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GENERAL REPORT

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ON THE

TOPOGRAPHICAL SURVEYS

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BENGAL PRESIDENCY,

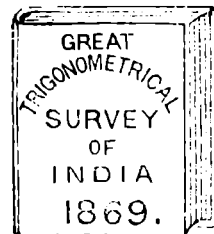
FOR

SEASON 1862-63.

BY

LIEUT. COLONEL H. L. THULLIER,

SURVEYOR GENERAL OF INDIA.



CALCUTTA:

O. T. CUTTER, MILITARY ORPHAN PRESS,

1864.

Ob

No. 33 A.

FROM

LIEUT. COLONEL H. L. THUILLIER,
Surveyor General of India,

TO

THE SECY. TO THE GOVT. OF INDIA,
MILITARY DEPARTMENT.

SURVEYOR GENERAL'S OFFICE,

Calcutta, 26th April 1864.

SIR,

I have the honor to submit, for the information of Government,
my Report* on the operations of the Topographical
Branch of the Survey Department for the past Professional Season of 1862-63.

* No. 33, dated 26th April 1864.

2. The Revenue Survey operations, which are likewise under my superintendence, are reported on separately to the Foreign Department.

I have the honor to be,

SIR,

Your most obedient Servant,

H. L. THUILLIER, *Lieut. Colonel,*

Surveyor General of India.

GENERAL REPORT

ON THE

TOPOGRAPHICAL SURVEYS OF THE BENGAL PRESIDENCY, SEASON 1862-63.

No. 33, dated Calcutta, 26th April 1864.

GENERAL REMARKS.

1. **INTRODUCTORY.**—In continuation of my Report* on the Topographical Surveys of the Bengal Presidency for the two Seasons of 1860-61 and 1861-62, the following narrative is submitted of the operations and progress of the Topographical Branch of this Department for the past Professional Season of 1862-63, extending nominally from 1st October 1862 to 30th September 1863, to which latter date all accounts and returns are made up, but in reality they are not rendered to this Office before the month of December or January following.

2. In addition to the Executive Establishments embraced in the last Report, a fifth Number of Parties employed. has been employed in the Rewah Territory, and although it returns no area of final work actually accomplished, yet its first Season's work has laid the foundation for what is to follow, and is, therefore, so much good work performed. The addition of this Party was referred to in paragraph 10 of my last Report, and its constitution is fully explained in the sequel.

3. This branch of the Department has been further augmented during the current Season by three more Parties as per margin,* bringing the number up to eight, which are at the present time actively engaged, as described under the head of Executive Surveys. In succeeding reports, therefore, the area will be materially augmented.

4. No. 6 Party has been raised, on the application of the Bengal Government, for the Cossyah, Jynteah and Garrow Hills, to survey the belt of Hills extending from the Brahma-pootra River on the west to the eastern head of the Assam Valley, and between the Plains of Assam and the Plains of Mymensing, Sylhet and Cachar. This will embrace likewise the Anghami Naga Hills, falling within the British Frontier, which at present are almost entirely unknown. No. 7 Party is an expansion of the old Gwalior No. 1 Party, intended to take up the Rajpootana Agency, so as to make a greater impression on the enormous area shewn to remain for survey there, and will extend its operations westwards of Scindhia's Dominions, or the Indore Circle or Agency.

5. No. 8 is an old establishment which has been at work for some years, entirely independent of this Department, but has now just been brought under the financial and administrative control of this Office, in the same manner as all the other Surveys. Its field of employment is in the Pegu Division, where it has already finished about three-fourths of the whole Province, on a system peculiar to itself, the results of which have not yet been sufficiently developed or made known. The enquiry into these special operations, and the investigation of maps and computations of so many years' standing, will be a very laborious task, for which

my already over-taxed ministerial establishment is by no means prepared. The important additions thus enumerated, it will be seen, exactly double the numerical strength of the Executive Topographical Branch, and form a most serious accession to the labors of the Supervising Office.

6. The following Statement exhibits the area, total cost and average mileage rate of Survey. 12,965 square miles of final work have been completed, and mapped on the 1 inch, as well as $\frac{1}{4}$ inch scales, besides an area of 20,048 square miles of Triangulation, laid out and executed in advance of the details:—

DESIGNATION OF SURVEY PARTY.	Final Survey completed in Square Miles.	Total Expenditure for the Season 1862-63.	Average rate per Square Mile of Final Survey.	REMARKS.
	Square Miles.	Rs. A. P.	Rs. A. P.	
No. 1. Topographical Party Gwalior and Central India Survey. Lieut. Col. D. G. Robinson, Supdt.	3,457	65,852 14 0	19 0 0	Besides the final work, 2,560 square miles of Triangulation have also been completed. N. B.—The cost per square mile of this Party for the final Survey or Topographical details completed during the season of 1861-62 was taken on the combined areas, and therefore erroneously given in my last report at Rs. 14-10. It should be Rs. 27-1.
No. 2. Topographical Party, Hyderabad Survey. J. Mulheran, Esq., in Charge.	2,333	32,043 3 0	13 11 0	In addition to the final work, 4,046 square miles of Triangulation have also been completed. N. B.—The rate of final Survey or Topographical details completed by this Party during the season 1861-62 was, for the same reasons as above, erroneously given at Rs. 16-13 per square mile in my last report. It should be Rs. 31-8 per square mile, and the general mean average, instead of Rs. 14-9, should have been Rs. 19-12.
No. 3. Topographical Party, Ganjam and Orissa Survey. Lieut. Col. G. H. Saxton, in Charge.	3,975	52,605 11 0	13 3 0	About 6,000 square miles of Triangulation, in addition to the Topographical details or final work completed. Some of this was done in a prior season.
No. 4. Topographical Party, Chota Nagpore Division Survey. Captain G. C. Depree, in Charge.	3,200	38,592 9 0	12 1 0	Besides final work 3,010 square miles of Triangulation have also been completed.
No. 5. Topographical Party, Rewah Territory Survey. Lieutenant W. G. Murray, in Charge.	...	45,136 8 0	... ..	This Survey having only started work in the season under review, no final work was taken up. The Triangulation completed as a basis for future topographical work covers an area of 3,708 square miles. The expenditure noted represents cost of the Party since its organization in July 1862, and including the cost of first equipment, Camp equipage, &c.
Total	12,965	2,34,230 13 0	14 8 4	= mean rate per square mile of final Survey.

at a total cost of Rs. 2,34,230, which gives a mean average of Rs. 14-8-4 per square mile. The mean average progress is 3,241 square miles each Party of final work, and 4,009 square miles of Skeleton Triangulation in advance.

7. From a comparison of these results with those given in page 2nd, para. 5 of my last Report for the two previous seasons, it will be seen that during the season under review, the area finally surveyed is fully equal to three-fourths of the area completed in the two previous seasons, or an increase of one-fourth over the previous annual progress shewn in the margin, *whilst the average area accomplished by each Party has increased very materially, viz., from 2,051 to 3,241 square miles, thus shewing that the exertions of the Officers employed have been well directed and highly successful.

* Area surveyed in the two seasons of 1860-61 & 1861-62	} Square Miles. = 16,408
Do. in season 1862-63		= 12,965

Report for the two previous seasons, it will be seen that during the season under review, the area finally surveyed is fully equal to three-fourths of the area completed in the two previous seasons, or an increase of one-fourth over the previous annual progress shewn in the margin, *whilst the average area accomplished by each Party has increased very materially, viz., from 2,051 to 3,241 square miles, thus shewing that the exertions of the Officers employed have been well directed and highly successful.

8. This improvement in the general progress, as I anticipated in my former review, is very satisfactory and commendable. The mean average cost per square mile is also materially reduced by about one-fourth as detailed in the margin.†

	Rs.	A.	P.
† For 1860-61 and 1861-62	19	12	0
For 1862-63	14	8	0
Difference	5	4	0

9. This cost, which is equivalent to 29s. 0d. 4 farthings of English money, is very moderate, and when it is further considered that, owing to the expansion of the Topographical Branch of the Department, it has been necessary to introduce into each Party a large proportion of untrained Agency, which does not for at least two years yield a return commensurate to the expense incurred in instructing and training, the results obtained must be considered very satisfactory, and the prospects for the future, when the entire machinery employed will be in full working order, are most cheering.

10. The area assigned for Survey to this Branch of the Department, chiefly Native States, was previously shewn to amount to the figures noted in the margin.‡ To this must now be added the Province of Pegu, the Survey of which has just been placed under the control of this Department. Of this, the larger portion has already been surveyed. The balance remaining to be provided for is still very large indeed. Of this, it is expected that about 20,000 square miles will be completed during the current season. At the existing rate of progress, therefore, there is at least 18 or 20 years' work for the present number of Parties.

Extent of Topographical Surveys to be accomplished.

‡ Page 3, para. 9, printed Report.

		Sqr. miles.
Previously reported .. .. .	..	3,83,838
Pegu Division .. .. .	..	32,250
		4,16,088
Completed during past 3 seasons by Regular Department	29,373	= 48,892
Ditto in Pegu	19,519	
Balance remaining ..		3,67,196

11. In addition to the above Surveys however, which constitute the regular Topographical Branch of the Department, another Topographical Survey has, I am informed, been commenced on the Bombay side, in Guzrat or Kattywar, which the Government have entrusted to the Superintendent of the Great Trigonometrical Survey. I am, therefore, not in a position to afford any information as to what is really being done there. In the first instance I was applied to by the Bombay Government for a scheme and estimate for this Survey, and was placed in communication with the Political Agent of Kattywar on the subject, but after certain correspondence with the Bombay Authorities, I found that definite instructions had been issued by the Military Department direct to the Superintendent of the Trigonometrical Survey, who informs me that he has put the Survey in train.

12. There are likewise other Topographical operations combined with the Great Trigonometrical Survey of the Himalayahs going on in Kashmir, Thibet, Ladak and Baltistan, under Captain Montgomerie, which are fully reported on by the Superintendent of the Trigonometrical Survey. This Survey is a special one, which has always been conducted by the Officers and Staff of the Trigonometrical Survey. The scale employed is only $\frac{1}{2}$ inch to the mile, which is sufficient for such a mountainous country. The whole of this will be completed during the present summer, and it is intended to take up afterwards Kumaon and Gurhwal from the Nepal Frontier, and sanction has already been given for this Survey.

13. The various records and Maps of each Party, as detailed under their respective heads, have been duly received in this Office, and supply a large amount of geographical materials to be worked up, and which will be turned to immediate account. The completion and rendering in due time of all the seasons' records in a style of progressive improvement, is very creditable to the management of the Officers in charge of Parties, and to their several Subordinates. No arrears, it is reported, exist—such few records as have been detained being required for reference as the Survey operations extend.

14. Of the 1 inch and $\frac{1}{4}$ inch Maps received into this Office, the former have to a large extent been reduced and printed by the Photographic process, whilst the latter have been re-produced on the same scale. A printed impression of the $\frac{1}{4}$ inch Map of Gwalior is annexed as a specimen of the style of Photograph taken. I may mention that copies of this Map were sent back to Lieutenant Colonel Robinson, for presentation to the Maharajah Scindiah and the Political Agent, the same week the original was received. The original was not executed expressly for Photography, but the copy, whilst it is of course a perfect *fac simile* of the original, is a most practically useful Map, and the attainment of such copies within a few days is a grand step in advance, and saves Executive Surveyors from the vast labor of making manuscript copies.

15. The 1 inch Sheets have likewise been re-produced on the same scale for the Jhelum and Gwalior Surveys, and in the Ganjam and Chota Nagpore Division Surveys, where the country is very wild and of less importance and value, the Photographs have been reduced to half scale. These Sheets are most useful and answer all immediate local purposes. They have been freely supplied to the District and Police Officers; specimens of both Scales are annexed.

16. The advantage thus gained by the early dissemination of Photographed copies may be appreciated when I mention that up to within a very late period no single map of any of the Topographical Surveys now going on for so many years had ever been published or issued in any way. Owing to the extraordinary progress of the Revenue Surveys, and the utter incapability of the very small Lithographic Establishment attached to this Office, competing with the area surveyed annually, no Topographical Survey Map has as yet been lithographed. One or two Sheets of the engraved Atlas of India,* containing portions of the Ganjam and Chota Nagpore Surveys have very recently been received from England, but with these exceptions, the valuable Geographical materials produced by this branch of the Department have remained in abeyance. The Maps of Jhelum and Rawul Pindee, the Surveys of which commenced in 1851 and ended in 1859, are still unpublished, the originals having all been sent several years ago to England for the purpose of being engraved or lithographed, where they still remain. The return of these important and beautiful Maps is most anxiously looked for, and the subject has been separately brought to notice.

* Nos. 114 and 115.

17. In the Photographic branch of the Office our means and appliances are small, consisting of two Sappers only, as described in my General Narrative Report,† paras. 53 and 54. A glass house of suitable dimensions has recently been erected, affording every convenience, and a good Reducing Lens, by Voightlander, as well as another large triplet one, specially made by Ross, have been added to the Camera, which will greatly facilitate the taking of larger Plates, a supply of the proper size glass for which I hope soon to obtain. The following Statement exhibits the extent of work performed by this Branch for the year ending 31st March 1864, amounting to 2,524 Prints, or impressions of

	Rs.	A.	P.
Establishment	2,400	0	0
Contingencies	2,334	5	1
Total	4,734	5	1

Sections of Maps, at a total cost for Establishment and Contingencies, including Chemicals, of Rs. 4,734-5-1. For this sum we have not only the above number of Prints, but the Negatives for further copies, as well as the Plates, which are

available for other Maps. The expense of two Lenses and a Rolling Press is also included in the above expenditure, which is so much stock :—

Original Sheets.	Subject.	No. of Plates.	No. of Prints.	Original Scale.		Photographic Scale.	
				Mile.	Inch.	Mile.	Inch.
9	Jhelum and Rawul Pindee Plane Table Sections	34	102	1	1	1	1
23	Ditto, ditto, ditto	61	488	1	1	1	1
1	Sumbulpore and adjacent Mehals	9	54	4	1	4	1
26	Ganjam and Orissa Survey	51	510	1	1	2	1
1	Degree Sheet, Gwalior Topographical Survey	4	40	4	1	4	1
4	Gwalior and Central India Topographical Survey	49	222	1	1	1	1
3	Oudh Revenue Survey, Final Sheet	6	24	1	4	2	1
1	Ditto, ditto, ditto	1	6	1	1	4	1
1	Ditto, ditto, ditto	2	8	1	1	2	1
		1	4	1	1	4	1
2	Districts Derah Ishmael Khan and Bunnoo	32	352	1	1	1	1
4	District Hazareebaugh	32	128	1	1	1	1
3	„ Manbhoom	21	105	1	1	1	1
19	Artillery Men and Horses, equipped	19	19	Re-produced.			
1	Sketch Map of Jeypore and Bustar	4	16	2	1	4	1
5	Views of Hazareebaugh for Report	7	350	Re-produced.			
1	Genealogical Chart (Bonslays of Sattara)	4	84	„			
4	Hindoo Mythological Subjects	4	4	Slightly reduced.			
1	Department, Prize Medal from Great Exhibition	2	6	Re-produced.			
1	Trigonometrical Chart (Hydrabad)	1	2	„			
110		334	2,524				

18. The chief want now to bring this Photographic process to general practical account in the Department is to have sufficient superintendence to manage it. A qualified Officer who might devote his entire time to it in elaborating the system is necessary with some slight inferior Establishment for performing the commoner details. The coloring and general style

of the Departmental Maps is now in keeping with these requirements and will be carefully attended to. The same system as observed in the Ordnance Survey Office at Southampton, with similar means to carry it out efficiently, should be provided for. The adaptation of the Photozincograph or Photo-Lithograph process requires to be matured; as yet little or no progress has been made with this or with the Anastatic process, which we so much need for the reproduction of our old lithographed Maps now out of print, and for which the demand is always increasing. To this end the services of an Officer possessing good qualifications as a Photographer, and who has had a sufficient training at Southampton might with great advantage be made available.

19. The two Sappers* who have been engaged in this duty since the 1st June 1862 have afforded me very great satisfaction; they are both painstaking, intelligent and well-conducted men. They have hitherto drawn a consolidated allowance of Rs. 100 per mensem, inclusive of all Military claims for Clothing, Rations, &c.; and it was proposed in the letter from the Chief of Military Finance, No. 865, dated 20th August 1862, as per margin, to increase this allowance to Rs. 150 per mensem, after a specified period of approved service, on my report of their qualifications and conduct. The time has now, I am of opinion, arrived for carrying out the suggestion of the Chief of the Military Finance. I have had great satisfaction therefore in testifying to the highly deserving character of both the Sappers, and I trust the increase specified and separately applied for may be sanctioned from the 1st May next. The small extra expense may easily be met by a transfer from the Departmental Budget. The Sappers have likewise been recommended for the Rank of Sergeants on the Unattached List in conformity with the rules prevailing at Army Head Quarters.

