, and after receiving several feeders from Sôgaru, Naudapúr &c., descends into the plains at Kottah, where it is a large stream averaging 30 yards in width and from 3 to 4 feet in depth (in the month of March.) From Kottah, it follows a northwesterly course to a place called Bâkderigarlu where it is joined by a small nullah called the Kurlugára. Thence its course is Southwesterly, and after being joined by another stream called the Súpéru, it runs through the hills into the low country. At a village called Timispit it is joined by a considerable stream called the Rôngapani, and a little lower down, at Salmi, by the Garia-Gára. In March these streams contain barely a foot of water; their beds are from 40 to 50 yards broad and generally deep. Between Salmi and the junction with the Siléru, a little below Môat, there is but one affluent worthy of mention, viz, the Potéru, which enters a few miles above Pettah; the bed of this stream was nearly dry in March. From Tsúnkom downwards the river has a considerable volume of water, averaging 100 yards in width, the depth in midstream exceeding 6 feet. Its bed is much interrupted with large rocks, and parts are successions of deep pools connected by narrow rapids. Near Jirapili the river had quite an English look from the willow trees that grew along its edge. A little below Môat it is joined by the Siléru, a river of nearly if not quite equal size, which rises at the back of the Gálikonda hills, and flows through the Aruku valley, and afterwards past the villages of Khurdeh, Auwaradah and Kondankanru. Soon after its confluence with the Siléru the Savéri widens out, its breadth averaging 200 yards, with very high banks, which, at Ulumuru, are as much as 50 feet above the river. One more large nullah joins it, namely, the Sokaléru, which runs in at Múkonur. The Savéri enters the Godaveri at Konáren, immediately opposite to Rádrankollah, in the Hyderabad territory. In the upper country between Kottah and the hills, the stream is sluggish, but between Tsúnkom and the Godaveri, the river falls nearly 450 feet. Nearly the whole of this fall occurs in the first fifty miles between Tsúnkom and Pettah. The river falls 100 feet between Tsúnkom and Jirapili, a distance of not more than 14 miles. Its bed at Rámáram, which is very broad, (3 miles above Jirapili) is covered with large rocks often piled up one above another. In the month of March the river was low, but the sound of it could be heard all along the road from Tsúnkom; during the rains it must be a torrent. Below Pettah its velocity does not exceed $3\frac{1}{2}$ miles an hour, the fall is something less than 9 inches per mile, but the bed is much obstructed with rocks. The temperature of the water is very high. I measured it at three places, at sunset, in mid-stream, viz at Jirapili, 88°, Môat, 89°, and at Ulumuru below the junction of the Siléru 90·5°.

5. The principal forest trees are the Sâl, Kúsm, and Sîj; the first is so well known that any description is unnecessary; it grows to a large size in the northern districts of Jeypore, but ceases abruptly a few miles below the Kuttanapali Ghat, and is not subsequently found in the low country. The "Kúsm" (Uriah) is a very handsome tree, the leaf is palmated, something like a chestnut, and when young is of a red color; the tree bears a nut which I believe is eaten; the wood is exceedingly hard—it abounds chiefly in the Malkagiri District. The Sîj (Uriah) in Telugu Jabira, is a useful tree, and very common all over the country, attaining occasionally a considerable size; it bears a nut used by the natives in dyeing—the wood is good, and large quantities are yearly floated down the Savéri. The timber is dragged to the river's edge by bullocks, and then collected, and made into rafts ready for the freshes. Above Môat I saw no timber rafts on the river, nor any tracks through the jungles, so that it is very probable that the Sâl forests are quite untouched. The teak tree may be said to exist, and no more; the few specimens seen near Tsúnkom and Kúrti and Murwápili were very small and stunted, and quite valueless. At a place called Akúra, about 14 miles North of Malkagiri, I was told that there were trees, but these also from the description were of no better quality. The Mhowa tree is common, especially in the Northern part of Jeypore, where it appears to grow wild; further South it is less common and is evidently planted. It bears a small white berry, from which the natives extract an intoxicating beverage of which they are very fond; its wood is good, but rarely used, the tree being too valuable to be cut down.—The Palmyra is tolerably plentiful from Malkagiri southwards, but is not found above the Kuttanapali ghat. The mango and tramariud

are grown about the villages; the former in particular is cultivated with considerable care. The bamboo is found chiefly on the hill sides, and on the banks of the ravines; and nullahs—it does not attain to any size in the low country. There are of course numerous other trees and shrubs; for instance the “Dhak” is common in the jungles, the Pipal and Banian are occasionally seen; but the above are the principal trees, which I was able to get the names of, or recognize.

