

GENERAL REPORT

OF THE

Topographical Surveys

OF THE

BENGAL PRESIDENCY

AND OF

THE SURVEYOR GENERAL'S OFFICES

FOR SEASON

1867-68.

SUBMITTED TO THE GOVERNMENT OF INDIA, HOME DEPARTMENT.

CALCUTTA :

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1869.

SURVEYOR GENERAL'S OFFICE,
Calcutta, 5th February, 1869.

To

THE SECRETARY TO GOVERNMENT OF INDIA,
HOME DEPARTMENT.

Sir,

I have the honor to submit for the information of the Government of India, the annual Operation Report on the Topographical Surveys of this Presidency for the past season of 1867-68, drawn up by Captain Montgomerie, Offg. Deputy Surveyor General, who has superintended this branch of the Department for the latter half of the official year, or since the month of May last.

2. In consequence of my special deputation to England on duty under the orders of Government No. 2108 of the 29th April last, for the purpose of arranging for the transfer of the engraving of the sheets of the Indian Atlas, from the hands of the Geographer at the India Office to my own Office in India, Lieut. Colonel Walker, Superintendent of the Great Trigonometrical Survey, was appointed to officiate in my place in addition to his own duties, under the orders cited in the margin, whilst the Superintendence of the Topographical Surveys was entrusted to Captain Montgomerie of the Great Trigonometrical Survey, and the charge of my Head Quarter Offices at the Presidency devolved on Colonel Gastrell and Major Macdonald, Deputies Surveyor General and Superintendents of the Revenue Surveys respectively, as their tours of inspection permitted them to remain in Calcutta. This arrangement lasted from the 10th of May last to the 7th January, the date of my return to duty, in conformity with the orders conveyed in the despatch of the Right Hon'ble the Secretary of State for India, No. 102, dated the 24th November 1868.

3. The general results of the entire operations embraced by the several Executive field Parties, in both the Topographical and Revenue branches, are detailed in the following Statement:—

	No. of Parties.	Square miles.	Cost.	Rate per square mile.
			Rs.	Rs. As.
Topographical Surveys, ...	7	20,201	3,64,211	18 0
Revenue Surveys {	Upper Division,	10,297	5,27,677	
	Lower Division,	6,319	3,57,251	
	24	16,616	8,84,928	53 4
Total area executed, ...		36,817	12,49,139	33 14
Ditto in previous season, ...		27,629	12,54,110	45 6
Difference, ...		+ 9,188	-4,971	-11 8

4. A total area of 36,817 square miles has been accomplished at an aggregate cost of 12,49,139 Rs. or at the rate of 33 Rs. 14 As. per square mile. This contrasted with the outturn of the previous season, shews that a larger area by 9188 square miles has been surveyed at a less total outlay, which reduces the mean average mileage rate by Rs. 11-8. The rate of the Topographical Surveys is Rs. 18 per square mile, for the one inch scale; and the rate of the Revenue Surveys is Rs. 53-4 for the four inch scale.

5. These results may be said to be highly satisfactory and encouraging, and looking to the detailed reports of the Deputies Surveyor General, commenting on the progressive improved style of the Maps and Topographical delineation of the country, I am of opinion that the labors of the Department, both Administrative and Executive, are eminently worthy of the favorable recognition of the Government.

6. Annexed to the report on the Topographical Surveys, will be found detailed Statements of the working of the several branches of the Head Quarter Offices, by the Officers who respectively held charge of the same, shewing the nature and extent of the mapping and publication of the results of the vast amount of Geographical materials rendered during the season, by the combined efforts of the 24 Executive Parties employed.

7. Printed reports on the operations of the Great Trigonometrical Survey and Revenue Surveys, have already been submitted by the Superintendents of those branches respectively, and afford full details as to the localities in which progress has been made, and as regards the particular results in each District or Province. I have to solicit that all these reports which combine full information on the various operations of the Survey Department, may be transmitted to the Geographical Department of the India Office.

8. I would draw attention to the enormous increase of business, detailed in the enclosed reports of the Photographic and Lithographic branches of my Head Quarter Office, from which it appears that no less than 650 original large manuscript maps, were reproduced and 92,596 copies or impressions taken from them during the past year. All these maps were of an important character. The very useful and rapid process of Carbon Transfer Printing on zinc, from Photographic Negatives, has materially increased, and been most successfully applied through the able and energetic exertions of Captain Melville, the Officer in charge of that Branch, under various difficulties of climate and want of proper accommodation and means, for conducting such peculiar and trying work, which need not be enlarged upon in this place.