20. The labors of the Lithographic Branch have been increasing, and many valuable additions have been made since my last report, through its Agency, to the published Geography of India. At the same time, from the causes which I have so forcibly and repeatedly brought to the notice of the Government, viz., the utter inadequacy of the small Establishment allowed to grapple with such an overwhelming amount of work, as is now produced by the largely increased number of Executive Surveys, we are only able to bring out about one-fourth of the area annually surveyed, whilst the arrears of geographical materials now waiting to be lithographed are estimated to employ such an establishment a period of about 16 years. Some increase to this useful branch of the Department is a matter of the utmost moment, and I trust it may not be much longer delayed.

21. Unable therefore to meet the demand as to quantity in the issue of published maps, it is satisfactory to be able to say, that the quality of the work turned out is of a very superior order, and that constant improvements are being made in the style and execution of the published maps. A specimen Map of India printed in colors is annexed, as a fair sample of the style of work now performed.

22. In compliance with an application made by myself some time ago, the Right Hon'ble the Secretary of State sent out from England during the past year Mr. White, a Chromo Printer, for the purpose of tinting our maps on the stone, to save the great labor and delay of coloring by the hand. Mr. White was engaged in England on a salary of £7 per week, or Rs. 300 per mensem, and he arrived here on the 27th July last. His qualifications are those of a Mechanical Printer only. He is no draftsman or artist and understands nothing more than his own immediate work of printing, the style of which is unexceptionable. I regret to add that his health failed so much as to compel him to return to England under medical certificate, and by the orders of Government cited in the margin, he was granted leave for one year under the ordinary Uncovernanted Absentee Rules, and he quitted India on the 23rd March last.

Military Department, No. C55, dated the 17th March 1864.

23. The inadequacy of the Staff of my Ministerial Office in its several branches, to cope

Revision of Ministerial Office.

discussed during the past year in

*Surveyor General to Military Department, No. 23, dated 11th April 1864.

Chief Military Finance to Military Department, No. 511, dated the 24th July, with Docket No. 480, dated 20th August 1864.

Surveyor General to Military Department, No. 76M, dated 15th October 1863.

with the perpetually increasing nature of the Executive Surveys, as alluded to in para. 19 of last Report, has been fully the correspondence as per margin.* The representations I therein made were admitted by the Chief of the Military Finance Department, to prove that some addition was necessary to the existing establishment, but he advised that a thorough investigation should be made into the office business and arrangements of my Department, before any satisfactory report as to the increased means to be allowed could be drawn up.

24. Consequent on the above recommendation the Government of India in the Financial

Special enquiry.

Department directed a special enquiry to be made with a view of placing my Central or Ministerial Office on a better footing, and also for giving a systematic organization to the whole Department. For this purpose Lieutenant Colonel Dickens, of the Department Public

Proceedings No. 5980, dated 3rd December 1863, also No. 6334, dated 21st December 1863.

Received with Military Department, Docket No. 704, dated 29th December 1863. *

Works, was appointed in December last, in communication with myself, to carry out the investigation which has for some time past been going on. Pending the consideration and final orders on the report which this Officer will, in due

course, submit, the pressing difficulties we labor under which I brought to the notice of Government a year ago must not only continue, but increase in proportion with the expansion of the Executive Surveys as above described. The elaborate enquiry which Colonel Dickens is making has entailed considerable extra labor on my existing Establishment, but his wants and requirements have been cordially responded to.

25. During the past year I proceeded on a tour of inspection of certain Survey Parties

Tour of Inspection.

* Paras. 46, 47, 48, 140, 141, 142.

both Topographical and Revenue, the results of which will be found detailed in the paras. noted in the margin.* I place great importance on the advantages of frequent personal communication with the Officers of my Department. The Revenue Parties visited are reported on in my separate report on that branch of the Department. During my absence from the Presidency the charge of my Head Quarter Offices devolved on Lieutenant Colonel Gastrell, the Boundary Commissioner of Bengal and Behar, who conducted all the current duties ; and I am greatly indebted to this excellent Officer for the cordial and efficient aid he rendered me.

26. The business connected with the sale of maps to the public has continued to entail very heavy and responsible duties on this Office, for which adequate establishment has never existed. The accounts and cash transactions involved have now risen to such a degree as to preclude the possibility of my continuing to carry them on longer ; and I have, therefore, under

* Home Department, No 1365, dated 31st October 1855.

the authority of a former order of Government,* made over all sales of published maps to the Calcutta booksellers, from

the commencement of the ensuing financial year, from which date cash transactions, it is hoped, will cease. All applications from officials *bonâ fide* on the public service will be supplied as usual from this Department ; a notice to the above effect has been published in the Government Gazettes and public papers. The account sales of maps are rendered in the Civil Department, and appear in the Report on the Revenue Surveys.

27. The annual despatch of geographical materials to the India Office, for the year ending

Despatch of geographical materials to England.

* Statement A. with letter to Military Department, No. 21, dated the 31st March 1864.

Atlas Sheets completed Nos 15, 16, 29, 106, 108, 115.

Portions of Nos. 1, 9, 54, 55, 72, 73, 74, 107.

31st March 1864, as per margin,* is a very large one containing many valuable Charts of the Great Triangulation, and materials for the entire, or partial completion of the Sheets of the Indian Atlas as specified, besides copies of the District and other general and miscellaneous Maps lithographed at this Office. These, together with the materials previously transmitted for Nos. 17, 28, 30, 31, 119 and 120, all of which are still unpublished, will, it is hoped, receive the earliest possible attention of the Geographer,

as the wants of India for good maps are of the most pressing nature, and severe disappointment is felt by the public in these days of progress, and investment of capital. My anxious attention is always directed to the early transmission of the results of the Survey of India to the Geographer in England, and by the ever zealous and efficient exertions of Mr. James, the Head Assistant and Chief Draftsman of this Office, the work is turned out in a manner which reflects credit on himself and on the Department. Mr. James' services continue to afford me the highest satisfaction.

28. The Budget for the Financial year of 1864-65 amounts to the sum of Rs. 5,94,966

Departmental Budget, Military and Civil Estimates.

TITLE I.		Rs.	As.	P.
1. Surveyor General's Department, Central Ministerial Office, including Correspondence, Drawing, Lithographic, Photographic, and Observatory Branches	...	1,27,105	0	0
2. Mathematical Instrument Establishment	...	26,893	8	0
3. Topographical Surveys 8, Executive Parties	... ..	4,40,967*	9	10
Total ...		5,94,966	1	10

* Susceptible of some reduction as regards Pegu.

as detailed in the margin. This is exclusive of the Trigonometrical and Revenue Branches. It was decided by the Government of India, in Proceedings No. 1140 A, dated 11th December 1862, and of the Board of Audit in No. 217, dated the 2nd January 1863, that the charges of the Trigonometrical and Topographical Surveys should remain as heretofore in the Military Estimates, but that the Salary and Office Establishment of the Surveyor General, and the charges of the Mathematical Instrument Maker's and the Lithographic Departments are to be adjusted in future as Civil charges. The Estimates for the above items having hitherto been entrusted to the Military Finance Department for revision, it was declared desirable by the Board of Audit that they should continue to be audited in the Military Department as at present, but that they should not in future appear in the Military Budget, but be forwarded after revision by

the Chief of the Military Finance Department to the Accountant General to the Government of India for entry in his General Budget Estimate, in accordance with previous practice. The Bills are therefore now audited in the Military Department and passed as a Civil charge, for payment from the Government Treasury at the Bank of Bengal.

29. The Estimates for the Executive Topographical Surveys are made on the full

Difficulty of working up to Estimates.

strength, or authorized maximum grant for each Party, but it is not possible always to work up to full strength or the

allowed means, owing to the particular nature of the work, and the precariousness of the Subordinate Agency, as well as the great difference in local circumstances affecting each Party. The object aimed at is, of course, to make the actual expenditure and the Estimates as identical as possible, but with Survey operations carried over such diversified countries, the expenditure and economical working of the several Establishments must depend greatly on the nature of the work to be performed, as well as on climatic and various other considerations, which necessitate the strength of Field Parties to be varied. Some allowance ought, therefore, to be made when reviewing and comparing the actual expenditure with the Estimates of so peculiarly constituted a Department.

30. The Mathematical Instrument Workshop and Depôt which is so useful an appendage

Mathematical Instrument Depôt and Work-shops.

of this Department, and under my superintendence, has recently suffered a most serious loss, which I deeply regret,

in the death on the 11th February 1864 of the respected Seid Mohsin, who for 40 years had served in the Survey Department, and as Mathematical Instrument Maker. The mechanical abilities and perfect knowledge of all Departmental Instrumental requirements, of this faithful and efficient old servant of the Government were held in high repute, and his place cannot be filled by any Member of the Department, either European or Native, possessing the required mechanical qualifications; and I believe there is no one likely to be found in this country fit for such a situation. I have therefore submitted my recommendation that a suitable Instrument Maker may be sent out from England on the same footing and terms as Mr. Barrow, who formerly held the appointment when Sir George Everest was Surveyor General.

31. The extension of the Topographical Surveys has created a great demand for qualified Assistants for transfer to the new Parties, and for suitable candidates to fill up the vacancies in the lower grades.

Vacancies of Sub-Assistants.

At the present date, there are 13 vacancies in the regular Establishments, as provided for in

No. 1 Party	...	...	2
" 2 "	...	...	1
" 3 "	...	...	0
" 4 "	...	...	1
" 5 "	...	...	1
" 6 "	...	...	3
" 7 "	...	...	5
			<hr/>
			13
No. 8 Party	...	..	5
			<hr/>
Total	..		18

Budget, (detailed in the margin ;) and if the Pegu Survey is to be raised to a similar strength, and placed on a par with all the others, then five more will be necessary. These vacancies are recruited as fast as circumstances will permit, but the required qualifications, mental as well as physical, are very difficult to obtain. I am happy however, to be able to state that I have four promising young men now in the Office as Apprentices, who are qualifying themselves in draftsmanship,

and who may be expected to be ready to join a Survey by the ensuing field season. The prospects held out are now of an improved character, and we have a right to expect superior qualifications.

32. The specification of the details regarding each Executive Survey Party is as follows :—

EXECUTIVE SURVEYS.

No. 1, TOPOGRAPHICAL PARTY,

Gwalior and Central India Survey.

33. The entire Party of the strength marginally noted started from Recess Quarters about the beginning of October, reached Dholepore on the

Season 1862-63.

Lieut. Col. D. G. Robinson, R. E.,
Superintendent.

Lieut. G. Strahan, R. E., Assistant
Executive Officer.

Lieut. R. V. Riddell, R. E., Assistant
Executive Officer (doing duty.)

Mr H. Horst,
" J. Baness,
" H. J. Holst,
" G. P. Chill,
" E. S. P. Atkinson,
" W. Chapman,
" J. H. Hussey.

NATIVE SURVEYORS.

Abdool Sumad Khan,
Joala Pershad,
Kalka Pershad.

the 20th, and resumed work in the Gwalior State on the 22nd of the same month. Fever prevailed in Camp chiefly amongst the Native Establishment for a month after taking the field, owing, it is believed, to the variation of temperature between the days and nights, which, during the months of October and part of November, is very marked. It has often been observed that the too early taking the field with large Establishments for Survey duties entails a great deal of sickness, and proves far from advantageous towards effecting a good outturn.

34. The operations of the season extended through portions of the Native States of Dholepore, Kerowlee, Gwalior and Dutteah. Owing to the Triangulation having been well advanced during the two former seasons, Lieutenant

Disposal of the several field parties.

Colonel Robinson devoted his time, on first taking the Field, to instructing his Military Assistants in plane tabling and the delineation of ground. Lieutenant Strahan's artistic skill and natural talent for Drawing enabled him very soon to master this portion of his duties ; he was then left to finish the section of ground allotted to him, instruct his Native Surveyors, and afterwards to take part in minor Triangulation. Lieutenant Riddell, temporarily placed on this Survey for the special object of deriving his first instruction from the best School, although he suffered from repeated attacks of fever, made fair progress and completed the Survey of the ground apportioned to him. The field work of both these Officers was inspected by the Superintendent during the month of December, and was favorably reported on.

35. After having fairly started the several detail Parties, and seen all his Assistants properly at work, Lieutenant Colonel Robinson commenced Triangulation and inspection of field work, Lieutenant Strahan, who had completed his Section of details, also joined the Head Quarters Camp with the view to receive instruction, and take part in the Triangulation ; the final observations for the net work of secondary triangles was now taken up, extending South to the parallel of 25° and West as far as the

Koonoo River on the meridian of $77^{\circ} 15'$, and an area of 2,560 square miles, carefully covered with a suitable number of points for future detail operations.

36. On working up towards the Koonoo River, the dense forests adjoining which one of the Native Surveyors had failed to penetrate, Lieutenant Colonel Robinson carefully reconnoitred the ground, and

Local difficulties.

reports as follows:—

“In the interim I had done a large amount of Triangulation and reconnoissance and came to the conclusion that it would be an enormous waste of time and money to attempt to carry the Triangulation across the wooded plateaus on the Koonoo River at present. After the triangulation has been carried round it, perhaps it may be feasible to carry the Triangulation over it, or at any rate to fix a number of points by means of observations taken with a reflecting Instrument, from the tops of bamboo platforms (machans) placed on the tops of trees. The top is so flat, and the trees so high, that it seems almost useless to attempt to build towers and clear rays, and at same time the plateaus are so intersected by enormous ravines or valleys, that it would be almost impossible to do anything by mere traversing with chain or perambulator, though doubtless these means will be of assistance in places where the grass has been burnt. Again, until the weather gets quite warm, the grass is so high, that a Surveyor is almost buried in it, and for this reason, let alone the numerous wild animals, they ought to have elephants, &c.”

37. The country south, south-west and west of Gwalior, or the highlands intersected by the Sank, Asan, Kooaree, and Koonoo rivers, appears to be about the most difficult for Survey operations that can well be imagined. The plan suggested of working round the Koonoo Plateau, and then endeavouring to pick up by points within it, is the only one likely to be feasible; the plateau is extensive and it must be dealt with cautiously, with reference to malaria, and risk to life. The experience and knowledge of the Surveyor himself can alone enable him to master such difficulties, which have been well discussed between Colonel Robinson and myself, and I have every trust that the energy and skill of the Surveyors will be sufficient to overcome them.

38. Without Elephants of course such tracts cannot be penetrated with any degree of safety. An ample supply of such animals is therefore absolutely essential, and it is satisfactory to find that, under the special provision made in the Foreign Department letter cited in the margin,* Elephants may be borrowed from the Native Chiefs in the furtherance of the

* No. 635, dated 31st December 1863.

Survey of their respective States.

39. On the 20th of March Lieutenant Colonel Robinson obtained a month's privilege leave on Medical Certificate, owing to the general state of his health, which had been much shaken by a most serious accident from the discharge of a Rifle, the ball from which penetrated his right hand, and forced the Superintendent to seek Medical aid at Etawa. He consequently made over charge of the field work to Lieutenant G. Strahan with the following directions:—

“My instructions to Lieutenant Strahan, as regards the Triangulation, were to work down to Latitude 25° , re-measuring the great triangles of the great Arc series on four zeros, if the weather would permit of it; if not, to confine himself to covering the ground with secondary triangles, based on the old great arc Stations, taking the centres of the platforms or ruins as representing the centre of the Stations at all those places where the Stations had been destroyed.”

40. These instructions were carried out in the following manner, as described by Colonel Robinson:—

“The weather was hot when I left Camp, and soon became too hazy to admit of his doing more than fulfilling the second part of the instructions; and that he did with so much difficulty, and he suffered so much from the exposure, that ever since his health has been in a very bad state.”

41. The state of Lieutenant Strahan's health is very much to be regretted, and the more so as his services just at present are much required owing to the transfer of the charge of the Party by Lieutenant Colonel Robinson to Captain A. B. Melville, Assistant Surveyor from the Kashmir Survey, on the 10th November last. Lieutenant Strahan's professional knowledge and experience in the District under Survey is of great value; and I am happy to be able to state that he is now improved in health and likely to remain at his post.

Field work completed. 42. The nature and amount of work completed is as follows:—

	Square Miles.
Triangulated in advance ...	... 2,560
Secondary triangles ...	... 55 Completed.
Second Class triangles ...	... 64 „
Minor triangles ...	... 282 „
Heights ...	... 12 „

43. The Topographical details completed, in addition to the Triangulation in advance, amount to 3,457 square miles, consisting of the eastern portion of the Gwalior State, as far as the meridian of 78°, and down to about the parallel of 25° 30'. This area effected by the several Assistants, in the proportion as per margin, has been completed with the utmost accuracy and minuteness that plane tabling is susceptible of. The area is moderate for so strong a Party, but several of the hands were new to the work. As the Junior Surveyors gain experience I have little doubt that the future outturn will increase considerably. Atlas Sheets Nos. 68 and 69 have thus been filled up completely, and portions of 50 and 51 have been also done. New editions of the two former may now be published.