6. I cannot pretend to describe the geological character of the country, as my knowledge of the subject is very slight. The main range is generally granite, and either granite or gneiss is the rock principally met with. Quartz rock is abundant and I saw occasionally schistose rocks. On the elevated plateau between Galikonda and the Pettah ghât there is a good deal of laterite. The soil in the upper portion of the Jeypore plain is rather black, but further South it is of a reddish color. I saw no black cotton soil until near the Godaverî.

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DEDUCTION OF THE LATITUDE OF JEYPORE, (LT. SMITH'S BUNGALOW,) IN MARCH 1863.

Instrument		No. of Pairs of obser- vations	Date	Star observed	Sidereal Time	Observed Altitude	Refraction	Reduction	Corrected Altitude	Zenith Distance	Stars Declination	Latitude	Remarks	
7 Inch Theodolite by Troughton and Simms.														
2			8th March	Polaris	H. M. S. 6-12-9	19. 3-41	2-27	* -9-24	18-51-50			18-51-50	* By tables in Nautical Almanac.	
2			9th "	"	6-46-30	19. 1-58	2-27	-7-40	18-51-51			18-51-51		
2			10th "	"	6-54-0	18-59-27	2-28	-5-2	18-51-57			18-51-57		
2			11th "	"	6-48-15	19. 1-32	2-27	-7-10	18 51-55			18-51-55		
1			12th "	Canopus	6-40-12	18-25-26	2-31	+7-21	18-30-16		° ' "	18-51-60		
1			" "	"	6-40-5	18-20-20	2-32	+12-31	18-30-19		S 52-37-42	18-51-62		
2			13th "	Polaris	7-20-20	18-49-46	2-28	+4-44	18 52- 2					
											Mean.	18-51-56.7		

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OF JEYPORE (LIEUT. SMITH'S BUNGALOW) BY CHRONOMETERS FROM NORTH END OF BASE.

Station.	Date 1863	Days and Decimal parts of a day.	Interval days	McCABE, NO. 472.				Parkinson and Frodsham No. 3569.				Remarks
				Error	Difference	Correction for rate	Difference of Longitude	Error	Difference	Correction for rate	Difference of Longitude	
North end of Base Jeyapore— Lt. Smith's Bungalow,	Febr. 4th	34.606		⁺ M S 13.47.5	M S 2.53.4	M S -0.11.0	M S 2.42.4	⁺ M S 34.49.5	M S 13.1.9	M S -10.13.0	M S 2.48.8	
	March 5th	66.845	31.649	16.40.9	2.53.4	-0.11.0	2.42.4	47.51.3	13.1.9	-10.13.0	2.48.8	
	" 9th	67.846	32.650	16.39.2	2.51.7	-0.11.3	2.40.4	48. 7.9	13.18.4	-10.32.4	2.46.0	
	" 10th	68.344	33.648	16.40.3	2.52.8	-0.11.7	2.41.1	48.26.8	13.36.8	-10.51.7	2.45.1	
	" 11th	69.336	34.640	16.40.0	2.52.5	-0.12.0	2.40.5	48.43.0	13.53.5	-11.10.9	2.42.6	
	" 12th	70.308	35.612	16.41.5	2.54.0	-0.12.4	2.41.6	48.59.9	14.10.4	-11.29.7	2.40.7	
	" 14th	72.827	38.131	16.42.3	2.55.3	-0.13.3	2.42.0	49.50.1	15. 0.6	-12.18.5	2.42.1	
	" 15th	73.830	39.134	16.43.3	2.55.3	-0.13.6	2.42.2	50.10.4	15.20.9	-12.37.9	2.43.0	
	" 16th	74.821	40.125	16.44.0	2.56.5	-0.13.9	2.12.6	50.30.3	15.40.8	-12.57.1	2.43.7	
	" 19th	77.376	42.680	16.45.0	2.57.5	-0.14.8	2.42.7	51.18.8	16.20.3	-13.46.6	2.42.7	
				Mean				Mean				
				-2.41.72				-2.43.86				M S -2.42.79
				General mean, in time,				do.				In arc
				Longitude of North end of Base				Longitude of North end of Base				83.16.11
				Longitude of Jeyapore,				Longitude of Jeyapore,				82°.35'.29'

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MEMORANDUM OF ROUTE.