9. These results together with what is shewn in the Deputy Surveyor General's return as to the business transacted in the Compiling and Drawing Branch under the immediate able Superintendence of Mr. James, Assistant Surveyor, combined with the transactions for the issue and sale of maps to the public and officials, and the money value for the same, may give some idea of the outturn of the supervising office, and the constant expansion of its manifold duties, which are now still further most seriously affected, by the immense demands and wants of the Irrigation Department, which will require corresponding extension of our means and appliances in the Administrative branch of my Department.

10. In addition to the various duties devolving on my Office, as previously described in the annual reports, a new branch has now been added for Copper Plate Engraving, and the final publication of the sheets of the Atlas of India, and other general maps hitherto executed in England, by the Geographer to the Secretary of State, and this duty has now been commenced by the staff of European artists, six in number with one Plate Printer, whom I have brought out to form the nucleus of an establishment for that purpose, and to teach natives in the art of Copper Plate etching and engraving, which has been so little known or practised in this country. An impetus will now be given to this important object, of bringing out the engraved sheets of the Indian Atlas, and rendering the geographical materials of the great national survey of India, speedily available, which I trust will be very beneficial to the public service in this country, as well as to the numerous enquirers for good maps in Europe.

11. The Engraving Department has been accommodated in my chief office, by the removal of the Revenue branch to another house as authorised by Government, but the general question of office accommodation and the peculiar requirements of the Photographic and Printing Departments most urgently presses for some satisfactory solution, and the question, which presents many difficulties, is being dealt with in communication with the special Officer of the Public Works Department, appointed for that purpose, as directed by the Government.

12. The new arrangements proposed by myself whilst in England, and directed in the despatch of the Secretary of State, before quoted, to be carried out, for the prosecution of the Atlas of India here, and for the constitution of a proper Department at the India Office, for the transaction of all geographical business, and the needful extension of facilities for the sale of maps in England, will no doubt lead to a more satisfactory system than that which has hitherto prevailed, and nothing will be wanting on the part of this Department to co-operate in the fullest degree to this effect. It appears to me highly desirable that some Officer of this Department who may be well acquainted with the duties of the administrative branches, or working of the details of the Head Quarter Offices in this country, should be occasionally employed in the geographical Office at the India Office, where his assistance and knowledge of the extensive operations going on in India, may prove highly beneficial.

13. A new edition of the catalogue of available published Engraved, Lithographed and Photozincographed Maps, with a revised Index map of the sheets of the Indian Atlas, is now in the Press, and will be issued immediately, and transmitted to England for the information of the Home Authorities, with a proper supply of the maps, with the view of facilitating the sale of the maps of the Survey of India in that country, as contemplated in the Secretary of State's Despatch above quoted.

I have the honor to be,

Sir,

Your most obedient servant,

H. L. THUILLIER, *Colonel,*
Surveyor General of India.

To

THE SURVEYOR GENERAL OF INDIA.

SIR,

I have the honor to forward herewith a report on the operations of the Topographical Surveys, of which I took over charge on your deputation to England on duty on the 10th May last.

I have the honor to be,

SIR,

Your most obedient Servant,

T. G. MONTGOMERIE, *Captain, R. E.*

Offg. Depy. Surveyor Genl. and Supdt., Topl. Surveys.

CALCUTTA, }
The 15th January 1869. }

GENERAL REPORT
ON THE
Topographical Surveys
OF THE
BENGAL PRESIDENCY,
FOR
SEASON 1867-68.

Dated Calcutta, 15th January 1869.

In the Topographical Survey Department, there are at present seven complete parties, four of which are employed for the most part in British Districts, and three in Native States.

The work of the Topographical Surveys may be said to be entirely confined to the more uncivilized parts of India, to great tracts of which there have hitherto been but poor apologies for maps, or no maps at all. Several of the Surveys might in fact be called organized exploring parties, as their duties take them into unknown places, which have never been visited by Europeans, and their results would be accepted as exploration, if it were not that they were carried on within the bounds of British India.

The country under survey embraces every variety of ground from the arid, sandy tracts of Bickaneer, where there is hardly any rain, to the mountains of the Cossyah and Jaintiah Hills, which are deluged with a rain-fall of more than 600 inches per annum.

The variety of arrangements that are required for such diversified work can easily be imagined; in the more northerly parts camels are used for carriage, in others bullocks and elephants, while in the Cossyah Hills, coolies are alone capable of moving about the mountains.

Every district under Survey is more or less mountainous with a very large proportion of dense jungle, and the Native Establishments have to take all sorts of precautions against tigers, which in some parts are so exceedingly numerous as to make all travelling on foot dangerous for solitary men. In the Central Provinces, the Surveyor came across a tract which had been utterly devastated by a single tigress, which was estimated to have killed upwards of 50 people, and was known to have driven the inhabitants away from 13 villages. This scourge was ultimately removed by Major Priestley, who very kindly accompanied the Surveyor and shot it.