Area topographically surveyed.	Square Miles.
Lieutenant G. Strahan ...	... 148
„ R. V. Riddell ...	... 296
Mr. H. Horst ... ..	... 415
„ J. Baness ... ..	... 600
„ H. J. Bolst ... ..	... 208
„ G. P. Chill ... ..	... 326
„ E. Atkinson ... ..	... 522
„ J. H. Hussey ... ..	... 297
„ W. Chapman ... ..	... 208
Native Surveyor Abdool Samad Khan ... ..	... 140
Native Surveyor Joala Pershad ...	... 297
Total ...	... 3457

Recess Duties. 44. The records completed during the Recess are as follows:—

- Entire computations up to date.
- General Report Volume, fair copied, and completed.
- Copies of Angle Books 12 Originals.
- Village Registers 10 „

CHARTS AND MAPS,

ORIGINAL FIELD SECTIONS—27 SHEETS.

- Scale 1 mile = 1 inch. {
- No. 1.—Chart of Triangulation, showing the Principal, Secondary and Minor Stations of the Gwalior and Central India Topographical Survey; season 1860-61-62-63.
 - No. 2.—Chart showing the arrangement of the Principal, Secondary and Minor Triangulation, and of all the intersected points to illustrate the General Report Volume.
 - Degree Sheet No. 1.—Parts of Gwalior, Dholpore and Dattiah States. Scale 1 mile = 1 inch.

- Scale 1 mile = 1 inch.
- Sheet 1.—Part of Gwalior Territory, size 20 minutes of latitude by 30 minutes of longitude.
 - „ 2.—Parts of Dholpore and Gwalior Territories, size 30 minutes of latitude by 30 minutes of longitude.
 - „ 3.—Parts of Gwalior and Dattiah Territories, size 30 minutes of latitude by 40 minutes of longitude.
 - „ 4.—Part of Gwalior Territory, size 30 minutes of latitude by 30 minutes of longitude.
 - „ 5.—Parts of Dattiah and Gwalior Territories, size 30 minutes of latitude and 30 minutes of longitude.
 - „ 6.—Parts of Gwalior and Dattiah Territories, size 30 minutes of latitude by 30 minutes of longitude.
 - „ 7.—Parts of Dholpore and Gwalior Territories, size 30 minutes of latitude by 30 minutes of longitude.

45. Of the above, all have been safely received in this Office with the exception of

Sheet 6,* which the Superintendent has retained for a time owing to two small detached portions of the Dattiah State,

which could not be completed during the past season.

* Since received.

46. Under the orders of Government as cited in the margin†, I proceeded in the month

of May last to inspect this as well as other Parties, both of the Topographical and Revenue Branches. I had frequent opportunities of visiting Lieutenant Colonel Robinson's Office

† No. 229, dated 9th April 1863.

Inspection of the Party.

at Landour, where I entered into all the details of work which were going on, and I am able to express my entire approval of the manner in which the season's work has been carried out, the Triangulation and Topography laid down, and the maps and computations brought up.

47. The whole of the past and future operations were fully discussed and explained by the Superintendent, in connection with the records of his Office, which I found in systematic order. The District under Survey presents many obstacles both physical and political, and it is very difficult to make more rapid progress in consequence. But the several measures which we concerted together for future guidance may, I trust, have the effect of alleviating some of the obstacles besetting the Surveyor's path. The Superintendent carries on his political relations with the Authorities and the Durbar of Scindhia with great judgment and success. It is most satisfactory to find that the Survey operations have thus far gone over the territory without any complaints against the Establishment.

48. My inspection gave me a most favorable impression of the steady business-like habits of the whole Party. Lieutenant Colonel Robinson is most indefatigable in imparting instruction to all his Subordinates, and in setting them an example of zealous interest in the work. The execution of the maps, and the masterly delineation of the Topographical features, is in the usual style of this Officer, and afforded me the greatest satisfaction.

49. These maps well sustain the reputation of the Party, which boasts of several very accomplished Draftsmen, whose labors it is a great pleasure to witness. Messrs. Baness, Horst and Bolst are entitled to

Opinion of Maps.

honorably mention for the clearness and beauty of their drawing and printing. The Topographical Drawing turned out by this Establishment partakes of a standard degree of excellence, and I believe is not to be excelled by any other Survey or Country. This result is due to the finished instruction imparted by the Superintendent, who spares no pains in setting before his Subordinates his own knowledge and power of execution.

50. The special requirements of Photograhy, in the preparation of these Maps, have not been forgotten. This adds greatly to their value ; and I am now engaged in reproducing them, as well as reducing the scale by the Photographic process in this Office, with the view of placing such valuable records, to immediate practical use ; and I hope to have some good impressions printed from the negatives before this Report can be copied, and they will be duly submitted for the inspection of Government.

51. The general report of all the computations for the three seasons which this Survey has been in progress having been brought up and rendered, the outturn is most satisfactory and creditable to the Superintending Officer as well as his Assistants. The Party consequently takes the field this Season without any arrears, a point of great importance, and the more so, under the circumstance of Lieutenant Colonel Robinson having been relieved by another Officer.

52. The total area surveyed, total expenditure and average cost per square mile of Survey are as follows :—

Triangulation, Square Miles.	Topographical details in Square Miles.	Expenditure for the Season 1862-63.		Average cost per Square Mile Final Survey.	
		Rs.	A. P.	Rs.	A. P.
2,560	3,457	65,852	14 0	19	0 9

The average rate here shewn of 19 Rupees a square mile on the completed area alone is considerably lower than the true rate of the prior season 1861-62, which was recorded on the combined area of Triangulation and details, instead of on the completed area alone, as alluded to in the Tabular Statement, para. 6. The cost is still higher than that of other Surveys, for the reasons given in para. 69 of my last printed Report, which still hold good. A fairer comparison can be made after a few seasons' more work, as time has scarcely been allowed yet (only three seasons' work since Gwalior was commenced) to arrive at the lowest average.

53. At the commencement of the season under review, the Gwalior and Central India Survey largely contributed towards the formation of the Civil and Native Establishments for the Rewah Topographical Survey, and has thus been deprived of the valuable services of several efficient hands, who, had they worked with the Gwalior Party, would have largely contributed towards increasing the area surveyed in detail, and assisted also in instructing the new hands.

54. Again at the commencement of the present season, additional aid was granted of two Sub-Assistants* towards the nucleus of the new Party for the Cossyah Hills, and two new Sub-Assistants have been posted to do duty for the Season to learn their Field duties prior to joining the Hyderabad Survey. These circumstances involve extra expense, without giving a fair return of work, and hence the Gwalior Survey, as the best training School for the Department, must receive some allowance or consideration for the great benefit it confers. The cheerful assistance rendered at all times by Lieutenant Colonel Robinson towards equipping new Parties, for which purpose he gives up trained men and thereby weakens the efficiency of his own Establishment, is most praiseworthy, and entitles this Officer to my warmest acknowledgments.

55. For the character and style of the Survey, the cost is within reasonable limits ; the results produced are very valuable, and will bear the test of time. I must express my sense of the good service rendered by Lieutenant Colonel Robinson in achieving the results now recorded, as well as of the zealous exertions made by the whole Party to map and compute the work, so as to be able to bring up the General Report for three seasons, and to finish all the Maps, both 1 Inch and $\frac{1}{4}$ Inch.

56. The Superintendent records in his Annual Report his high opinion of the abilities and exertions of his Military Assistant, Lieutenant George Strahan, and I am fully satisfied from personal knowledge, that it is well deserved. The part taken by the Assistant, both in Triangulation and Plane Tabling, is very creditable to him; he is an Officer of the highest promise and merit. The Civil Assistants and Junior Sub-Assistants have likewise worked well and zealously, and the three mentioned in the margin* are entitled to commendation for the aid they have rendered during the season.

Military Assistant.

* Messrs. Horst, Baness and Bolst.

57. The programme of operations for the present season is to extend a net work of triangulation, first-class Secondaries to the North-West with the Rahoon Meriadinal Series of the Great Trigonometrical Survey. This Triangulation will be limited by the meridian of 76° East Longitude, and Northward by the boundary of the British Districts of the Delhi Division, and it provides for the whole of Sheet No. 50 of the Indian Atlas, and a considerable portion of Sheet No. 51.

Proposed work for 1863-64.

58. The Topographical details will be filled in, on the Sections South and South-West of the area performed last season, working South in Scindhia's Territory, and West in Kerowlee in Atlas Sheet No. 51.

59. By the Orders of Government specified in the margin, the Executive charge of this Survey has changed hands temporarily, Lieutenant Colonel Robinson having been nominated to officiate as Superintendent of the Great Trigonometrical Survey, in the room of Major Walker, proceeded to Europe on duty. The loss of the services of so experienced and able an Officer as Lieutenant Colonel Robinson must be severely felt, and especially at a time when there is a demand for qualified Officers to undertake new Surveys. Captain A. B. Melville, Assistant Surveyor with the Kashmir Survey, has been appointed to officiate during Lieutenant Colonel Robinson's absence, and he joined on the 10th November last, and is now conducting the current duties. With the able assistance of Lieutenant G. Strahan, and so efficient a Party, I have every hope of Captain Melville doing full justice to the task before him.

Change of Executive Officer.

G. O. G. G. No. 147 A, dated 2nd October 1863.

G. O. G. G. No. 674, dated 16th November 1863.

60. With the view of providing in a more rapid manner for the Survey of the very large area comprising the various Native States in Rajpootana, as detailed in my last report, the nucleus of another Party has been authorized by the orders cited in the margin,* to be raised during the current professional season, and to work in combination with No. 1 Party under the same superintendence, with the view of a complete establishment being formed next year, and for which provision has been made in my Departmental Budget. The funds necessary to meet the extra expense for the current financial year, or up to the 30th April next, are to be met from the existing Departmental Budget.

* Military Department, No. 771, dated the 26th September 1863.

61. The Gwalior Establishment has consequently been recruited as far as possible for the present season, but great difficulties have been experienced in finding a sufficient number of likely candidates for Sub-Assistants to meet all the existing requirements, and it must take time to train up the Subordinate Staff, for so many Parties.

62. Lieutenant Charles Strahan, Royal Engineers, a most promising young Officer, has been appointed as the Military Assistant, and joined early in November, in time to accompany the Party to the Field, where he is now undergoing instruction, and taking an active part in the operations, under his brother's excellent guidance.

G. O. G. G. No. 606, dated 26th September 1863.

63. In the Appendix will be found a copy of the Superintendent's Triennial Report, or Introduction to his first Volume of the General Report of this Survey, which has just been received. It contains useful information which it is most desirable thus to place on record in print.

No. 2.—TOPOGRAPHICAL PARTY.

HYDRABAD SURVEY,

Season 1862-63.

64. After the completion of all Recess duties, the Party, as shewn in the margin, started from Ellichpore in the middle of November. Mr. Mulheran,

James Mulheran, Esquire, Executive Officer in charge.

Mr. Andrew Chamarett, 2nd Civil Assistant.

Mr. J. B. Smith, 1st Class Sub-Assistant.

Mr. R. Daly, 2nd Class Sub-Assistant, (deceased.)

Mr. R. D. Farrell, 3rd Class Sub-Assistant.

Mr. A. Chennell, 3rd Class Sub-Assistant, (Probationary.)

with Messrs. Chamarett, Chennell, and a Native Surveyor proceeded to the Makalgandi Pass in Latitude $19^{\circ} 33'$ Longitude $78^{\circ} 41'$ to extend the principal Triangulation east and south towards Sironcha and Ramgir, while Mr. Smith, with the rest of the party, marched to take up the Topographical details in continuation of the work of the former season, situated within the Pergunnahs named in the margin*, and to complete some minor triangulation required to furnish points for the detail Surveyors.

NATIVE SURVEYORS.

Ramchunder.	Janardanrao.
Pandarrao.	Mypatrao.
Baparrao.	Sheikh Omar.

* Pergunnah Kinwat.

"	Gurj.
"	Utnur.
"	Rajur.
"	Both.
"	Kosmet, and
"	Chund.

* Under orders of Government, dated 19th September 1863.

65. In para. 111, page 26 of my printed Report for Seasons 1860 to 1862, I mentioned that the effective strength of the Party had been much reduced by the retirement of Mr. Leigh upon Superannuation Pension,* the transfer of Mr. McGill, Senior Sub-Assistant to the Chota Nagpoor Division Survey, and the death of Mr. Daly. To fill these vacancies, all of which occurred at the beginning of the field season, when it was too late to make any arrangements to strengthen this Survey, only one suitable candidate could be found near

at hand, Mr. A. Chennell, and he was appointed as Probationary 3rd Class Sub-Assistant on the 10th November 1862.

66. On arriving at the H. S. of Pipardara, near the head of the Makalgandi Pass, considerable delay and difficulty was experienced in fixing sites for the Stations in advance, owing to the peculiar nature of the

hill ranges in the vicinity, nearly all of which run parallel to each other, are perfectly flat at the summit, and covered with high and dense forest. On overcoming the chief difficulties which appeared, Messrs. Chamarett and Chennell were detached with instructions to complete the Secondary Triangulation West and South of Sironcha, near the confluence of the Pranhita and Godavery Rivers, or West of the meridian of 80° . This duty was well and speedily performed by Mr. Civil Assistant Chamarett, and he then crossed the Godavery and triangulated the Sironcha Pergunnah.

67. Mr. Mulheran, after experiencing many serious difficulties, all of which were overcome with great tact and judgment, succeeded in extending the principal Series up to Sironcha and fixed approximately some Stations in advance South and West of Sironcha, by which a junction will be effected with the Triangulation in the Nizam's dominions, executed in 1819. It was in this neighbourhood that Colonel Everest and his entire Party, in October 1819, were laid prostrate by jungle fever, and forced to fall back on Hyderabad. (a) Although Mr

(a) This locality is thus described by Colonel Everest:—

"Account of the measurement of an arc of the meridian between the parallels of $18^{\circ} 3'$ and $24^{\circ} 7'$ London 1830.

"On the 2nd October, in the evening I found myself laboring under the effects of a violent typhus fever. Mr. Voysey was seized very soon after; within the next five days the greater part of my Camp (nearly one hundred and fifty in number) were laid prostrate, and it seemed indeed as if at last the genius of the jungle had risen in his wrath to chastise the hardihood of those rash men who had dared to violate the sanctity of his chosen haunt." • • • •

"But the jungle fever pursued my Party like a nest of irritated bees, long after we had quitted the precincts of the forest, and on arrival at the head quarters of my unfortunate followers, it appeared that not one individual had escaped the fever, and that fifteen of their number had sunk beneath its severity, and been left to perish miserably by the roadside."

Mulheran's Camp entered the tract at a time when the forest is generally considered safe, it narrowly escaped the same disastrous fate, and it was only by a rapid retrograde movement on Sironcha, where medical aid was procurable, that the Surveyor succeeded in extricating his Party with the loss of only one man.

68. The total area actually covered by Principal and Secondary Triangulation of the season amounts to 5,769 square miles, of which 1,436 square miles *Area triangulated.* has to be deducted for secondary work completed, and for which credit was taken during the season of 1861-62, but over which the principal series only was extended during the season 1862-63. Extracts from the Surveyor's Narrative Report for the season are given in the foot notes. (b)

69. The Triangulation of this deadly tract, including some of the worst portions of the Atmur, Manikgurh, Nirmul and Ramgeer forests, all more or less deserted, is a subject for hearty congratulation, but I still look forward with considerable anxiety to the filling in of the detail Survey of these parts, during which time the Surveyors will be compelled to plod carefully through the forests, and their stay within them must of necessity be protracted.

Results of Triangulation. 70. The outturn of work for the season under review is as follows :—

12 *First Class Triangles.*

Average error per Mile will be given as soon as the connection with the old Triangulation is completed.

54 *Secondary Triangles.*

Average error per Mile = 2.76 Inches.

34 *Second Class Secondary Triangles.*

Average error per Mile = 2.52 Inches.

211 *Minor Secondary Triangles.*

Average error per Mile = 6.48 Inches.

36 *Heights.*

(b.) *Para. 35.* The greater portion of the tract through which the principal Triangulation has been extended is poorly populated, and overrun with unhealthy forest. The portion triangulated by Mr. Chamarett South of the Godavery and as far East as the station of Kondaram, is extensively cultivated, the population consisting principally of people of the Telegu Caste. The cultivation consists chiefly of Rice, and the short Jowari known as Dadri. The former is reaped twice in the year, being irrigated from tanks beow which the fields are situated. The latter is reaped in March, and is considered by the people to equal wheat in taste.

Para. 36. The whole of the Sironcha Pergunnah is covered with heavy forest. The inhabitants belong chiefly to the tribe of Gothals, and resemble the Gonds in dress and appearance, being excellent woodsmen. Both men and women are scantily clad, and excessively fond of colored beads, which they wear round their necks and arms. All are more or less addicted to drinking, but are civil and obliging in disposition.

Para. 37. The portion of country triangulated by Mr. Smith embraces the whole of the Kinwat Pergunnah, as well as portions of the Pergunnahs of Kosmot, Both, and Chand. The entire tract is poorly populated, and overrun with unhealthy forest, similar to that adjoining the Manikghar range, of which the upper plateaus south-east of Pipargao are a continuation.