Marches. Names of Villages.	Miles	District	at 3—0 P. M.		Height above Sea	Remarks
			Barometer Mountain	Therm		
Kasipûram,			29-753	83-0	251 feet	
Maywala,	9-09	Tâneh Pentah	27-834	78-5	2692 "	Ascend ghât—fair road.
Gâlikonda.	5-96		25-954	81-5	4213 "	
Aruku,	12-09		26-898	84-7	3156 "	Descend ghât—4 nullahs cr
Dârbah,	6-84	Jeypero	27-116	85-3	3002 "	Large nullah crossed twice.
Padawah,	7-99	"	{ 27-166 at 2 P. M. 26-952	90-5	2983 "	
Kamtôr (small village),	6-40	"		92-3	3202 "	
Sôgarû,	6-58	"	26-991	92-5	3155 "	
Lampîarpût,	8-31	"	27-210	92-6	2914 "	
Pettah,	9-04	"	27-284	87-2	2832 "	Two nullahs crossed.
Kottah,	5-02	"	28-108	97-5	2006 "	Descend ghât—road bad.
JEYPERE,	7-01	"	27-990	91-7	2019 "	Cross Kolâb or Savéri.
Gosella,	7-15	"	28-170	92-7	1836 "	Cross nullah and Kolâb.
Sônlopût,	9-28	Râmgîr	28-072	92-5	1928 "	Cross small nullah Kurlogé
Râmgîr,	11-00	"	28-028	81-6	1957 "	
Nr. Kuttanapali,	11-55	"	29-198	91-3	774 "	Descend steep ghât—bad r
Manjigûda,	11-46	Malkagiri	29-284	100-2	750 "	Cross Rongapani and Gari
Kotameta (small village),	8-41	"	29-102	97-0	842 "	
Malkagiri,	14-86	"	29-336	91-7	669 "	Rether bad road
Tsunkom,	18-71	{ Bustar Tsun- kom	29-257	91-5	758 "	Cross Savéri—ford.
Jirapili (small village),	10-49	Malkagiri	29-390	100-1	585 "	do. ... boat.
Pôreh,	8-00	"	29-464	94-0	519 "	
Mûrwânpili,	17-04	"	29-550	98-0	412 "	
Tarowah,	10-63	"	29-492	102-5	499 "	Cross Poteru—nearly dry.
Pettah,	7-11	"	29-602	101-1	354 "	
Môat,	8-67	"	29-590	99-5	382 "	
Ulûmûru,	10-98	Râkapili	29-670	102-2	305 "	Cross Silêru—boat.
Râkapili,	11-74	"	29-650	100-6	327 "	
Kasaraw,	10-10	"	29-652	104-5	+ 327 "	Cross Savéri—boat and for
Nellipâka,	15-32	Bhadrachellum	*	103-2	+ 345 "	* Barometer injured.
Bhadrachellum,	8-65	"		101-4	268 "	+ By aneroid—Stn. about 4 the river.
South end of Base,			29-724	81-5	* 311	* By Spirit Leveling.

Note. Captain Vertue R. E., in his report on the route from Madagala to Jeypero gives the heights of { Sogara 2300
{ Jeypero 153
does not state how they are obtained.

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ABSTRACT OF OBSERVATIONS TAKEN AT LT. SMITH'S HOUSE AT JEYPORE FROM 9TH TO 19TH MARCH INCLUSIVE.

No. of observations	Mean Time	Barometer	Thermr.	Remarks.
10	7.30 A. M.	28.039	74.7	Barometer in house near door but out of draught. Thermometer in verandah against S. wall.
12	10 A. M.	28.103	84.4	
9	Noon	28.078	89.6	
2	1.0 P. M.	27.992	93.0	
7	2.0 P. M.	28.030	90.7	
6	3.0 P. M.	27.990	91.7	
3	5.0 P. M.	27.943	90.6	
1	8.0 P. M.	27.990	78.6	

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MEMORANDUM OF ROUTES,
FROM NATIVE INFORMATION.

Village	District	Miles	Remarks.
<i>Tsunkom to Bustar</i>			
Sindigádi,	Tsunkom	12	These are all large villages; the road is to be difficult between Umrigádi and Sindawára where there is a steep ghât.
Umrigádi,	"	12	
Sindawára,	Bustar	12	
Maringa,	"	14	
Bustar,	"	10	

Tsunkom to Bustar, 2nd, and better Route.