In the Cossyah Hills, the tigers roam about at great altitudes and are so bold that the party lost two men by them, one being carried off in the night, the brute actually breaking through the side of the hut in which he had taken shelter, while the other was carried off in mid-day on the line of march.

The peculiar method of survey which the Topographical Department follows is more especially adapted for these wild and rugged portions of India. With the theodolite and plane table, it progresses with an accuracy and rapidity with which no other system of Survey can in such ground compete.

The system is moreover admirably suited for the survey of Native States, for being carried on without the aid of a chain, its operations excite but little jealousy among the Native officials, who are apt to associate the chain with inquiries as to revenue, the yield of fields,

&c., &c. The plane table on the other hand being looked upon as a matter of curiosity in no way likely to interfere with them.

Maps of these unexamined and little known portions of India are consequently being produced in numbers, and by the aid of the Photozincographic Department, are being rapidly published and made available for general purposes.

The services of the Topographical Parties are also made available for the survey of large Cities, Cantonments, Forts, &c., and large scale plans of Gwalior, Agra, Nagode, Deoli, Ulwar, &c., have already been completed.

The following table shows the progress and cost of the work of each party :—

Designation of Survey.	Topography number of square miles.	Triangulation number of square miles.	No. of points observed at	No. of points fixed.	No. of square miles to each point fixed.	No. of heights.	No. of square miles to each height.	AREA OF MAPS EXCURED.		Total cost.	REMARKS
								On 1 inch scale standard.	On 1 inch scale exaggerated.		
No. 1, Gwalior and Central India Survey ...	3,832	Nil	...	...	...	...	...	3,680	{ 3,777* 2,803	48,365	Hills covered with jungle.
No. 2, Central Provinces Survey ...	2,131	3,008	64	219	14	140	20.2	699	552	49,607	Ditto ditto ditto.
No. 3, Central Provinces and Vizagapatam Agency Survey ...	1,527	1,500	76	52	28	46	32.6	1,401	1,516	57,770	Hills with dense jungle, very malarious.
No. 4, Chota Nagpore Division Survey ...	2,865	1,550	28	124	13	74	20.0	2,809	2,808	50,305	Hills and plateau covered with jungle.
No. 5, Rewah and Dunderkund Survey ...	2,273	400	25	83	5	43	0.3	{ 1,012* 2,412	{ 3,260* 2,474	54,210	Mostly hills and jungle with some flat cultivated country.
No. 6, Cossyah and Garrow Hills Survey ...	3,073	4,374	65	121	30	90	48.6	{ 392* 1,044	{ 288*	83,088	Mountainous, very difficult owing to dense jungle.
No. 7, Rajpootana Survey	3,900	3,500	44	222	10	102	34.3	{ 510* 3,816	{ 1,875 5,316	40,798	Part desert, remainder low hills covered with jungle and some cultivated plains.
TOTAL ...	20,201	14,332	302	821	19	504	28	18,033	24,778	3,64,211	

* From work of previous seasons.

From this it appears that there has been a total out-turn of Topographical materials for the Maps of 20,201 square miles, 14,332 square miles of Triangulation with 504 determinations of heights. This work was done at a total cost of Rs. 3,64,211. This shows an increase of 5,571 square miles in Topography, a decrease of 10,833 square miles in Triangulation, and a decrease in the cost of about Rs. 25,781.

Taking the Topography to represent the amount of finished survey, the cost per square mile is about Rs. 18, but as an equal amount of triangulation was not completed during the season, and it would probably have taken Rs. 35,214 to complete the 5,869 square miles by which it falls short, it will be fairer to assume that the cost of a finished square mile of survey with its triangulation and topography was nearly Rs. 20.

The increase in topography is due partly to one survey having done no triangulation, but chiefly to the natural progress due to the increased experience of each party.

The decrease in triangulation was intentional, as the parties have all sufficient, ready for the topography of the ensuing season.

The decrease in cost is general, but the cause is not very apparent, though a small portion of it is due to better management in No. 6 Party, and to the reduction of the scale on which $\frac{2}{3}$ of its work was turned out. Part of the Topography of No. 6 Party having been done on the 1 inch to a mile scale, and part on the $\frac{1}{2}$ inch to the mile scale, it was impossible to assign the respective cost on the different scales.

But omitting the results of No. 6 Party, it would appear that the cost of the Topographical Surveys on the scale of one inch to the mile does not exceed Rs. 20½ per square mile.