Para 38. The whole party has suffered more or less from exposure in the unhealthy forest in which they had been employed. All however, excepting Native Surveyor Mypatrao, have, I am happy to say, recovered, and will leave Elichpore as soon as carriage can be procured, in progress to Jangao and Chinnur.

71. The Topographical detail Parties filled in an area of 2,333 square miles of difficult, raviny, hilly, and forest covered ground, as shewn in the margin.* Before returning into Recess quarters, the Party also completed the Survey of 296 linear miles of boundary between Bisnur and Bassim, which was omitted in the old Hyderabad Survey under Major Brown, and to which I referred in para. 113, page 26 of my last printed Report. This was necessary to form a proper and complete junction between the old and new Surveys and to render the Maps complete.

Area Topographically Surveyed.		Square Miles.
* Mr. J. B. Smith		... 423
" R. D. Farrell		... 280
Native Surveyor Ramchunder		... 380
" " Pandarao		... 330
" " Baparao		... 360
" " Janardanrao		... 280
" " Mypatrao		... 280
Total		... 2,333

72. Several members of the Party suffered from relapses of jungle fever during the Recess duties.

†13 Principal Triangles.	
297 Secondary Do.	
20 Deductions of Lats., Longs. and Azths., Principal Stations.	
296 Deductions of Lats., Longs. and Azths., Secondary Stations.	
21 Deductions of Heights, Principal Stations.	
47 Do. Do. Secondary Do.	

Of these, the documents marked with an asterisk* have been received in this Office, and will in due course be forwarded to England.

73. The total outturn of work, viz. 4,333 square miles of Triangulation, and 2,333 square miles of Topographical details, is in excess of the returns of the two previous seasons, and considering the nature of the country traversed is fair. The total cost and average rate of final Survey are as follows :—

Area, Cost and Rate, and opinion on the Season's work.	Expenditure for the Season 1862-63.	Final Survey in Square Miles.	Average Cost per Square Mile.
Register of Common Sides. * Alphabetical list of Latitudes, Longitudes and Heights of Principal and Secondary Stations. * Four Angle Books. * Two Copies of Registers of Villages of Sheets Nos. 13, 15 and 16, containing Latitudes, Longitudes and Statistical information. Maps Scale 1 Mile = 1 Inch. * Fair—3 Sheets Nos. 13, 15, and 16 of Dewany Mehals. Fair—3 Trace Maps of Boundaries. Fair—10 Copies of Original Plane Table Sections for Record. Scale 4 Miles = 1 Inch. * Fair—1 Sheet, reduction of Sheets Nos. 13, 15 & 16. Do. 1 Do. Do. for Record. Scale 8 Miles = 1 Inch. * Fair—1 Sheet, Chart of the Season's Triangulation.	32,043-2-9.	2,333	13-11-9

This rate or cost per square mile of 13-11-9 on final Survey is well within allowed limits. It is of necessity lower than that of the Gwalior Survey, owing to the peculiar constitution of the Party, and also from the difference in the nature of the country, and the minuteness and accuracy of the details required and attainable in one and not in the other. The Hyderabad rate is somewhat on a par with that of the Ganjam operations, and a little higher than that of the Chota Nagpore Survey, with both of which the style and nature of the Hyderabad Survey may be classed.

74. In consequence of so large a portion of the European Agency having hitherto been employed solely on the Triangulation, it is to be expected that additional power will be put on the details in future seasons, and as the Triangulation is completed in advance, more progress will be made with the final Survey. The area finally completed by this Party is considerably under that of either of the other Surveys, and also below the mean average. It will be the Surveyor's object more nearly to approach the results shown in the General Abstract in future seasons.

75. The mapping executed by this Party has been commented on in my last Report, para. 114. In many respects it does not meet my expectations, and requires considerable improvement, before it will bear a good comparison with the records received from other Surveyors. The basis of this Survey is so well laid out and executed by Mr. Mulheran, that I am the more desirous to see the

Topographical Maps of a higher order. The subject has been fully discussed with the Surveyor, and every assistance in the way of advice and good specimens of Maps sent him.

76. During the current season the Triangulation will be carried through a portion of the Mahore Circar (900 square miles) formerly left unsurveyed, and extended Southward from Sironcha to embrace the Godavery Talooks down to Budrachellum, thus completely covering with Triangulation the unsurveyed Area in the Nizam's Dominions, and all the Upper Godavery Talooks or Districts in the Central Provinces. The Topographical Survey of this last-named tract is considered by the Chief Commissioner very desirable, and as no Revenue Survey Parties are likely to be available to undertake it for many years, and the ground being at present unsuited to expensive and minute Survey operations, I have deemed it advisable to avail myself of the opportunity offered by the proximity of the Hyderabad Topographical Survey to direct Mr. Mulheran to include it in his work.

	<i>Square Miles.</i>
Sironcha	720
Noogoor	160
Albaka	40
Cherla	180
Bhudrachellun	450
Rakapilly	450
Total Square Miles ...	<u>2,000</u>

77. The area of these Talooks is estimated to be 2,000 square miles, and the Surveyor reports that the country partakes of much the same character as that west of the Godavery in the Nizam's Dominions, being sparsely populated, covered with forest, and yielding only a small revenue.

78. With reference to what was stated in the last Report on this subject, the area left for final Survey in the Nizam's Dominions now appears, on a careful estimate, made from all the materials lodged, to be as follows :—

	<i>Square miles.</i>
Area left for final Survey at close of present season (Nizam's Dominions)	6,308
And portion of the Mahore Circar	950
	<hr/>
	7,258
Add Area of the Upper Godavery Districts	2,000
	<hr/>
Square miles ...	<u>9,258</u>

After the close of the present field season of 1863-64, it will no longer be necessary to employ any of the Sub-Assistants on triangulating, and as the Party will be materially strengthened, by filling up all existing vacancies, the annual progress will, it is anticipated, be increased to nearly 3,000 square miles, so that the survey of the above area will in all probability be accomplished in three years more. In making this estimate all professional circumstances have been fully considered, but casualties and unforeseen delays arising from the pestilential nature of the country have not been reckoned upon.

79. The Surveyor reports favorably of all the members of his Party, European and Native, and specially mentions Messrs Chamarett and Smith Assistants. for the ability and zeal with which they perform their duties. Mr. Farrell, 3rd Class Sub-Assistant, having served on that grade for a period of three years, * G. O. G. No. 643, dated 20th October 1863. has been promoted to 2nd class.* Messrs. Ogle and Scanlan, † the former a student of Roorkee College, the latter from the Manor House School at Mussoorie, were selected by myself, as promising candidates, to fill vacancies in this Survey. They have been temporarily posted to the Gwalior Division to learn their work for the present

† G. O. G. No. 587, dated 18th September 1863.

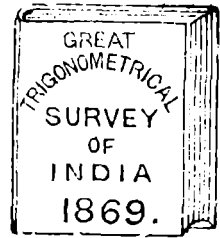
season. Mr. Mayne, a candidate met with at Ellichpore and recommended by the Surveyor, has likewise been appointed a Probationary 3rd Class Sub-Assistant.

80. The success with which the Surveyor has managed to carry his Triangulation, and in taking his Party with comparative safety through so difficult and unhealthy a tract, is deserving of much commendation. Mr. Mulheran, in addition to his other qualifications, is an excellent Photographer, and has produced a series of admirable pictures of groups of the various tribes in Central India, which have met with the approval of the Government of India, as well as of the Right Hon'ble the Secretary of State, and he has furnished a very large number of these Prints, with descriptive Notes. The Photographic views of the rock-cut temples which abound in Berar, taken by this Artist, are most interesting and valuable pictures. The caves of Adjunta and Ellora will be visited during the present season, and from which a rich harvest may be expected.

No. 3 TOPOGRAPHICAL PARTY.

GANJAM AND ORISSA SURVEY,

Season 1862-63.



81. On the 10th December 1862 the Party under Major (now Lieutenant Colonel)

Lieutenant Colonel G. H. Saxton, Executive Officer in charge
 Lieutenant C. E. Armstrong, Assistant Executive Officer.
 Mr. T. Claudius, Civil Assistant.
 „ D. Atkinson, Senior Sub-Assistant.
 „ R. W. Chew, 1st Class Sub-Assistant.
 Mr. J. Harper, 1st Class Sub-Assistant.
 „ F. Adams, } 2nd Class Sub-Assistant.
 „ J. A. May, }
 „ T. W. Bobanau, 3rd Class Sub-Assistant.
Native Surveyors.
 Abdool Rahiman Khan.
 Baboo Ghonasam Banerjee.

Saxton's Command started for the field from Cuttack. The plan of operations for the season under review is fully described in page 36, para. 153 of my last printed Report, viz., the completion of the portion of country required to fill up blanks in the Sheets of the Indian Atlas Nos. 106 and 107, embracing portions of the old Tributary Mehals, Patna, Phuljur, Bodasamur, Karial, and Nyagar, with Kalahandy now attached to the Central Provinces, and a small portion of Chinna Kimediy in the Khond Hills in Ganjam, and the extension of the Triangulation in advance of details westward into the Chutteesghur Division.

82. In placing the Topographical detail Parties over the ground for Survey, every pre-

Preliminary arrangements.

caution was adopted to ensure success; due discrimination being used, in apportioning to each plane table such tracts as were best suited to the experience they had gained in the delineation of ground, and keeping the younger and less experienced hands well within reach of the advice and assistance of the Senior Surveyors.

83. While proceeding to the field of Survey, the Party fell in with Captain Loch, Assistant Commissioner of Sumbulpore, who was about to enter the Khond Mehals in Kalahandy on a tour of inspection. Lieutenant Colonel Saxton availed himself of this opportunity to place under Captain Loch's protection two Sub-Assistants (Messrs. Atkinson and May) to secure the Survey of the ground from which the former Assistant had to retire during the last season, owing to the opposition of several Khond tribes, vide page 33, para. 140 of my last Report.

84. The Surveyor and his Military Assistant then commenced the Triangulation in ad-

Triangulation.

vance and extended it to the meridian of 82° , and up to about the parallel of $21^{\circ}15'$, well into the Ryepore District of the Central Provinces, completing about 5,000 square miles of difficult country, and covering it with 19 principal and 276 secondary points; the heights of 121 principal and secondary points were also obtained by Trigonometrical levelling.

85. Angular measurements for principal triangles were made on four zeros and repeated. For secondary and minor triangles, observations were taken on from one to four zeros, and repeated—

The average error of sides of principal triangles, = 2 inches per mile.

” ” ” of secondary and minor triangles, 1.1 foot per mile.

86. The area of Topographical details completed, which embraces the western portions of Atlas Sheets Nos. 106 and 107, amounts to 3,975 square miles,* by the several Assistants as noted in the margin.

Topography completed.		Square Miles.
* Mr. Claudius		466
” Atkinson		313
” Chew		651
” Harper		403
” May		341
” Adams		574
” Babonau		328
Abdool Rahman		465
G. Banerjee		434
Total		3,975

This outturn is considerably in excess of that of the two previous seasons, and is a most satisfactory season's work for such ground, and as filling up two Sheets of the Atlas of India, the materials are valuable and very acceptable. The accomplishment of such an area, so conveniently and systematically arranged, is very creditable to the Surveyor's management, and to the Establishment generally. The duration of the working season is necessarily short, being only five months,

which includes the time occupied in the march to and from the Field, which in the present instance occupied about six weeks.

87. The total expenditure for the season including all charges is Rs. 52,605-10-8. The average mileage rate on the completed area alone is as follows:—

Total Cost.			Topography completed in Square Miles.	Rate of Survey per Square Mile.		
Rs.	A.	P.		Rs.	A.	P.
52,605	10	8	3,975	13	3	9

This rate on the final or completed Survey is below the average of the two preceding seasons and is very fair.

88. The several detached Parties were inspected whilst at work by the Surveyor and his Military Assistant, and the results are reported to have been most satisfactory. This is an important duty on which I put much stress. The entire programme for the season was successfully carried out in all its details, and even a larger area of topography completed than was required to fill the blanks in Atlas Sheets 106 and 107.

89. A small area of ground covered by Major Saxton's Triangulation has been taken up for the details by Captain Depree's Party, because I was most desirous to make sure of filling up the Atlas Sheets in question, in order to supply the materials to the Geographer in England, with a view to early publication, and the locality was in close proximity to the Chota Nagpore Division work. The credit therefore of this small portion of work, about 880 square miles, will have to be considered as due to both Parties conjointly.

90. The Triangulation in advance altogether still exceeds 6,000 square miles or sufficient to keep the plane tablers in work for nearly two seasons. Lieutenant Armstrong has been instructed in observing and triangulating, so that it is hoped he will be able to take a full share in the current season's Topographical delineation, and thus perfect himself in all the different branches of his profession.

91. During the Recess the entire computations and copies of Angle Books were completed, besides a complete set for the Surveyor's Office. The mapping was also finished up to date, and the Surveyor reports that no arrears exist in his Office. The records marginally noted have been safely received in this Office.

Computations.		
Angle Books ... ..	...	4
Computations of Principal and Secondary triangles ... ..	...	2 Sets.
Do. of Latitudes and Longs. of Do. ... ..	...	2 "
Do. of Heights of Do. ... ..	...	2 "
Register of Heights ... ..	...	2 "
<i>Maps—Scale, 1 Mile = 1 Inch.</i>		
		Sheets.
Fair Maps 15' × 30' ... ..	...	10
Copies for record on vellum cloth ... ..	...	9
Original Plane Table Sections ... ..	...	25
<i>Scale, 4 Miles = 1 Inch.</i>		
		Sheet.
Fair General Map for 1862-63 ... ..	...	1
Chart of Triangulation for 1862-63 with numerical data ... ..	...	1

One set of the computations and Angle Books, together with the fair Maps and Chart of Triangulation will shortly be forwarded to England.

Death of Senior Civil Assistant.

Assistant attached to this Party, who had for some time been suffering from relapses of jungle fever, I regret greatly to state died suddenly on the 7th June last, thus adding another name to the heavy list of casualties, which have occurred on this Survey and to those faithful Servants of the State who have lost their lives, in the steady performance of their duties, owing to the unhealthiness of the climate, as detailed in the Appendix to my last Printed Report. Mr. Claudius had served the Government for upwards of 30 years, was an able Surveyor, well acquainted with the country, and inured to the climate. It will be most difficult to supply his place. In fact, no Civil Assistant from any other Survey can possibly be found, the demand being so great for new Surveys.

Along the Tel River there are extensive tracts under cultivation, and at one place on that River Lat. 20° 19' and Longitude 83° 21' a suitable place has been chosen, for forming a gigantic Reservoir in connection with the works now being undertaken by the Irrigation Company in Orissa. The wild hilly country occupied by the Khonds proper, is completed as far south as my Survey extends, and the mapping progress through the tributary states under Sumbulpoor Deputy Commissionership. These tracts contain many extensive masses of hill covered with jungle, but there are intermediately extensive tracts of plain country, chiefly forest, but capable of high culture. The Patna Rajah's Estate now completely surveyed, is perhaps of all the Gorjats most neglected with regard to its capabilities. The Rajah entirely neglects the improvement of his property. Many of his zemindars hold the best portion of the country and are almost independent of his control.

In Patna there is a range of hills rising to 3,300 feet above the sea on which there is considerable table land. The hill runs north-east and south-west for many miles, wooded except on the top, which is rocky generally. On the western side are beautiful waterfalls in different places, and at foot on same side, there are extensive orange gardens. A temple of considerable importance as a Hindoo Shrine is prettily situated in the village of Norsingnot. If accessible this hill would make a delightful place of resort for the hot months, there being ample space for every kind of recreation and suitable places for making permanent water reservoirs. I was delayed on the hill for a week up to 14th March, when it was quite cool.

In the Phuljer Estate there is a remarkable hill named Siswal, with precipitous rocks on nearly all sides, and an undulating table of some 3 or 4 square miles at an elevation of 2,200 feet above sea level. Many other hills and chains of hill lie within the survey now reported on, but with the exception of the Khond country (the gap of former mapping) there is no inhabited tract above the ordinary level of the country which may be taken at about 800 feet.

Of Rivers the only considerable one is the Tel, on which Irrigation works will be shortly commenced. Further interest is now attaching to this chief tributary of the Mahanuddy, by the value of Teak forests on its bank just beyond the limit of the detail, but within the triangulation area of this season's operations. The timber in these forests has been secured by a European gentleman, and is now being felled.

It will be seen from my Maps that the importance of the Tel River, as to body of water, accrues from the confluence of a number of streams from South, West and North-West. On the North of my Map the most important River is the

94. Baboo Ghonasam Banerjee, Native Surveyor, who had gained much aptitude for Plane Tabling, resigned his appointment for other employment on the 1st October 1863. The Party, thus weakened by the loss of two such highly experienced hands, had the greatest difficulty in completing the large mass of computations and mapping, which were due for the season, and it was only by the most strenuous and increased exertions that all arrears were cleared prior to taking the field again.