Golagúdam,	Tsunkom		These are small villages, about 2 miles apart.
Múrtonda,	"		
Atkargúdam,	"		
Nénár,	"		
Góril,	"		The road is said to be better than the calling one. Between Kimar and Katikalára—Garhi, [Katikalárah in Captain Stewart's map] there is a ghât.
Kúnar,	"	12	
Katikalára—Garhi,	Bustar	12	
Pakunár,	"	8	
Chitapúram,	"		
Kurma,	"		
Rájúr,	"	12	
Tokapili,	"		
Sosanpili,	"		
Maringa,	"	12	
Bustar,	"	10	

Tsunkom to Chintaluár.

Pátungúdam,	Tsunkom		This road is evidently very circuitous. Chintaluár cannot be more than 35 miles, as the crow flies. There is one ghât between Mankapili and Púrdim, and another between Arpúram and Gúmaráki. A man unencumbered goes in three days. The road is said to be very jungly.
Silagúdam,	"		
Turapili,	"		
Kúramarka,	"	12 or 13	
Mankapili,	"		
Púrdim,	"		
Pótel,	Khokonda	16	
Kúkúri,	"		
Arpúram,	Chintaluár		
Gumartáki,	"	8 or 9	
Bikrampili,	"		
Chintaluár,	"	10	

Tsunkom to Dantiwára.

* Kuramatka,	Tsunkom	12 or 13	There is said to be no ghât on this road.
Khokonda,	Khokonda	12	
Dantiwára,	Bustar	12	

Villages.	District	Miles	Remarks.
<i>Tsunkom to Dumogúdam</i>			
Gongel,	Tsunkom	2	The road is said to be good throughout and free from gháts.
Rámárám,	"	5	
Kirlapili,	"	6	
Pina Beji,	Beji	6	
Nagalgunda,	"	5	
A'ragatta,	"	4	
Beji,	"	7	
Korásgúdam,	"	6	
Kamlapúram,	"	6	
Rámárám,	"	6	
Chintagúpa,	Bhadrachellum	8	
Dámogúdam,	"	6	
<i>Ramaram to Chintalnar.</i>			
Golagúdam,	Tsunkom		Road said to be tolerably good; there is a ghát, between Wágarakonda, and Kotapili.
Ekarú,	"		
Quona Beji,	"	7	
Páriár,	Chintalnar		
Wágarakonda,	"	6	
Kotapili,	"	"	
Chintalnár,	"	14	
<i>Beji to Chintalnar.</i>			
Palamaru,	Beji		Villages all small—the largest, Korapili, containing only 8 houses.
Kórapili,	"		
Gode'gúdam,	"		
Gámgalowa,	Chintalnar		
Chintalnar,	"		
<i>Malkágiri to Rajahmundry.</i>			
Potru,	Malkágiri	10	Road described as very difficult. The Sileru is crossed at Kondahkamru. Between that place and Darakonda there is a steep Ghat. There is probably a second Ghat to be descended near Kótah, as that place is not more than 400 feet above the sea.
Kondahkamru,	Gúddum	10	
Darakonda,	"	16	
Gurtera	"		
Bhimávaram,	"	20	
Kótah,	Rampah	10	
Gokúram,	Godaveri		
Rajahmundry,	"	40	

ROUTE FROM MADAGULA (COMMONLY CALLED MADAGOLE) TO SOGARU, FROM REPORTS BY CAPTAIN VERTUE, R. E., AND MAJOR OWEN.

Villages	No. of Marches	Distance Miles.	Size of Village &c.	District	Remarks.
Madagula				Madagula	
Tataparti		5		"	Ghat, road very steep and stony, commences $1\frac{1}{2}$ miles beyond Takapati, resting and watering place 4 miles East of watershed.
Mulogupahlu		5	No village	"	3 miles West of watershed.
Minuagalur	1	7	9 huts.	"	Paderu—large village (and police station) 2 miles to West (Bng. 80° from South.)
Tumpada		4	15 "	"	Road over a plain 1 to 2 miles broad, wet and dry cultivation, much long coarse grass, one large stream and 8 smaller nullahs crossed. Road through plain for 2 miles, afterwards through hills and jungly.
Ugampett	2	$4\frac{1}{2}$	Rather large.	"	
Tuduru		12	Not stated.	"	
Wandragedda	3	4	60 houses.	Jeypore	3 large stony water courses crossed—road through jungle and along hill sides.
Anoradah or Auroda	4	7	Large	"	A small ghat crossed 2 miles from Wandragedda—road stony. Remainder good through plain.
Wonturu		3	Small.	"	Patalgedda (Sileru) crossed and Huringyedda.
Soguru	5	7	60 houses.	"	Road good, over open ground.

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