With reference to the proportion of heights to the area triangulated, it must be observed that the orders as to increasing the number of heights did not reach the Officers in charge in time, to apply it during the season under review. The average proportion of heights to area is one to every 28 square miles as compared with one to every 31 square miles last season. The proportion of 1 in 28 will be improved during the next field season by the determination of some more heights in the ground already triangulated, but as the number of points fixed is on an average only 1 in every 19 square miles, the proportion of heights cannot be more than the said 1 in 19 without entailing an extra cost, which it is not now advisable to incur.

During the ensuing field season, the proportion of heights to area in the new triangulation will be brought up as near to that ordered *viz*: 1 in every 10 square miles, as the nature of the various countries under survey will permit, but in many parts the dense jungle and other obstacles will prevent its accomplishment, in such places a useful approximation to the differences of level may be obtained by the use of the aneroid barometer and observations of the boiling point where the differences of heights are considerable.

The following Table shows the results of the Triangulation, it has been generally of a good quality though there is still room for improvement in that of No. 5 and No. 6 Parties :—

DESIGNATIONS OF PARTY.	NUMBER OF TRIANGLES.				TRIANGULAR ERRORS IN SECONDS.		DISCREPANCIES BETWEEN COMMONSIDES IN INCHES PER MILE.				REMARKS.
	1st Class.	2nd Class.	3rd Class.	4th Class.	1st Class.	2nd Class.	1st Class.	2nd Class.	3rd Class.	4th Class.	
No. 1 Party, Gwalior and Central India Survey	No return.
No. 2 Party, Central Provinces Survey ...	13	209	919	...	1'68	6'0	3'0	6'4	...	...
No. 3 Party, Central Provinces and Vizagapatam Agency Survey ...	...	...	111	...	...	...	...	...	...	...
No. 4 Party, Chota Nagpore Division Survey ... ..	...	...	12	214	...	4'0	...	5'0	7'0	...
No. 5 Party, Rewah and Bundelkund Survey ... ..	...	29	289	72	...	9'4	...	1'4	19'0	15'4
No. 6 Party, Cossyah and Garrow Hills Survey	11	91	...	207	2'23	37'4	4'5	10'7	...	42'0	
No. 7 Party, Rajpootana Survey ... ..	...	28	15	285	...	4'2	...	4'7	1'0	10'0

The topography has for the most part been carefully supervised and has satisfactorily stood the checks and tests which have been applied to it.

In No. 2 Party, the Officer in charge has devoted too much of his time to purely trigonometrical work, a larger amount of inspection and examination on his part would have prevented Mr. Smith from doing so much bad work, and Native Surveyor Baparao would have had his errors pointed out in time to correct them before the close of the field season.

Several of the members of No. 5 Party being still but partially trained, the Officer in charge should devote as much time as he can possibly spare to examining their work.

The following Table shows the number of Trigonometrical points and the plane table stations used in each Survey :—

NAME OF PARTY.	No of square miles to each Trigonometrical Point.	No of plane table fixings in each square mile.	REMARKS.
No. 1 Gwalior and Central India Survey	4'6	} For the $\frac{1}{2}$ inch scale, } '65 per sq. mile.
" 2 Central Provinces Survey	14	2'6	
" 3 Central Provinces and Vizagapatam Agency Survey ...	29	6'9	
" 4 Chota Nagpore Division Survey	13	7'0	
" 5 Rewah and Bundelkund Survey	5	6'1	
" 6 Cossyah and Garrow Hills Survey	36	4'1	
" 7 Rajpootana Survey	16	3'3	

The general out-turn of maps by the Department has been capital. From the table on page 4 it will be seen that with the exception of Nos. 2 and 6, the parties have generally completed the maps of as large an area as they surveyed during the field season. The amount completed by No. 2 Party is particularly small, but portions of various other sheets were done during the recess, which will add to the out-turn of next season.

Had Nos. 2 and 6 been able to do their full share, the mapping would have kept pace with the surveying as far as the standard sheets are concerned.

With the exaggerated sheets for reduction to the $\frac{1}{4}$ inch scale, great progress was made, and there is every hope that all arrears will be cleared off in one or two seasons more.

The standard maps of No. 1 Party are very good. The hill shading of those of No. 2 has improved, and is less stiff than formerly, the printing has also improved. The maps of No. 3 continue to show improvement both in hill shading and printing. The contour lines of the shading are rather too close in some parts, and the features, spurs &c., should be shown more distinctly.

The maps of No. 4 are still somewhat stiff, and require more finish generally. Those of No. 5 are good and the hill shading is improved. The hill shading of No. 6 is capital, though the small $\frac{1}{4}$ inch sheets hardly admit of sufficient room for studying the variation in the ground.