95. With reference to what was stated in my last Report regarding the mapping executed by this Survey, I have great pleasure in stating that, during the season under review, marked improvement has taken place. Opinion on Maps. The General Map Scale, 4 Miles = 1 Inch, has been exceedingly well finished. It is a fair specimen of neat and artistic drawing, and shews that every advantage has been taken of the hints and instructions issued for guidance, which entitles the Surveyor to my best thanks.

96. The large Scale Maps (1 Mile = 1 Inch) are likewise much better than the last. There still remains some room perhaps for improvement in the latter, which I have no doubt from the success which has already attended the discussion of the subject with the Surveyor will be effected in due time. The ground under survey is very difficult to delineate accurately, owing to its inaccessibility from being almost entirely covered with dense tree and bush jungle.

97. The entire season's work both in the field and Recess has been very satisfactory, and Good management of Executive Officer. to Lieutenant Colonel Saxton is due the credit of the success which has attended the labors of his Party. His own indefatigable exertions, and the leading part taken by him in all a Surveyor's duties, is most praiseworthy and merits special mention, and to his example and kindly bearing towards his subordinates is chiefly attributable the cheerful manner in which the Sub-Assistants under his orders invariably perform their duties in a very difficult country.

Ong, which flows into the Mahanuddy a short distance above where the Tel joins it. On the Ong exists a most suitable place for forming on a less gigantic scale a reservoir similar to that fixed for construction on the Tel. This spot has not come under the examination of any Surveyor of the Irrigation Company, but has been, and will be further, brought to their notice.

The country triangulated borders immediately on the West of that surveyed in detail. Its chief hill feature is a chain, running North and South for 25 miles with a breadth of some 5 to 10 miles. On the eastern side, the fall into Karrial is by wooded slopes more or less abrupt, with occasional precipitous rocks of immense height. All along the Western side, the rise is by perpendicular rocks, extending uninterruptedly for many miles. This hilly tract ranges from 2,500 to 3,500 feet above sea level, and is almost uninhabited. I passed through a hamlet just below my principal Station of "Katpar;" the few occupants were not to be seen during my stay of a week. About the centre of these hills exists a path out of Karrial on the East, into Nongon on the West. On this path up in the hills on the Karrial side is a small village, and with a few such exceptions, I heard of no other occupants of this wild tract of country, though it was apparently suitable. From the extent and formation of the hills, there can be no scarcity of water, which could be seen in many places, in the lower ground, from my Station of Katpar.

The few inhabitants keep aloof from the people below. They scarcely can be said to cultivate any ground; the little done is without plough or other efficient implement. The only intercourse with the people below is when they bring baskets, with which they obtain their few wants by barter. The northern end of these hills gave shelter to the rebels of the Sumbulpore States, and whilst I was carrying on my operations, the presence of a party of rebels prevented my Signallers occupying a position I sent them to. I was delayed by this cause for a week on Katpar, and after all had to give up my plan of principal Triangulation, and proceeded myself to the locality, and there found that a Police party from Raipore had surprised the rebels, and killed and captured some and driven the others (with the head rebel severely wounded), into the neighbouring State of Patna. I had serious fears as to what had become of one of my Signal parties, being given to understand that where they had been sent was where they would very likely meet with the fugitive rebels, when their fate would be alarming. I sent a party of my Guard under the Senior Officer to trace and follow them up, but was soon relieved by their safe return. In conjunction with the Karrial Rajah I organized an armed party to support my Signallers, who then proceeded into the hills, and I had the satisfaction after all of getting the Heliotrope shewn to me on Stations I afterwards observed on.

At the village of Kotgaon, situated at foot of this range of hills on the south-east end in Lat. about 20° 14' and Long 82° 34' there is a warm spring, from which a considerable stream flows at all times. At the spring is a pool of a few yards diameter, and 5 or 6 feet deep, perfectly clear. At the bottom, the force of the spring is seen in violent action. The temperature of the pool is that of a comfortable warm bath.

Hot Spring.

98. Lieutenant Colonel Saxton reports very favorably of the endurance and good conduct under trying circumstances of all his Sub-Assistants, and specially mentions Messrs. Atkinson, Chew and Adams as deserving praise. During the year those mentioned in the margin* have been promoted to the extent specified.

G. O. G. G. No. 544 dated 27th August 1863.

Mr. J. Harper, to 1st Class.

Mr. J. A. May and Mr. F. Adams to 2nd Class.

G. O. G. G. No. 643, dated 20th October 1863.

Mr. Leonard, Assistant Apothecary in Medical charge of the Party, is also honorably mentioned, for the able and efficient manner in which his professional aid is rendered at all times, as well as for the assistance he has given on various occasions in current Office duties. The Medical services of this gentleman cannot be too highly appreciated, with a large Establishment scattered over such a country as that described.

99. During the current year the detail work will extend in connection with the Topography of the previous season from Latitude 20° to 21° and from Longitude 82° to 82° 45' covering portions of

Programme for the current season.

Karial, Nyagar and Bodasamar, while the Triangulation in advance will be carried Northwards to the parallel of 22°, and connected with the work of season 1861-62 and Southwards into Bustar as far as time and circumstances will permit.

100. The remaining portions of the Gurjat or tributary estates of Orissa lying immediately West of Sumbulpore District, up to the limits of the Belaspore District in Atlas Sheet No. 91 will thus be accom-

Direction of future operations.

plished. From thence Lieutenant-Colonel Saxton will work Southwards, taking up the remainder of the Gurjat estates with Konkeir, and other unproductive tracts situated in Atlas Sheet No. 92, and subsequently Jugdulapoor or Bustar and its dependencies in Sheet No. 93, filling up all the remaining unsurveyed portions of the Ganjam Districts under the Madras Presidency.

The field of my past season's Triangulation contains numerous rocky heights of all dimensions and of most fantastic shape. Throughout my long experience, all the difficult positions I had heretofore seen were not equal to what we had to overcome in this one season.

Difficult nature of ground.

In part this was an advantage, for I found many natural points for intersection, which saved the labor and expense of fixing artificial objects, but the difficulty of getting my Instrument and myself into position practicable for observing, was frequently appalling, and often great part of the time available on a Station was occupied in arranging means of standing and moving round my Instrument. Reaching the Station at all was several times only attainable by series of rudely made ladders and bridges. The physical formation of the tract of country alluded to, adjoining the rich but totally featureless plain of Chutteesgurh, is very remarkable. The separation of the two totally different natures is marked for probably 100 miles by a monotonous slightly elevated line, covered with jungle.

The Rajah of Karrial and Nyaghur the chief owners are, like the generality of Rajahs in Orissa, hopelessly deficient as to any attempt at progress of any kind.

Karrial and Nyaghur.

Rivers.

The only chief Rivers are the Jonk and the Paira, tributaries of the Mahanuddy. Both rise in the hill tract above described, the Jonk running to the North and the Paira to the North-west till they join the Mahanuddy. They have very little stream during the dry season. Several other small streams run into Chutteesghur.

On the extreme South-west of my Triangulation I came to the source of the Mahanuddy at the foot of a small rocky hill on which is Singari rock, 1,834 feet high at a short distance (one mile) my village Station "Sisida" gives the height of the country 1,428 feet above

Source of Mahanuddy.

the Sea. There is no stream from the source during the dry season. The village of Sihoa stands under Singari and is a clean and large place, occupied by apparently well to do people, chiefly Brahmins. There are temples, and Sihoa is a place of resort for Hindoos, who hold it in reverence, and inscribe their names on a large tree. A legendary story ascribes the origin of the Mahanuddy to the accidental upsetting of a vessel of water being carried by a holy monk residing in a cave of Singari rock. A peculiar bend in the course of the stream at the source is said to be caused by the holy man changing his mind, and making the stream return after flowing for a short distance.

No trade appears to exist within the limits of the country surveyed this year, nor is there anything further of much interest to notice in it. Some of the routes between Chutteesghur and the

Trade.

Coast run through, and large droves of Cattle pass, and some of the lines they form are well-beaten tracks, giving capital fair-weather roads. With these exceptions the only road through the country is that between Sumbulpore and Raipore, which passes through the detail done by No. 4 Party, and through the extreme northern portion of my Triangulation.

101. Mr. Babonau, Junior Sub-Assistant appointed on this Survey, has been transferred to No. 4 Chota Nagpore Division, in exchange for Mr. Rayner from the latter. Mr. T. E. M. Claudius, son of the Civil Assistant whose death has been recorded, was appointed a Probationary Assistant on this Establishment to fill the vacancy.

Transfer of Sub-assistants.

No. 4.—TOPOGRAPHICAL PARTY.

CHOTA NAGPORE DIVISION SURVEY.

102. In the month of November 1862, Captain Depree having previously prepared the Hill Stations which he was likely to visit for the season's Triangulation, started on the 1st December with the entire Party of the strength shewn in the margin*, for the Field of Survey in the South-Western Frontier Agency.

- * Captain G. C. Depree, R. A.,
Executive Officer in Charge.
- Mr. G. A. McGill, Senior Sub-Assistant.
- „ J. Vanderputt, 1st Class.
- „ D. Antrobus (on sick leave to
(Europe), 2nd Class.
- „ A. J. Wilson, 2nd Class.
- „ G. A. Wyatt, } 3rd Class.
- „ J. A. Craven, }
- „ R. P. Rayner. }

Draftsmen and Native Surveyors.

- Baboo M. S. Dutt,
- Mr. D'Souza,
- Sheik Abdul Rahman.

Field of Operations.

District of Singbhoom and Chota Nagpore, South-West of the Parallel of the Town of Chaibassa forming a compact block, together with the Gurjat Mehals of Gangpore and Bonai in the Chota Nagpore Division, and portions of the District of Sumbulpore and Gurjat Estates of Phuljur, Raigurh and Sarungurh now attached to the Central Provinces.

103. The programme for the season was as follows; to extend the Triangulation Northwards from the parallel of 23° connecting the Kolhan and Sumbulpore secondary series with the Calcutta Longitudinal and South Parasnath meridional series of the Great Trigonometrical Survey, and Westwards through the Southern portion of the Chota Nagpore District. The detail Parties to occupy portions of the Dis-

104. This latter portion of country is situated at the extreme limits of both the 3rd and 4th Survey Divisions below the Parallel of 22° North Latitude, and although detached from the remainder of the work performed during the season under review by this Party, lies in connection with that executed during the previous season. It being of material importance that this should be got out of hand so as to fill up the long standing blank required to complete Atlas Sheet No. 106, Captain Depree was directed to detach two Sub-Assistants for its detail Survey, on the Triangulation executed previously by Major Saxton. He is therefore entitled to credit for the Topography only, whilst the labor entailed by the Triangulation belongs to Major Saxton.

105. Captain Depree observed his first angles on the 2nd December 1862, and continued triangulating without interruption until the 4th February following. The extracts from the Surveyor's Report given in the foot notes describe the nature and value of this portion of the work performed.

Triangulation.

4th. It having been ordered, that arrangements should be made to continue immediately the Survey of the Singbhoom and Chota Nagpore Districts as the more valuable of the Division. I made it my object to cover with Trigonometrical points the tracts North of 22° 30' and Westward of the Midnapore boundary, and at the same time to fix Stations within and beyond the mutual boundary, to enable the adjoining Revenue Survey to be satisfactorily connected.

Programme of Triangulation.

5th. All the Stations having been prepared during the month of November by the Native Establishment I left Dorundah on the 1st December, and ascended the first H. S. on the 2nd idem, thereby losing not a day of the fine weather in marching out. After ascending the Baragai H. S. I found it necessary to take up Cheinpur H. S., which involved four stages march, out of my own district into Hazar

Narrative of Triangulated Operations.

106. The area triangulated covers 3,010 square miles in Singbhoom and Dalbhoom Districts, and this, added to the Triangulation in advance of Topography at the close of the last season gives a total of 8,250 square miles, so that we have enough ground ready for the detail Parties for more than the next two seasons.

107. The circuit made by this Triangulation from the starting or initial side of the Coast Series G. T. S. to its junction with the Calcutta Longitudinal Series, extends over a distance of about 750 miles. The differences in the linear values and spherical co-ordinates are as follows :—

	Feet.
Side Sukhan H. S. to Bicha H. S. by G. T. S. data ... =	89,540
Ditto Ditto by Sumbulpore and Kolhan } =	89,541
Minor Series }	
Difference	1
Side Ledasal H. S. to Dalma H. S. by G. T. S. data ... =	1,13,055
Ditto Ditto by Chota Nagpore } =	1,13,059
Triangulation }	
Difference... ..	4

recbaugh. The platforms and upper marks of these Great Trigonometrical Survey Stations were found intact, and when no longer required they were re-covered with piles of stones. The Station marks of Ledasal and Matiabandi were also thus identified and protected. Trigonometrical operations were continued without interruption until the required objects were attained, the last observations being taken on the 4th February. Two months and three days were thus employed in the Triangulation, during which I remained stationary one day only. The observations were all taken by myself assisted by Mr. Rayner as recorder, who joined a few days before taking the field, but who proved most teachable and intelligent.

6th. 3,010 square miles of the Chota Nagpore, Singbhoom and Dhalbhoom Districts were covered with Trigonometrical points, to which is to be added the balance of last year, giving a total of 8,250 square miles ready for detail Survey, or sufficient to employ the whole Party nearly three full seasons at the rate of 3,000 square miles of detail per annum.

7th. The South Flank Stations of the Calcutta Longitudinal Series Great Trigonometrical Survey generally lie in that part of the Chota Nagpore Division which has been assigned to this Party; and the side Cheinpur H. S. to Barangai H. S. (correct name Marang) has been adopted as the base on which to erect the Triangulation of the year.

8th. The principal Triangulation consists of 28 second class triangles, observed with a 10-inch Theodolite on two zeros, viz, LO and R 180° generally to luminous signals, and computed as spherical figures. On the base Cheinpur to Baragai have been erected two single triangles, followed by a quadrilateral, one side of which is connected with a short secondary series of four triangles, emanating from the Kolhan Longitudinal Series at the side Sakuruburu to Knouwari H. S. S.; thus tying by a series of triangles the Sumbulpore series directly with the Calcutta Longitudinal, and affording two independent computed values of the side Bicha H. S. to Sukan H. S. From a second side of the before mentioned quadrilateral emanates another short series of six triangles, running in south-easterly direction, two of the stations of which are Dalma H. S. and Ledasal H. S., principal points of the south Parasnath series; so that here again the triangles of this Survey are checked and bound up with G. T. S. The remaining 15 triangles are outlying, and not included in any regular series, but are formed by Stations required to fill in the tertiary triangulation.

	Latitude.	Longitude.	Height.
Sukhan H. S. by G. T. S. data ...	23° 4' 13".56	85° 29' 55".06	2351.4
Sukhan by Sumbulpore and Kolhan Minor Series ...	23° 4' 15".35	85° 29' 57".01	2359.9
Difference ...	0° 0' 1".79	0° 0' 1".95	Feet 8.5
Bicha H. S. by G. T. S. data ...	22° 49' 27".70	85° 29' 1".40	2776.4
Bicha by Sumbulpore and Kolhan Minor Series ...	22° 49' 29".45	85° 29' 3".34	2779.4
Difference ...	0° 0' 1".75	0° 0' 1".94	Feet 3.0
Ledasal H. S. by G. T. S. data ...	22° 41' 14".05	86° 30' 59".71	
Ledasal by Chota Nagpore Division Triangulation ...	22° 41' 14".08	86° 30' 59".92	
Difference ...	0° 0' 0".03	0° 0' 0".21	
Dalma H. S. by G. T. S. data ...	22° 53' 23".62	86° 15' 42".75	
Dalma by Chota Nagpore Division Triangulation ...	22° 53' 23".64	86° 15' 42".86	
Difference ...	0° 0' 0".02	0° 0' 0".11	

The differences here shewn, all circumstances being taken into consideration, such as the class of instruments used and the distance traversed by these minor operations, is fair and within allowed limits. The differences in the linear values are exceedingly good, being only one foot in 17 miles in one instance, and four feet in 21 miles in another case. But the error is considerably larger in the Latitudes and Longitudes, some portion of which may perhaps be due to the principal Triangulation of the Calcutta Longitudinal Series, which was conducted many years ago with inferior Instruments. On connection again with the Sumbulpore Series, a further check will be obtained.

108. Besides the 28 principal triangles, 111 prominent objects have been fixed by interseptions and numerous observations taken for heights. From the Surveyor's Narrative Report, it appears that numerous deductions of Heights of Stations have been made including that of Ranchee Church, the tower of which is 2,164 feet above the Sea, showing the general level of the plateau of Chota Nagpore to be 2,150 feet. The Civil Station of Chaibassa is determined to be 745 feet. The highest peak hitherto met with in this Division, "Baragai," is 3,440 feet above the Sea. Heights of fixed accessible and well-known places are of great practical value.

109. The details or Topography completed by the several Assistants noted in the margin*

<p>Topography laid down.</p> <p>* Mr. McGill 495 „ Vanderputt 585 „ Wilson 670 „ Wyatt 385 „ Craven 405 „ Rayner 110 Baboo Modosoodun Dutt ... 550</p> <hr/> <p>Total Square Miles .. 3,200</p>	<p>amount to 3,200 square miles and in connection with the work of previous seasons extends to the parallel of 22° 30'; being bounded on the east by the jungle Mehals of the Midnapore district, and on the west by the Meridian of 84' together with the detached portion required to complete Atlas Sheet 106. The whole of this has been most satisfactorily filled in and rendered in one unbroken line.</p>
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110 Owing to various circumstances and drawbacks caused by the sickness of some of the subordinates, the absence of one in Europe, and the rejection of one of the Plane Tabler's sections and his consequent dismissal for incompetency, a larger area was not returned for the season which occupied, including travelling to and fro, only 5½ months.

111. Captain Depree inspected nearly all his Plane Tablers whilst at work and reports that the accuracy of the details and the delineation of the ground was most satisfactory in every instance. Besides the check thus exercised, a regular itinerary of each day's march is kept in the Surveyor's Camp, in which is noted the name of every stream crossed, or village and Hill seen, in relative order.

The ground mapped was hilly and wild in the extreme, in most parts densely covered with bush and tree jungle and barely supplying even the common necessities of life. Where villages did exist they were very small, the greater number consisting of only four houses. In the level country, it was sometimes necessary to resort to the traverse or Route Survey system and trace between fixed Trigonometrical points for details, and although this is a most tedious process it was the only means by which the Surveyors could progress, when the view around them was entirely closed by high forest. It was scarcely to be expected that such inhospitable tracts could be got over without some of the Party suffering severely from fever, but I am happy to say that under proper treatment all recovered.

112. The majority of the Party were able to return for Recess duties by the early part of May, whilst two Sub-Assistants were detained out to a considerably late period, owing to the long distances they had to travel and other difficulties in finishing their respective Sections. The angle Books, computations and Maps marginally noted† were completed before the close of the season, and Captain Depree reports that no arrears exist in his Office, a highly satisfactory result, creditable to the whole Party. Of the records received single copies with the Fair Maps will be shortly despatched to England.

113. Besides the usual Recess duties a copy of the Map of the Bonai Estate was made during extra hours on the requisition of the Commissioner of Chota Nagpore for the Rajah, and an alphabetical list of villages, with their geographical positions names of Pergunnahs and number of houses in each village in the Saruda district has been furnished to the Commissioner; a similar Statement for the tributary estate of Bonai is in course of preparation.

114. The entire cost for the season amounts to Rs. 38,592-9-2. The outturn of work is of Triangulation in advance of plane tabling 3,010 square miles and of final Survey 3,200 square miles. The average cost calculated on the area finally completed and mapped is as follows:—

Total cost for 1862-63.			Area of final Survey in square miles.	Average rate per square mile.		
Rs.	As.	P.		Rs.	As.	P.
38,592	9	2	3,200	12	1 0	

115. This average rate of Rs. 12-1-0 per square mile is exceedingly moderate and below that of any other Survey for the season and coupled with the large amount of work both in the field and recess, which has been completed by the Party, is highly creditable to the Surveyor and his Assistants.

116. A marked improvement is noticeable in all the maps received this season from the Chota Nagpore Division Survey. The general maps on the scale of 4 miles = 1 inch are exceedingly well executed drawings of a difficult country; very clear and readable, notwithstanding the minute details inserted on them and the extreme difficulty of delineating such peculiar ground. The large scale maps are also well finished and rendered in a very conversant and systematic form. The hill shading in some cases is perhaps rather confused, wanting more delicacy in treatment, by which alone the depth of shades for relative heights can be preserved.

117. Captain Depree is giving his most careful attention to the mapping in his Survey. The improvements he has already effected in many respects, and the very deep interest he evidently takes in all his professional duties, satisfies me that no means will be left untried to attain to the required standard of excellence. Much credit is due to this energetic Officer for the able manner in which all his duties have been performed. He has also been successful in training young hands, and in bringing up his Party to a higher state of efficiency. Every year with such improved means, doubtless the style of work turned out will progress in an equal ratio.

118. The advisability of attaching a military or other efficient Assistant Executive Officer to this Party to aid Captain Depree in his arduous labors had been foreseen, and provision had been accordingly made in the Departmental Budget, but the situation remained unfilled owing to difficulties in the way of meeting an Officer of the requisite aptitude and some preliminary practical training. In August last, however, the abolition of the Indian Navy induced Mr. F. B. Girdlestone, who had for some time been a Midshipman in that service, to seek employment in this Department. Finding him to be a young gentleman possessed of good testimonials as to character and qualifications, and that the previous knowledge he had acquired of Maritime Surveying and Astronomical Observations, coupled with active habits, were calculated to ensure his usefulness in the Survey, I recommended that he should be appointed on probation in lieu of a Military Assistant, which was sanctioned by Government.*

* G. O. G. G. No. 535, dated 21st August 1863, Military Department.

119. Captain Depree speaks most favorably of Mr. Girdlestone, who promises to become a valuable addition to the Party, and on receiving a further satisfactory report from that Officer of the Assistant Surveyor's professional progress, I recommended the confirmation of his appointment on the full initiatory salary of the grade, which has been sanctioned.†

† G. O. G. G. No. 349, dated the 15th April 1864.

120. Mr. J. H. Wilson, a promising young man and brother of Mr. Sub-Assistant J. W. Wilson, who has served with credit with the Party, has been nominated temporarily to the vacant place of a Draftsman, until such time as he can pass the prescribed examination for admission to the higher grade of Sub-Assistant Surveyor.

Sub-Assistants.

121. Captain Depree reports in the highest terms of Messrs. Vanderputt, A. J. Wilson, and J. Craven, whose services both in the field and recess have been such as to meet with his special approbation, in which I fully concur. Mr. Craven's qualifications are declared of a superior order, worthy of special encouragement, which will not be lost sight of. Native Surveyor Baboo Modusudun Dutt has also been specially noticed as a trustworthy and efficient Surveyor and Draftsman possessing great energy. The Extract given below from the Surveyor's Report is most satisfactory.

Para. 28.—In enumerating the specialties of each Surveyor, I have omitted to notice the conduct of individuals, because the conduct of all has been alike unexceptionable; and I consider myself fortunate in commanding a Party in which the general tone of the Subordinates is so high, as well as the zeal and industry most commendable.

122. The plan of the future operations of this Party has been described generally in page 46, para. 195 of my last printed Report. For the current season the programme is as follows. One Sub-Assistant

Future employment.

to be employed in laying out the Triangulation west of the Meridian of $85^{\circ} 15'$ and north of the parallel of 23° , extending over the north and western portions of the Chota Nagpore district and part of Odeypore; the chief strength of the Party to work on the Topographical details north of latitude $22^{\circ} 30'$, embracing the northern half of the Singbhoom district and part of Chota Nagpore.

123. A connection will be made during the current season with the Revenue Survey work of Maunbhoom and Hazareebaugh, and the Atlas Sheet No. 114 filled up, after which the Topographical detail Survey will proceed regularly and systematically westward, through Chota Nagpore, Odeypore and Sirgoojah for Sheet No. 105, and a small portion of the south of No. 104. The prospects of the Party are most encouraging.

NO. 5, TOPOGRAPHICAL PARTY.

REWAH TERRITORY SURVEY.

124. Towards the close of the year 1861 my attention was directed to the formation of a Topographical Party for the Survey of Rewah as detailed in the Proceedings of the Government of India, in the Foreign Department, No. 271, dated 22nd November 1861, with Resolution, quoted marginally,* to which reference was made

Object of raising this Survey.

Lieutenant W. G. Murray, Staff Corps, Executive Officer in charge.

Transferred from the Gwalior and Central India Topographical Survey.

Lieutenant R. V. Riddell, R. E., Assistant (doing duty with Gwalior and Central India Survey) appointed by G. O. G. G. No. 838, dated 27th August 1862.

Mr. N. A. Belletty, Civil Assistant, transferred from the G. T. Survey.

Mr. R. A. Bell, Second Civil Assistant, transferred from the Gwalior and Central India Topographical Survey.

Mr. C. T. Neale, Second Civil Assistant, transferred from the Gwalior and Central India Topographical Survey.

Mr. J. B. Landeman, Third Class Sub-Assistant, Apprentice in Surveyor General's Office.

Native Surveyors, Prem Raj, Ali Ahmed.

* RESOLUTION.—The Governor General in Council is of opinion that if a Topographical Survey of Rewah is to be made, it ought to be on the Scale of one mile to the inch, like the Survey of Central India and Rajpootana now in progress. A Survey on a smaller Scale, say half an inch to a mile, though it might answer Mr. Oldham's purpose, would be useless, or nearly so, as a Military Survey of the country, or for other objects of a Topographical Survey, and would not be in conformity with other Surveys of the same kind, now in progress. In short the Survey of Rewah, if now undertaken by Mr. Oldham on a half-inch scale, would in all probability have to be undertaken again on the one inch scale in the course of a few years. His Excellency in Council is also of opinion that the Topographical Survey ought to be carried out by trained Establishments under the Surveyor General of India, and not by the Establishment of the Geological Surveyor. By the former it will be more cheaply and more thoroughly done, and there will be no greater delay in the one case than in the other, as it would be impossible to organise an Establishment for the purpose, so as to begin work before the season of 1862-63.

† Letter to the Secretary to Government, Military Department, No. 31, dated 5th May 1862.

in paras. 10 and 11 of my last Report and it was then decided by the Government that the second Party, sanctioned originally for the extension of the Gwalior and Central India Survey, should be transferred to Rewah and employed on the latter country to meet a special and important object.

125. It was also declared in the Resolution to be then too late in that season to make any arrangements to equip and start a new Party, which was consequently ordered to be provided in time to begin work in the season 1862-63. I availed myself therefore of the opportunity afforded me during my tour of inspection in March 1862, when I visited the Gwalior and Central India Survey at Dholpoor, to discuss and arrange with the Superintendent, Captain (now Lieutenant Colonel) D. G. Robinson and his Assistant, Lieutenant Murray, all preliminaries regarding the transfer of Assistants from his Party for the formation of the Civil and Native Establishments and the Instrumental equipment, &c., for the new Party intended for the Rewah Survey.

126. In accordance with the recommendation submitted in my letter cited in the margin,† Lieutenant W. G. Murray, Staff Corps, who had served as an Assistant in the Kashmir Topographical Survey, the Jhelum and Rawal Pindee Survey, and latterly in the Gwalior and Central India Survey, and who was thus fully qualified in all professional details and information, was appointed to the charge of the Party by G. O. G. G. No. 619, dated 12th June 1862, and a Military Assistant, two Civil Assistants, and one Sub-Assistant, were posted at a later date to form the nucleus of the new Party.

127. As the first commencement of a Survey in a new country, with a fresh Party brought together from various quarters, must of necessity prove tedious, and in respect of progress merely preliminary, I deemed it most advisable to recommend the employment of Lieutenant Riddell, Royal Engineers, as Assistant Surveyor, under Lieutenant Colonel Robinson in the Gwalior Survey, whereby the very best training was thus secured for the Assistant under the most experienced Master, and he has consequently been so employed for the entire season. Another advantage was likewise gained by this arrangement, in leaving Lieutenant Murray free from the task of tuition of a Military Assistant during his first season, his other duties not permitting him time for such purposes. Lieutenant Riddell having thus obtained his first experience from the Gwalior Survey takes it with him during the present season, to benefit the Rewah Party which he has now joined.

128. Complete instructions, based on the rigorous principles guiding this Department, as laid down by my predecessor, were then issued to Lieutenant Murray, regarding the conduct of the Rewah Survey, and he was directed to form his Establishment, collect data and Charts, send in Indents for Surveying Instruments, and generally to equip the party to start for the new scene of operations in October 1862, which, with the assistance of Captain Robinson and the Office of the Superintendent of the G. T. Survey at Dehra Dhoon, was done by Rail as far as Allahabad, and from thence the field was taken in Rewah at the usual time by the commencement of the cold season.

129. During the march down between Dehra and Allyghur the Native Establishment, which was formed chiefly of untrained men, was trained in the use of signals, &c., and on the Party arriving at Allahabad, the several Assistants were told off to proceed into the Rewah territory immediately abutting on the Allahabad and Mirzapoor Districts to reconnoitre and fix points for Triangulation in all the country north of the Soane River. By the end of November all hands were fairly started, and the Surveyor was then able to march to Rewah with the view to effecting proper arrangements with the Political Agent and Durbar, for the progress of the operations. Even at this early date obstacles and difficulties were constantly thrown in the way of the detached parties and the Vakeels or Agents and Guards, promised by the Durbar, were not forthcoming.

130. On arrival at Rewah Lieutenant Murray represented to Major Osborne, Political Agent, the inconvenience and delay which the tardy action of the Rewah Durbar occasioned, and through his mediation satisfactory arrangements were concluded; but on Major Osborne's removal to Bhopal, serious inconvenience was again experienced from want of supplies and other necessary co-operation in a new country which tended to retard the work, as will be seen from the foot note.

131. On the 24th December the Assistants, who had been deputed in advance to reconnoitre and fix Stations, joined Lieutenant Murray at Rewah, and after due investigation of the results of their labors the following programme for the triangulation was decided on and undertaken.

1st.—For the principal Triangulation a series of Polygonal figures emanating from the Karara Series Great Trigonometrical Survey on the Western boundary to fill up the intervening area, and to close on the Gurwani Series Great Trigonometrical Survey which runs through the North-eastern limits of Rewah, the Southern flank of these figures to rest on the crest of the Khymore range of Hills and the Northern on the summit of the scarp which bounds the Rewah plateau.

Paragraph 18.—Major Osborne left Rewah on the 20th to join his appointment at Bhopal, and I can truly say that his departure was deeply regretted by us all, and that the Rewah Survey is under the greatest obligations to him, not only for the ready assistance and hearty co-operation he afforded us on every occasion, but also for having smoothed down so many little difficulties, removed so many obstructions to our work, and placed us upon so good a footing with the Durbar that I confess I looked forward with much anxiety to the future, for the Durbar were now relieved of a great check, and the Political relations were carried on by an Assistant at a distance from the Capital. Nor was I deceived, for Major Osborne had scarcely left the State, when reports came in of Khalashies assaulted, supplies charily given and assistance denied, and up to the present time I have been unable, even with Mr. Coles' assistance, to get redress for many of these grievances.

2nd.—Minor Triangulation within the principal series, breaking down the large triangles, from which a sufficiency of intersected points could be laid down for the Topographical details hereafter.

3rd.—Minor Triangulation in the plains below or North of the scarp of the Rewah plateau extending Northwards to the British boundary, and overlapping a sufficient portion of the districts of Allahabad and Mirzapore previously surveyed.

132. During this the first season in breaking ground in a country quite unknown, and with a partially trained Establishment only just brought together, it was necessary that the ground should be Preliminary arrangements. thoroughly reconnoitred, and the Stations of the Great Trigonometrical Survey, the operations of which had passed through Rewah many years previously, be found and identified, as the initial elements for the present Triangulation were to be obtained from the Great Trigonometrical Survey, and as many of these Stations were hidden in the high forest, and others injured or destroyed by the inhabitants, this duty was by no means easy, and lastly it was of the utmost importance that the Triangulation should be laid out and sufficiently advanced to prevent the detail Survey in future seasons being in any way retarded a measure on which the success of all Topographical operations mainly depends.

133. The plan of operations above described was successfully carried out, and the whole tract covered, with the exception of the very small portion Area triangulated. lying in the North-east corner of the district on the Mirzapore Frontier, required to perfect the junction with the Gurwani Series of the principal Triangulation, which could not be reached owing to the bad weather setting in and the impracticability of observing with such long sides of the minor triangles as had been adopted. The approximate Triangulation has been well laid out in advance, extending North and South of the Soane River to embrace the above object, as well as with a view to further extension, and will be completed during the present season. The area covered by the final Triangulation with Troughton's 14 and 10 Inch Theodolites is 3,708 square miles. Observations were taken at 107 Stations and 560 points fixed by intersections; 4,000 square miles of country reconnoitred, 1,000 poles and brushes erected; 77 rays cleared, and 114 Stations built.

134. To illustrate these operations the extracts from the the Surveyor's report in the foot notes are quoted, from which it will be seen that he had no ordinary difficulties to contend against in breaking ground with a newly formed Party in a Native State, where a just appreciation of the object and nature of the work could scarcely be expected.

Para. 30. The scarp of the Rewah plateau is more or less the Eastern boundary between the British Collectorate of Mirzapore and the Rewah Territory, whilst the boundary between Rewah and the Districts of Allahabad and Banda to the North and the States of Nagode, Myhere and Sohawal to the West is more or less irregular. There is a great difference in the features of the country above the scarp, whilst all West of the Longitude Line $81^{\circ} 30'$ is clear and open scantily wooded, and dotted here and there with small conical and detached hills, affording plenty of good points for the Topography; that East of the same line is although intersected with ravines and undulating generally of a uniform height, densely wooded, with Mhown forest and Mangoe topes, with in most places a small population, bad roads, and scanty supplies.