The maps of No. 7 have been well turned out, but having but little more than sand dunes to delineate, there has been no opportunity for the display of the drawing powers of this party.

The style of the exaggerated maps shows progress, but the contour lines of all of them are still too close and generally too fine to stand reduction to a scale one-fourth smaller. The printing is a little too small, both words and figures require, as a general rule, to be carefully written.

The general progress of the Topographical Parties has been excellent.

The physical difficulties of the country have been surmounted, and those arising from the inexperience of untrained hands have been successfully met in most cases.

The general results of the season are alike highly creditable to the professional ability and to the zeal of the Surveyors, who have been employed on this arduous duty.

Progressing at the rate of 20,000 square miles per annum, the Topographical Department bids fair to open out all the wild parts of India, and before very many years are over, maps of every portion will be available.

These maps are much required and will be of great aid in all schemes for improvement which for want of them have hitherto been all but impossible. They will suffice in fact for all practical purposes for very many years to come, until advancing civilization and the increased value of land demand maps on a still larger scale. Meantime they are making a most valuable contribution to the geography of India.

EXECUTIVE SURVEYS.

No. 1.—TOPOGRAPHICAL PARTY.

GWALIOR AND CENTRAL INDIA SURVEY.

No. 1 Party under Lieutenant C. Strahan was employed in surveying portions of Jeypore and Ulwar.

The triangulation being far in advance of the Topographical work, no farther extension was required. Two pieces of minor triangulation were executed, *viz.*, those for the large scale plans of Agra and Ulwar, with this exception the whole strength of the party was devoted to the Topographical work. The area mapped consequently shows an increase on the previous

season. The country over which the survey work extended was for the most part very hilly; the centre of Ulwar more especially so, the hills rising to from 800 to 1,000 feet above the plain at its foot. The hills are very rocky and mostly covered with jungle, in some parts they are so precipitous that hardly anything but men can cross them. There are large valleys between the hills, and good crops of wheat and barley were seen on the more level portions.

The city of Ulwar is irrigated by two canals, and several minor channels were seen in the district.

The Siliser Lake feeds the Ulwar canals, and the minor channels are taken from the streams which intersect most of the valleys. The lake is an artificial one, formed by a masonry dam, carried across a narrow portion of a valley; it appears to answer its purpose capably,—it never dries up completely and is evidently of great value to Ulwar.

The hills form the winter grazing ground of large herds of cattle which move up from the plains after the rains are over.

Game is strictly preserved, Sambur deer and Neelgae consequently swarm in many places and do great damage to the crops. The jungles afford shelter to tigers which commit great havoc among the cattle and occasionally carry off the men.

Two specimens of native forts were seen, both built so as to take advantage of the natural strength of the hills. The extensive ruins of two ancient cities, *viz.*, of Ramnagurh and Bhangurh, were seen and also some very old temples. Ulwar produces both iron and copper ores which are partially worked.

	Square miles.	
* Lieutenant C. Strahan, R. E.	221	covered with jungle as in Ulwar. The land between the hills is nearly all cultivated, though the sandy soil did not appear to produce such good crops as Ulwar. The party has completed 3,832* square miles of sketching, the materials for the large plans of Ulwar have been prepared, and that for the cantonment and city of Agra have made considerable progress. Ten standard maps have been completed giving the mapping of 3660 square miles and 15 exaggerated sheets have been prepared for reduction to the $\frac{1}{4}$ inch scale to be used hereafter in the sheets of the Atlas of India.
Mr. H. Horst	454	
" H. J. Bolst	282	
" G. P. Chill	306	
" G. K. Allnutt	471	
" G. F. Murphy	139	
" G. L. Esteve	165	
" W. J. Cornelius	413	
Native Surveyor Joala Pershad	315	
" " Abdul Samad	283	
" " Abdul Sobhan	272	
" " Golan Mohamed	271	
" " Churatuun	240	
Total	3,832	

The Rajah of Ulwar did every thing he could to assist the progress of the survey, and his officials were particularly obliging and ready to assist on all occasions; the work consequently progressed much more satisfactorily than it did in the Jeypore State, where the Surveyors were constantly harassed by petty difficulties in which they could get no assistance. The contrast after Ulwar was so great that Lieutenant Strahan naturally congratulates himself that he has very little more of Jeypore to survey.

During the ensuing field season, the triangulation will be extended westward from Sipri, and also to the south of the country already surveyed. The Plane Table sketching will be carried over the country which was triangulated in previous seasons.

No. 2.—TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES SURVEY.

No. 2 Party under the charge of Mr. Mulheran was employed in the Baitool, Chindwara, and Seonce Districts of the Central Provinces.