31. The labour of triangulating in such ground when nearly every ray had to be cleared and the heavy jungle round each Station had to be cut was very great, and can perhaps be imagined when I state that the expenses for clearing rays and cutting jungle came to Rupees 925, or an average 200 per monsem, and another source of annoyance was the delay caused by searching for old Trigonometrical marks. In open ground of course they were easily found but not so on the wooded hills, and some idea may be formed of this too, when the clearing of the old Great Trigonometrical Survey Station of Jaliadhar cost Rs. 49 and at Mhow, a principal station of the Karra Series, the jungle was so thick and matted, that standing on the mark, you could not see the sun.

32. The difficulties in the way of moving about were great. Provisions were scarce and between Dibar and Mhown along the base of the Khyrnore range, had to be carried with the Surveyor's camp, so thinly inhabited was the country between those two places. Guides also were with difficulty obtained, and were but of little use when found, for they were either too stupid or too unwilling to afford any information.

135. The cost of these necessary preliminary or skeleton operations forming the basis on which the final survey or topographical features of the country will be introduced, reckoning from the 1st of July 1862, the date on which the first expenses were incurred by the nomination of the Executive Officer to take charge, to the close of the past season, amounts to Rs. 45,136-8-5 as detailed in the margin*. This includes all contingent charges, consequent on the forming and equipping of the Party. The result of the work performed cannot well be thrown as yet on this expenditure, because no final work has been accomplished, and the true average mileage rate cannot therefore be deduced; but taken on the triangulation alone, it comes to

	Rs.	As.	P.
* For portion of Season 1861-62	4,818	5	5
For Season of 1862-63	40,318	3	0
Total, Rs.	45,136	8	5

Rs. 12-2-0 per square mile.

136. The above expenditure, whilst it does not represent what the actual cost of the survey may eventually be, for the reasons stated in para. 45, page 12 of my last printed report, will have to be thrown on the future season's outturn. It includes many items due only to the preliminary equipment and expenses which will not again have to be incurred.

137. By the end of April the field work having been satisfactorily closed, the entire Party sought shelter for the Recess duties in the neighbouring small station of Chunar, which is conveniently situated and was the only place near at hand where suitable accommodation could be found. During the previous rainy season, when Lieutenant Murray was at Mussoorie, his health failed him and that climate not agreeing with him, it was not considered advisable to return to that Sanatorium in consequence.

138. The several records, computations and charts have been duly completed, but not yet rendered in this Office; these will be sent in with the final Maps next Season. The Surveyor reports that no arrears of Office work existed when he took the field. The following are the results obtained from a comparison of the Great Trigonometrical Survey values with the new minor Triangulation.

Of principal triangles.	Average difference	...	...	1.7	Inches per mile.
Of 1st class Secondaries	do.	do.	...	4.9	do.	
Of 2nd class	do.	do.	...	12.0	do.	
Average difference of Heights obtained by Trigonometrical levelling					2.5	feet.

139. These results as to the professional character are satisfactory, and prove that every care has been bestowed on the work performed. Though the outturn of work is not large, it is as much as under all circumstances could have been expected for a commencement. The area to be triangulated, and to be filled in, may be expected to increase annually as the strength and efficiency of the Party is expanded. Lieutenant Murray, and his Assistants, have worked hard and well and deserve every credit for their exertions.

33. During March and April the weather was against us and what with the long sides the cloudy weather, and the new hands among the khalashies. who had had scarcely sufficient training to be able to shew Heliotropes, at long distances 20 and 25 miles, it was impossible to get the connection between the Karara and Gurwani Series completely finished, and I have been compelled to leave it unfinished till the next field Season.

34. Another thing too, which has operated much to our disadvantage, has been the useless and uncensuring interference with our work on the part of the Rajah and his officials, and to such a pitch did this interference arrive, that I was obliged to report the minister Deen Bund for ordering Mr. Neale to stop cutting rays, or in other words to stop work; and I have every reason to believe that he received a severe reprimand for so doing.

35. The assistance we have obtained from them has been very small, and what with one thing and another I am confident that the difficulties we have had to encounter in this our first Season's work, have been of no ordinary kind, but as I said before I am in hopes we shall be placed this year on quite a different and a better footing. The one Elephant we did obtain from the Maharajah was of the greatest use to us, because we had at all times in that thick heavy jungle a ready made, moveable 12 feet tower, and there were many Stations selected this field Season, which would never have been found without it.

140. On my return from the Upper Provinces, after concluding my inspections of the Trans Indus Revenue Survey Party in the Punjab and the Oudh Revenue Survey Party at Lucknow, I proceeded to Mirzapore on the 1st December last, where I met Lieutenant Murray, whose work was in close proximity to that place. I had hoped to be able to reach this survey earlier, before the several assistants were scattered in different directions on their field duties, but I was not able to do so, as the Surveyor left his Recess quarters early in October.

141. Owing to the absence of the Surveyor's Office, I had not therefore an opportunity of inspecting his books as I could have wished, but I satisfied myself, from the explanations rendered, and from the narrative report of all that had been done, that the disposition of the work, both Triangulation and Topography, was advancing on proper principles in conformity with the stringent rules laid down for his guidance in the general instructions issued the previous season. During the two days I remained in company with Lieutenant Murray I discussed with him all his wants and requirements, and advised him on all points of reference which had been noted as requiring settlement. The full and explicit statements rendered by Lieutenant Murray, as to the progress of his work, satisfied me that he was fully master of what he had undertaken, and I derived the greatest satisfaction from the intelligent way in which all my enquiries were responded to.

142. As regards the zealous and energetic manner in which this excellent Officer conducts all his business I cannot speak too highly. His endeavours on all points merit my entire approbation, and if his health permits him, I have no doubt whatever as to the eventual success and high character of the Rewah Survey. The general state of Lieutenant Murray's health, however, causes me much anxiety. He has suffered very much of late from constant fever and rheumatism and the nature of the country south of the Soane River I fear is not likely to improve it.

143. The Surveyor reports very favorably of all his Subordinates and specially notices Messrs Belletty, Bell and Neale, Civil Assistants, who have cheerfully rendered him every assistance and performed all their duties, both in the field and recess, in a praiseworthy manner.

144. During the current Season the details of Topography over the area triangulated in the season under review will occupy the Surveyor's chief attention, and the main strength of the Party will be employed on this duty. The Triangulation will be extended southwards across the Soane River as far in advance as possible, and connected with the Great Longitudinal series of Triangles which occupy almost the entire area of Rewah, but it is not safe to employ the Parties there for more than three or four months in the year. From the experience of several medical men we learn that it is not practicable to attempt work in these parts before the early part of January, and this opinion has been sufficiently proved during the present season, the number of sick having been very great. It will be very desirable, if possible, to concert some plan for finding work in Nagode and Myhere to the north of the Khymore Range for certain portions of the year, and to employ the Survey parties on the south of the River only during the few months when it is really safe to remain there, but this will form the subject of a special report hereafter.

145. It was a leading object when this Survey was first started to take up the Coal-bearing tracts in the first instance. The Superintendent of the Geological Survey of India did not, however, intimate the locality of these being south of the Soane until it was too late to change our plan of operations, and indeed for systematic procedure the mode adopted was the only one to pursue. As far as possible the requirements of the Geological Survey will be consulted in the future progress of the Topographical Survey.

146. Lieutenant R. V. Riddell, R. E., Military Assistant, who, as before stated, had been doing duty temporarily with No. 1 Topographical Party Gwalior and Central India Survey, joined his own Party, shortly after it had left Recess quarters for the current season's field operations, and immediately commenced plane tabling with the valuable experience he had gained in the best school.

147. In consequence of the demand for another new Party for the Cossyah Hills, drafts were required from the Rewah Survey, and the services of Mr. N. A. Belletty, Civil Assistant, have consequently been transferred to the new Party, in lieu of whom Mr. E Atkinson, Sub-Assistant 2nd Class, has been brought down from No. 1 Party, Mr. C Hamer, Apprentice Draftsman as a Third Class Sub-Assistant, and Native Surveyor Janardanrao, from the Hyderabad Topographical Survey, have likewise been transferred to fill vacancies on Lieutenant Murray's establishment.

148. The arrangements involved by the creation of another Party prevented me from raising the Rewah Establishment to the full strength this season, but it has been increased as far as the means at my disposal, and the wants of the Department would admit. I have every hope that, during the present year, I may be enabled to add to the Staff of this Party so as to complete its efficiency. The large number of vacancies existing in the Department renders it difficult to find the subordinate agency possessing the requisite qualifications.

No. 6.—TOPOGRAPHICAL PARTY.

COSSYAH AND GARROW HILLS SURVEY.

149. During the current Season another new Party (No. 6), as detailed marginally*, has been formed and started for the Topographical Survey of the Garrow, Cossyah and Jynteah Hills, as alluded to in the 9th para. of my last Report.

* Captain Godwin Austen, Bengal Staff Corps, Topographical Assistant, Kashmir Survey. Transferred from the Great Trigonometrical Branch, 1st October 1863, absent on deputation with Bhootan Mission.

Assistant Surveyor (not yet appointed). Mr. N. A. Belletty, Civil Assistant, transferred from No. 5. Party Rewah Survey.

Mr. H. M. Atkinson, Sub-Assistant 2nd Class, transferred from Head Quarters Office, and previously in Chota Nagpore Survey.

Mr. J. H. Hussey, 3rd Class Sub-Assistant, transferred from No. 1 Party Gwalior and Central India Survey.

Mr. Charles Low, Apprentice in Surveyor General's Office, appointed 3rd Class Sub-Assistant. G. O. G. G. Military Department, No. 544, dated 27th August 1863.

<i>Native Surveyors.</i>					
Nusseeroodeen	...	...	...	...	1st.
Do.	...	...	...	...	2nd.

† Bengal Government to Surveyor General, No. 291, dated 24th December 1861.

Government of Bengal, to Government of India, Home Department, No. 643, dated 11th February 1863.

Government of India, Home Department, to Government of Bengal, No. 4110, dated 29th December 1863.

Scene of operations.

parallels of 25° and 28° North Latitude, embraces an approximate area of 21,134 square miles. Measures were accordingly adopted during the last Recess, in personal communication with the Superintendent of the Great Trigonometrical Survey, whilst I was at Mussoorie, to secure a competent Superintending Officer and Subordinate Staff for these important and difficult Survey operations with the object of starting the work early in the present field season.

151. The services of Captain H. Godwin Austen, Staff Corps, Topographical Assistant of the Kashmir Survey, an Officer of several years' experience in Himalayan Topography, and a most accomplished field Draftsman and delineator of hilly ground, having been placed at my disposal from that branch of the Department, he was appointed by the Government of India, Military Department, to the charge of the Party, by G. G. O., Military Department, No. 588, dated 11th September 1863,

and he was accordingly instructed to proceed from Kashmir, where he was actively engaged at the close of the Summer, to Dehra Dhoon to confer with me as to his equipment and general instructions.

152. The Civil Assistant, who was also promised by Major Walker in his letter of the 3rd January 1863, included in the published correspondence for the same duty, could not eventually be spared from the Trigonometrical Branch; consequently the nucleus of the Subordinate Staff had to be formed from the existing Topographical Parties alone.

153. To this end drafts were taken from the Rewah and Gwalior Parties, as shewn above, and Captain Austen was hurrying down in order to accompany me to Calcutta where his Party was to be collected, but whilst passing through Lahore, he received instructions direct from the Foreign Department to accompany the British Mission to Bhootan as a Surveyor and Assistant to the Political Agent, and to proceed to Darjeeling with all possible speed.

154. These orders were promptly obeyed by Captain Austen, whom I met on the road down, and thus had an opportunity of conferring with him as to the ulterior measures to be taken in consequence of this unexpected and sudden change in his destination, which was notified in General Orders as per margin* without any reference to myself, or previous notice of the intentions of the Government.

Temporary withdrawal of Executive Officer.

* No. 702, dated the 30th October 1863.

155. The loss of Captain Austen's services at such a moment upset the plans contemplated for the commencement of the Cossyah Hill Survey in November or December last. On my return to the Presidency on the 10th of the latter month from tour of inspection, immediate steps were taken to devise fresh arrangements for the conduct of this Survey. Definite instructions were given to Mr. N. A. Belletty, Civil Assistant, who had meanwhile reached the Presidency from Rewah, to form the Native Establishment, collect data and instruments, purchase Camp equipage, &c., and generally to provide for all the requirements of the Party: these duties he performed much to my satisfaction, and by the end of the month everything was prepared, and the party fully equipped quitted the Presidency on the 3rd of January by Rail and Boat from Kooshtea to Chuttuck at the foot of the Hills, and arrived at Cherra Poonjee on the 7th February.

156. As the most desirable arrangement under the circumstances of the case I availed myself of the opportunity which had just offered, by the appointment of Mr. J. O. Nicolson, Officiating Surveyor, of the Great Trigonometrical Survey (lately employed at the Andaman Islands,) to the Survey of Waste Lands in Lower Assam, to place him in temporary charge of the Topographical Party, and this was duly approved by the orders cited in the margin. Mr. Nicolson consequently conducted the Party to its ground, where he is now employed in laying out the Triangulation, and he will hold charge, in conjunction with his other duties, for the measurement of Waste Lands in the adjoining District of Kamroop, until Captain Austen's return from the Bhootan Mission, which it is hoped may be within a few months, as his presence with the Party is very necessary, in order to render it fully effective for the next season. A complete set of final instructions* were drawn up and issued for the conduct of the operations.

Letter No. 7, dated 4th January 1864 from Junior Secretary to Bengal Government.

* Surveyor General to Officiating Surveyor, No. 5A, dated 23rd December 1863.

157. Looking to the late period at which the Party, only about half recruited, arrived at their ground, much work cannot be expected this season, but good experience and reconnoitring of the country will be obtained, and it is hoped something may be effected with the Triangulation, whereon to start the Topographical details next year.

158. The country to be surveyed is admirably prepared for these operations by the Principal Triangulation of the Great Trigonometrical Survey, which has already traversed it longitudinally along the valley of the Brahmapootra, as far as Gowhatty, and Meridionally from Gowhatty across the Hills in 91°, through the Valley of Sylhet and along the Eastern Frontier. The point of departure for the Topographical Survey will therefore emanate from a side of the principal Triangulation in the neighbourhood of Cherra Poonjee, by which means the best disposition may be made in a new country and with new people at a late period of the season.

<i>Art.</i> 2.—Executive Officers	Rs.	As	P.
...	18,094	2	0
<i>Art.</i> 3.—Field Establishment consisting of Civil and Native Establishments	31,978	0	0
<i>Art.</i> 5.—Contingencies	7,675	0	0
Total	57,747	2	0

159. Before the ensuing season, I hope to see a Military Assistant appointed to this Survey, as well as the Establishment strengthened up to allowed limits. The estimate for the few months of the current financial season, as passed in a Supplemental Budget, amounted to Rs. 30,707, whilst the full estimate for ensuing financial year of 1864-65 is detailed in the margin, amounting to Rs. 57,747-2.

No. 7.—TOPOGRAPHICAL SURVEY.

RAJPOOTANA SURVEY.

160. The nucleus of a seventh Party, designated as above, has, under the sanction of the Government of India, conveyed in Military Department letter No. 771, dated 26th September 1863, been provided for in Central India during the current season and for the present is working in connection with and under the superintendence of the Officer in charge No. 1 Party,

* Lieutenant C. Strahan, n. E., Assistant Surveyor, appointed by G. O. G. No. 605, dated 26th September 1863.

Mr. R. Todd, Sub-Assistant 3rd class, appointed G. O. G. No. 673, dated 16th November 1863.

Mr. A. Connor, Sub-Assistant 3rd class, appointed G. O. G. No. 773, dated 19th December 1863.

Gwalior and Central India Survey, with the view to a full complement of Assistants, Sub-Assistants and Native Agency being collected and trained in time to act efficiently next season. The Military Assistant and two Sub-Assistants, as detailed in the margin,* have as yet only been nominated the great demand for Uncovenanted competent Agency for the other new Party, also raised this season, preventing

further additions being at present made.

161. This Party when fully formed is intended to expedite the Survey of the enormous area embraced in the Central India, (or Indore) and Rajpootana Agencies, quoted in the 9th para. of my last Report, amounting to 3,00,920 square miles, and is to act in concert with the Gwalior and Central India Topographical Survey as originally sanctioned, by the Government of India, Military Department, No. 549, dated 14th August 1861. The arrangements then made were altered by the Party raised, being subsequently transferred to Rewah, as directed in the orders cited

† Proceedings Foreign Department, No. 271, dated 22nd November 1861.

in the margin,† and it will thus be at least another season before the expansion of the Rajpootana new Party can be

expected to attain proportions sufficient to enable it to make any sensible progress.