The party completed 3,008 square miles of Triangulation and 2,131* of Topographical detail

	Square Miles.	
* Mr. C. Neale ...	194	with 165 linear miles of forest boundary. The country under survey was hilly and generally covered with dense jungle; the jungle in some parts being so dense that there was considerable difficulty in tracing even large water-courses. Wild animals abounded and tigers were so troublesome as to prevent the erection of signals in some parts. In one case, a single tigress seems to have caused the desertion of 13 villages and thrown about 250 square miles of country out of cultivation. This tigress killed upwards of 50 men and women before she was despatched by Major Priestley, who succeeded in shooting her in June last after a long and troublesome expedition. The district generally owes much to that sportsman's perseverance in the pursuit.
„ C. A. R. Scoulan ...	272	
„ A. Chennell ...	318	
„ J. Chennell ...	189	
N. Survr Ranchunder ...	250	
„ Pandarao ...	317	
„ Baparao ...	316	
„ Janurdanrao ...	275	
Total ...	2,131	

The civil and sub-assistants of the party have all given satisfaction, except Mr. Smith, who has been allowed to resign, being evidently unfitted for survey duties.

The Native Surveyors have also continued to give satisfaction with the exception of Baparao, a portion of whose work will be revised during the ensuing field season, with a view to see whether the whole should be rejected or retained.

With the exception of the work of Mr. Smith and Native Surveyor Baparao, the Topographical work has stood the checks applied to it satisfactorily. Such portions as were not examined will be taken up on another occasion.

The Triangulation will be extended during the ensuing field season to the south of Umarpathar and east from Deoghur to the boundary of the Seonee District.

The Topographical work will be chiefly in the Hill Jagheers north of Chindwara.

The portion of which the detail survey has been made is very much scattered, so that although it runs through 9 Standard Sheets, it only covers the area of about $2\frac{1}{2}$ sheets or 650 square miles. This is partly due to the bad work of Mr. Smith, but still more to the way in which the ground is divided with the Revenue Survey.

The hill shading of the maps has improved and so has the printing, but there is still room for a great deal of improvement, more especially in the latter respect and the general finish of the maps, before the work could be brought up to the standard of the best Topographical Surveys.

No. 3.—TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES AND VIZAGAPATAM AGENCY SURVEY.

	Square Miles.	
* Mr. Chew ..	234.8	No. 3 Party under the charge of Lieutenant Colonel Saxton was employed chiefly in Bustar, Kalahandi, &c. On the extreme south-east of the Central Provinces, about 200 miles north of the mouth of the Godavery River, the party completed 1,500 square miles of triangulation and 1,527* square miles of detail survey.
„ May ...	243.6	
„ Adams ..	280.8	
„ Claudius ...	249.6	
„ Pettigrew ...	167.7	
„ Cooper ...	51.2	
„ Trewman ...	150.0	
„ Atkins ...	149.5	
Total ...	1527.2	

The new country triangulated was of the wildest description and notoriously unhealthy. The ground was so impracticable in places that at one time the Officer in charge was separated from his main camp for 12 days consecutively without being able to communicate with it.

The triangulation was connected with the Coast Series of the Great Trigonometrical Survey on one side and a preliminary connection was made with the Hyderabad Survey on the other. The work was carried over hills running up to 4,000 feet above the sea.

The detail survey was carried on for the most part in the valley of the Indrawatti, an important tributary of the Godavery. Here the country was found to be more densely

populated and better cultivated than any other tract that the party has seen between the Godavery and the Mohanuddi, nevertheless many parts are covered with dense jungle, and the health of the party though better than heretofore was not very good, owing no doubt in some measure to sickness caught in previous seasons; the party having worked in very unhealthy districts.

Large game was abundant throughout the country surveyed.

The progress of the triangulation was good under the circumstances. Lieutenant Colonel Saxton's time having been greatly taken up by extra departmental work, in connection with the demarcation of the boundary between Bustar and Jeypore, an important case for the settlement of which Lieutenant-Colonel Saxton has already received the thanks of the Government.

The out-turn of detail survey is not so large as usual owing to diminution of strength of party, and the presence of several partially trained surveyors. The out-turn is on the whole as good as could have been expected, considering the above and the necessarily short field season.

The tract of country over which this party's operations have been carried, *viz.*, from the Mohanuddi west of Cuttack to within 200 miles of the Godavery, appears always to have been one of the most uncivilized parts of India: hitherto no ruins or temples of any kind have been met with, such as are seen in other parts of the country even when covered with jungle. Lieutenant Colonel Saxton records that the ruins of the interesting old town of "Barsur" with five temples of a peculiar style as the first he had met with for many years in the country he has been surveying.

The Officer in charge reports a marked improvement in the finishing of the maps, and in drawing generally.

The computations have been brought up as far as was required.

Sheets on the one inch scale have been sent in giving the details of 1,491 square miles, 1,516 square miles of exaggerated maps on one inch scale prepared for reduction to quarter inch.

The field and office work of the party have altogether been well kept up, a number of new hands have been trained, and there is every reason to expect a good out-turn during the ensuing season.

The party had considerable difficulties about camp equipments and carriage to overcome; the latter was however greatly facilitated by the civility of the Rajah of Vizianagram, who very kindly placed two elephants at the disposal of the Officer in charge. The party is very much indebted to the Rajah, as without this assistance the work would have been greatly hindered, and some portions would probably have remained unfinished.

During the ensuing season, Lieutenant Colonel Saxton will demarcate 50 miles more of boundary which is urgently required by Government; he proposes to employ the whole of his party on the country adjoining this boundary, so that after demarcation it may be entered on the finished maps.

Lieutenant Colonel Saxton will complete the connection of his triangulation with the Hyderabad Survey.

No. 4.—TOPOGRAPHICAL PARTY.

CHOTA NAGPORE DIVISION SURVEY.

The operations of No. 4 Party under Captain Depree has been confined to Sirgoojah, Korea, and Bhokhar on the south-west of the Chota Nagpore Division, formerly known as the south-western Frontier Agency, about 300 miles west of Calcutta and 200 miles south of Benares.

	Square Miles.	
* Mr. McGill	394	The party turned out 1,550 square miles of
„ Vanderputt	383	triangulation and 2,865* square miles of detail
„ Wilson (Senior)	374	survey.
„ James	389	
„ Barker	311	The country triangulated was very wild and hilly,
„ Rnc	94	covered with jungle and sparsely populated, elephants
„ Wilson (Junior)	330	being very numerous. The triangulation now covers
Baboo M. S. Dutt	338	the whole of Chang Bhokar, parts of Sirgoojah and
„ H. D. Dutt	168	Korea.
„ E. Shareef	84	
Total	<u>2,865</u>	

The detail survey was for the most part carried on in Sirgoojah including on the south the Manipul plateau 3,700 feet above the sea, in the centre the level country about Bistrampore and Pertabpur about 1,800 feet above the sea, and a tract on the north which slopes off to a lower level consisting of a succession of undulations covered with jungle, where villages, as a rule, are few and far between. The whole forming a very varied tract of country.

The triangulation being well ahead of the detail survey, the Officer in charge only devoted a small portion of his time to extension, hence a decrease in the out-turn as compared with previous season.

The detail survey on the other hand shows an increase, and the Officer in charge not having so much triangulation in hand, was able to give more time to the examination of the work finished and in progress, the out-turn has been on the whole very good, and the Surveyor reports that it has stood all tests satisfactorily.

Coal outcrops in various parts of Sirgoojah which have been noted on the Map.

The health of the party was unusually good, though working in a tract covered with jungle; this the Surveyor attributes to the good climate of Chota Nagpore where the party recess.

The drawing and computing of the party has been brought up to date.

Of the standard Maps, 5 sheets have been completed, embracing an area of 2,808 square miles and the same amount has been turned out in the exaggerated style for reduction by Photography.

Though carefully executed, the maps will still admit of great improvement in the style of shading, in the printing and general finish.

The contour lines are, as a rule, too close for Photozincography in the standard maps, and in the exaggerated sheets, they are so crowded that they will amalgamate on the reduced scale and form one black mass.

All the members of the party have had some training in the use of the Plane Table, but very few of them have had any practice in the triangulation. Measures will be taken during the ensuing season to correct this and to increase the number of Computers.

During the next season the detail survey will be carried on to the westward to the extreme limit of the Chota Nagpore Division through the north of Korea, and over the whole of Chang Bhokar, and will include a large part of Sirgoojah.

The triangulation will be extended to the west of Longitude 84°, and a junction effected with the work in Korea.

During the recess, Captain Depree compiled a Geographical and Statistical report on Chota Nagpore and Singbhoom, forming a valuable addition to the little that is known of the Chota Nagpore Division. This report will be printed separately for the use of the Civil authorities and public.

No. 5.—TOPOGRAPHICAL PARTY.

REWAH AND BUNDLEKUND SURVEY.

No. 5 Party under Lieutenant Riddell, R. E., was employed in Rewah and Bundlekund.