162. During the current financial year 1863-64 the means required for defraying the

‡ Article 2, Executive Officers	Rs.	A.	P.
.. 3, Field Establishment	8,709	6	0
.. 5, Contingencies	32,530	6	0
	7,642	0	0
Total	48,881	12	0

small extra expense entailed, will be met out of the existing Departmental Budget, for which there is sufficient margin, and for the ensuing year of 1864-65 the Estimate as per margin‡ has been included in the Budget, amounting to Rs. 48,881-12

39 B, dated 6th July 1863.

for a full Establishment, which cannot be all

utilised the first year, as the European and Native Staff must be obtained and trained gradually, as explained in my letter marginally quoted.

163. As soon as fairly started, and set to work independently, it is contemplated to place this Party in charge of an Assistant Surveyor on the intermediate grade and salary of Rs. 400 but under the supervision of the Superintendent of the Gwalior Survey, whereby considerable economy will be gained; and when Lieutenant Colonel Robinson rejoins his own substantive appointment from which he is at present detached, whilst officiating for Major Walker, Superintendent Great Trigonometrical Survey, the great advantage of that Officer's knowledge and experience will be brought to bear on the general operations in Rajpootana. Whilst the original or No. 1 Party will prosecute the Survey of the Gwalior and other States between the meridians of 76° , and 78° , working Southwards, for filling up the several Sheets of the Atlas Nos. 50, 51, 52, 53 in succession, the new Party by extending their Triangulation North-westwards from the present work in Ulwar and Jeypoor, will be able to provide for the corresponding Sheets between the meridians of 73° and 76° , Nos. 32, 33, 34, 35, and 36, which embrace the heart of the Rajpootana States with some portion of the Central India Agency from the Sutlej to the Nerbudda River.

164. Thus, even with the above distribution, there is more than an ample area for each Party to employ it for many years to come, each Sheet of the Indian Atlas occupies an area of 17,824 square miles, the above-mentioned Sheets therefore, embrace no less than 71,296 square miles for No. 1 Party, and 86,120 square miles for No. 7, the new Party. In addition to the above Sheets there are others lying to the Westward, Nos 9, 10, 18, 19, 20, 21, and part of 22, to complete the above Agencies, so that the whole of these Native States of Central India cannot be brought under Survey for many years to come.

$2\frac{1}{2}$ Degrees of longitude by $1\frac{1}{2}$ degrees of latitude, size 3 feet $4\frac{1}{4}$ X 2 feet $3\frac{1}{2}$; scale 4 miles = 1 inch, area 17,824 square miles each.

No. 8.—TOPOGRAPHICAL PARTY.

PEGU SURVEY, BRITISH BURMAH.

165. By the Resolution of the Government of India, in the Financial Department, No. 2900, dated the 1st July 1863, the Pegu Survey was placed under this Department with a view to its being brought upon the same footing as regards administrative and financial control as other Topographical Surveys under my direction, and subsequently I was called on, through the Military Department,* to report on the work which has been completed and remained, as well as the cost of the Survey from the commencement.

* Vide Endorsement No 125, from Foreign Department, dated 5th August 1863, on Financial Department Resolution above cited.

† Letter No. 105 (a), dated 10th August 1863.

‡ "To prepare with as little delay as possible a succinct general report of the history, rise and progress of the work *ab initio*, the total cost, the rate per square mile, the style and system of the survey, the scale employed, the records rendered up to date, what remains to be performed, and how long it is calculated with existing means, that the whole may be brought to a close."

166. On receipt of these orders no time was lost in communicating them to the Chief Commissioner† of British Burmah, in view to his instructing Captain FitzRoy, Superintendent of the Survey, to act in obedience thereto, and that Officer was also at the same time furnished with the requisite instructions direct from this Office in the terms cited in the margin. ‡

167. On the 9th September last the Chief Commissioner, it appears, directed Captain FitzRoy to submit the required Report with as little delay as possible, and on the 11th November following, in reply to the urgent requisition of this Office for Professional Reports and Financial Statements connected with the operations, the first intimation was received from the Superintendent that he had forwarded the required documents to the Chief Commissioner.

scheme will be submitted for the more efficient organisation of this Party, as soon as Captain FitzRoy will enable me to do so.

173. The amount of work completed and the cost of the Survey from the commencement in 1853 to 1862-63 is 19,519 square miles, and Rs. 3,64,932 which yields a general average rate per square mile of Rs. 18-11-1, but the absolute annual progress and the areas executed by the above Officers respectively, I have as yet been unable to ascertain.

174. Captain FitzRoy appears to have anticipated in his report* for 1861-62, that the whole of Pegu would have been brought to a completion by the month of May 1864. In a subsequent report he gives the probable time of completion as May 1865, but he now states that he made the above estimate "provided only that the records alleged to exist proved of sufficient value." This statement being unintelligible requires further explanation. The area now remaining after current Season is declared to be about 7,731 square miles as shewn in the margin; † this must take at least a season or two more at the present rate of progress, and on the present system.

Area remaining.	
* Dated 27th June 1862.	
† Already Surveyed	19,519 sqr. miles.
Remaining for Survey	12,731 "
Area of Pegu Division	32,250 "
Probable outturn for 1863-64	5000 " ?
Still remains ..	7,731 "

175. No maps or calculations have as yet been regularly rendered to this Department but one sheet of a general Map of Pegu, on the scale of 4 miles to the inch, embracing $\frac{1}{4}$ of the entire Division of Pegu, was lithographed at the Press attached to this Office last year, for the Chief Commissioner under special orders from the Foreign Department, and No. 2 Sheet, on the same scale, containing another quarter of the Province, has also been recently sent up to this Office by the Superintendent for a similar purpose, with a request that it might be published on his own responsibility. With reference, however, to the duty now devolving on this Department, I was necessitated to call for the data on which the map had been constructed before venturing to publish it under my own authority, and on a reference to the Government of India, Foreign Department, on the subject, the publication of the map was ordered to be deferred until such time as Captain FitzRoy furnished these necessary particulars. This he has not yet done. A map of the town and environs of Rangoon, on a scale of one inch to the mile, was at the same time transmitted, which is detained for a similar object.

176. In the 51st para. of the Superintendent's Printed Report, † it is stated that maps of Teiks have been made on the scale of 4 inches to the mile, and also that maps of circles are formed on the one inch scale, which again are reduced into the general map on the scale of 4 miles to the inch. But although the Survey has been in progress for the long period of nine years, not one of the larger scale maps has been rendered to this Department for practical purposes, and until the month of January 1863 even one of the general maps was not forwarded to Calcutta either for publication or for use in this Office.

177. With a Survey which has been going on for so many years without professional aid or advice, and under special and peculiar circumstances has laid down nearly 20,000 square miles of difficult country, but of which the maps, Field Books and calculations have never been seen or examined, it will be seen that the task of arriving at a clear understanding of such work is not an easy one, and until the results of so many years' labors are placed before me and properly explained, and time is allowed to make the necessary examination, I shall not be in a position to arrive at a definite opinion on the real value and nature of the Pegu Survey, and how long it will take to complete it.

178. The foregoing comprise all the Topographical Surveys at present employed or ordered, but they form only a small portion of the supervising duties
Conclusion. devolving on this Office. The Revenue Surveys, more than double in number to the above, have to be provided for, but these being under the Civil Department are reported on separately. The various details of work in the several Branches of this Department requiring my attention, with the existing means allowed for the purpose, have been carefully examined into by Colonel Dickens in the enquiry he has made, and his report will no doubt enter into a full explanation of the same, with suggestions for carrying on in future the duties of a Department, the operations of which are ever on the increase.

SURVEYOR GENERAL'S OFFICE, }
CALCUTTA, }
The 26th April 1864.

H. L. THUILLIER, *Lieut. Col.*,
Surveyor General of India.

APPENDIX.

INTRODUCTION TO GENERAL REPORT.

Triennial Report on the Gwalior and Central India Topographical Survey for Season 1860-61, 1861-62 and 1862-63.

DATED, OFFICE GWALIOR AND CENTRAL INDIA

TOPOGRAPHICAL SURVEY,

November 10th, 1863.

To

COLONEL H. L. THUILLIER, ROYAL ARTILLERY,
Surveyor General of India.

SIR,

Three years having now elapsed since the Survey of the Native States of Central India was commenced, I have now, in obedience to the instruction cited below,* issued for my guidance for this Survey, the honor to transmit to you the undermentioned documents, records, maps and charts, the produce of our operations during the period above named :—

1. 7 Sheets of General Maps, each Sheet 30' longitude × 30' latitude.
Scale one mile to one inch.
2. 1 Degree Sheet or Geographical Map, scale four miles to one inch.
3. 2 Charts of Triangulation.
4. All the computations connected with the above.
5. The original Plane Table Sheets.
6. The Village Books, and Alphabetical list of villages in Duttiah.
7. Such Angle Books as can be spared, original and duplicate.

2. These details will furnish all the data required for the completion of Atlas Sheets, Nos. 68 and 69, and a little for Nos. 50 and 51. They include altogether 5,540 square miles of country, carefully surveyed, at a cost of Rs. 22 per square mile.

3. The three seasons under report have been spent as follows. The first was devoted entirely to Triangulation, executed by a Party at half strength. The Triangulation was required as a basis on which to found the Topography, and should always be kept in advance. The amount thus obtained during the first season being still in hand, may be considered as an inefficient balance which will not come into account until the conclusion of the Survey, and consequently all expenses connected with it must remain in suspense until that time, or until such a time as there shall be no Triangulation ready in advance of the Topography.

4. The other two Seasons, 1861-62 and 1862-63, have been spent partly in Topography and partly on the Triangulation, the whole of their expenses are debited to finished work, including the General Report.

5. The whole of this work has been very carefully executed; the Triangulation is excellent for the class of Instrument used, and the Topography is correct. All the physical features of the country, the areas cultivated, and all that can be useful for Military or Civil Engineering purposes, has been shewn to scale, and when these facts are considered, the rate of Survey appears moderate enough.

6. The Triangulation is based entirely on such Stations of the great arc of India series (measured by Colonel Sir G. Everest in 1832) as were found. But few of them have escaped the ravages of time, and still more destructive man; and consequently most of the triangles

* Instructions for the prosecution of the Gwalior and Central India Topographical Survey addressed to Captain D. G. Robinson, Royal Engineers, by Sir Andrew Scott Waugh, Surveyor General of India and Superintendent Great Trigonometrical Survey of India in September 1860, No. 15999, dated 14th September 1860.)

had to be re-measured. This series was connected with such Stations of the Budhon series as could be found, by a continuous net work of large triangles, and the linear values of the sides of that series have been used as a check on them, but a correction of $+0.19''$ was applied to all Longitudes, to adjust them to the great arc values.

7. That this discrepancy of 17 feet in Longitude does exist there can be no doubt, for fortunately at five Stations, Narwar and Sheregarh, Dhobaie and Karia and at Raiepoor, the series approximate so very closely that the distance between them can be directly measured to within four inches for a certainty, and as this discrepancy is shewn at each of these connections, and moreover makes the rest of the connection agree well instead of badly, as it otherwise would do, I have no hesitation in applying it.

8. This discrepancy may at first sight appear large, but when it is remembered that it is probably due to errors in both series going in opposite directions, and the length of the circuit is taken into consideration, it is easily accounted for. I am also of opinion that the mass of the Bindrachal range lying on the west of the Budhon series must have materially affected the perpendicularity of the plummet.

9. This range is of great thickness, and some hundred feet higher than the majority of the stations of the Budhon series, and must, I think, have sensibly attracted the plummet of the Budhon series, though it would not affect the great arc which passes along the top of it. Whenever I have leisure I purpose to investigate this question.

10. The large triangles of this net work, and the triangles of the great arc which have been almost all re-measured by me, I have treated as principal triangles. They were measured with either a twelve or fourteen-inch Theodolite on four zeros, $\frac{0}{180}$, $\frac{90}{180}$, and give limits of error, which, as will be seen in the abstract appended, are very small and far below what is really required for Topographical work. In the mountainous country, they were broken down into secondary triangles shewn by red lines in the Charts, but in the well wooded flat country to the east of Dholpore, and north and east of Gwalior, this process would have been too expensive, so in lieu thereof, minor series of Triangulation were carried along the valleys of the Banganga, Chambal, Sind, and Koari rivers, starting from, connected with, and closing on the principal Triangulation, to which they were further adjusted by treating them as ray traces. This reduction is shewn in the body of the Report.

11. On this Principal, Secondary and minor Triangulation depend the intersected points, that is to say, the positions of remarkable objects, such as temples, buildings in forts, remarkable trees, or poles and brushes, erected for the purpose, all of which had to be laid down to furnish data on which the detail Surveyors could base their work. These positions are obtained by observations taken generally on one zero only, from two or more Trigonometrical Stations, and are shewn in the second chart of Triangulation by blue lines. They are dotted about all over the country, at short distances of from two to four miles. The distances at which they should be placed must depend on local circumstances.

12. Again on this Triangulation is based the detail Survey executed on Plane Tables, on a scale of one mile to one inch. No conventionalities have been allowed, and the plane table maps have been made as far as the scale would admit fac-similes of the country surveyed. In the neighbourhood of Gwalior the amount of iron in the rocks rendered the compass useless and deprived the surveyors of the great assistance this useful Instrument affords, under ordinary conditions, for fixing their approximate positions.

13. The maps now submitted include the whole of Duttiah, nearly the whole of Dholpore and about $\frac{1}{2}$ of Gwalior. An alphabetical list of all the villages of Duttiah, shewing the number of houses in, and the geographical position of each village, is appended. Allowing five inhabitants for each, the population of Duttiah appears to be 1,91,150.

14. Similar lists for each State will be submitted as the survey of them is concluded.

15. This being a professional report it is unnecessary to enter into the statistics of the tracts surveyed; when the work is more advanced, I purpose to do so separately.

16. The data on which the work is based is as follows.

17. The Geodetical elements which are unreduced for discrepancy in amplitude are all obtained from the original computations of the great arc and Budhon meridional and Calcutta longitudinal series of the Great Trigonometrical Survey of India, which are not exactly in the same terms, consequently these are not final results. Further, wherever the Great Arc and Budhon Series, which at some points almost touch each other, have been connected, a discrepancy of $0^{\circ}19'$ in longitude is found to exist. A correction therefore of $+0^{\circ}19'$ has been applied to all longitudes of the Budhon series to assimilate them to those of the Great Arc.

18. The longitude is referrible to the old value for the Madras Observatory $80^{\circ}17'21''E$, to which a correction of $3'25''5$ is applicable to reduce to the value adopted by the Admiralty and Royal Astronomical Society, or $3'1''8$ to reduce to the result of Taylor's observations up to 1845.

19. The linear values are derived from the length of the Sironj Base assumed at 38413.32 Ft longitude $=4.5844818$.

20. The azimuths depend on the observed value of Surental or Kalianpoor, taken at $190^{\circ}27'6''205$.

21. The latitudes depend on that of Kalianpoor taken as $24^{\circ}7'11''837$: the longitudes on that of Kalianpoor taken as $77^{\circ}41'44''748$.

22. The heights depend on that of Kalianpoor taken as 1765.1 Feet.

OFFICE GWALIOR AND CENTRAL INDIA
TOPOGRAPHICAL SURVEY,
The 14th November 1863.

D. G. ROBINSON, *Lieut. Col., R. E.,*
Supdt. Gwalior and Central India
Topographical Survey.

Abstract of Work finished during the past three Seasons, 1860-61, 1861-62, 1862-63.

41 on four zeros.	First Class Triangles with 12 or 14 inch Theodolite.
339 on two ditto.	Second Class Triangles with ditto ditto.
231 ditto ditto.	Second Class Triangles with 7 and 8-inch Theodolite.
878 one and two ditto.	Intersected Points.
210.	Heights of Stations and Intersected Points.
11513 square miles.	Total Area Triangulated.
5540 ditto.	Area Topographically Surveyed.
5973 ditto.	Triangulation in advance.
Rs. 1,55,174-1-1.	Total cost of Survey.
Rs. 1,15,711-11-9.	Total cost of finished work.
Rs. 20-14-2.*	Cost per square mile of finished work.
270.	Stations visited.
Amount of work completed	
895 pages of Angle Books. 1,895 Triangles, 212 Computation of Heights, 234 reductions by Ray Trace 541 Deductions of Latitudes and Longitudes of points 1 Degree Sheet Geographical Map Scale, 4 mile 1 inch. 7 General Maps $30^{\circ} \times 30'$, Scale 1 mile to 1 inch. 2 Charts of Triangulation. 3 Rough Charts. 671 Positions laid down by Triangulation.	
None.	Arrears.

* This includes the expense of training Officers and Sub-Assistants for other Topographical Survey Parties. Due consideration must also be made for the heavy expense of Guards supplied to all detached Europeans.

D. G. ROBINSON, *Lieut. Col., R. E.,*
Supdt. Gwalior and Central India Topog. Survey.

(True Copy,)

H. L. THUILIER, *Lieut. Col.,*
Surveyor General of India.