	Square Miles.
• Lieutenant R.V. Riddell ...	229.3
" W. Badgley... ..	165.0
Mr. Chamaret... ..	318.9
" Hamer	160.6
" Howard	78.0
" Kirk	117.1
" Ryan	211.6
" Wainright... ..	174.7
" Kitchen	170.0
Native Surveyor Nabi Bux ...	163.6
" Prem Raj	214.5
" " Abdoor Rohin ...	132.1
" " Abdoor Ruhman ...	147.5
" " Ali Ahmad	7.0
	2,389.9
Overlap... ..	117.1
	2,272.8

The Party finished 400 square miles of triangulation and 2,273* square miles of detail survey.

The country triangulated includes some level cultivated ground and a forest-clad plateau, but fortunately there were throughout a good many small isolated hills well suited for trigonometrical points.

The detail survey in Bundlekund was partly in flat, well cultivated districts and partly in more difficult ground, but covered in both cases with a mass of small flat topped hills. In Rewah the ground was much more broken. As seen from a commanding

height, it appeared to be a gently undulating country covered with a dense forest; on examination it generally proved to consist either of a number of low plateaux rising abruptly from the plains or else of a mass of ravines and broken ground. The forest and general equality of level tending to hide the roughness.

The country throughout was covered with jungle and the only portions really cleared were narrow slips along the water-courses for the cultivation of rice.

The progress of the triangulation was small; sufficient area for the ensuing season having been provided by the work of former years.

The out-turn of detail survey shows a considerable increase over previous season, the diminished demand for triangulation enabling the Officer in charge to employ a larger portion of the party in the Topography. The area sketched is almost more than was desirable, considering the amount of accuracy required and the number of imperfectly trained hands in the party. During the ensuing field season, it will be advisable for the Officer in charge to devote still more of his time to inspecting and checking, more especially as the Assistant Surveyor attached to the party is proceeding on furlough and no one is available to supply his place.

Ten sheets of the standard maps have been turned out, giving an area of 3,424 square inches of mapping, and 13 sheets of exaggerated Maps for reduction with an area of 5,743 square inches, including maps that had been partly done in previous season.

The maps show improvement, but there is still room for further improvement in the shading, printing, and general finish.

The health of the party has much improved under Lieutenant Riddell's management and by judiciously carrying out Colonel Thuillier's recommendations, he finished the field season with but few cases of sickness, and without impairing the efficiency of the party.

Lieutenant Riddell concludes his report with a detailed memorandum on Bandogurb, with an enlarged plan of that fortress and its environs. This place is one of the most important strongholds of the Rewah principality; it is formed by taking advantage of a great rectangular mass of rock some 2,000 yards in length by 1,300 yards in width, which rises abruptly like a wall to a height of nearly 1,000 feet above the valleys at its base, being itself 2,662 feet above the sea. The precipitous sides of this rock are naturally inaccessible in most places, and in the few which are not, have been made so artificially by curtain walls, &c.

The fort has a considerable garrison and is jealously watched by the Rewah officials, who decline to admit any one into it. It has an abundant supply of water from tanks within the place itself. Large stores of grain, &c., are said to be kept in hand and the fort is evidently well supplied with guns and ammunition.

The memorandum fully describes all the approaches to the place, and every information as to this curious stronghold has been collected by Lieutenant Riddell, and the whole forms a valuable report.

No. 6.—TOPOGRAPHICAL PARTY.

COSSYAH AND GARROW HILLS SURVEY.

No. 6. Party under Captain H. H. Godwin-Austen was employed in various districts east of Cherrapoonjee, *viz.*, in the Khasi and Jyntiah Hills, in North Cachar, and Naga Hills, &c.

	Square Miles.
* Captain H. H. Godwin Austen ...	411.6
Lieutenant M. T. Sale ...	669.5
Mr. Babonau ..	346.0
„ Wyatt ...	227.5
„ Ogle ...	670.2
„ Gilhooly ...	690.7
„ Stratford ...	39.6
„ Doran ...	143.3
Nasirudin ...	268.1
Dalliludin ...	117.8
Goureuhundra ...	89.1
Total ...	3,673.4

The party completed 6,183 square miles of triangulation and 3,673* square miles of detail survey. The area triangulated includes some distant points, but excluding them, about 4,370 square miles of country were prepared for the detail Surveyors. Of the topographical work, about one-third was on the 1 inch scale, and two-thirds on the $\frac{1}{2}$ inch scale.

The country triangulated was of a very difficult nature, for the most part consisting of hills covered with dense forest and high elephant grass, in other parts low, with a flat monotonous aspect which did not afford many prominent points for intersection.

The detail survey was carried on in equally difficult ground including part of that triangulated. Some of the party were however employed in somewhat easier ground near Jawai and Shillong which was more populous and better cultivated; this part was done on the 1 inch scale, the remainder having been done on the half inch scale.

The progress both in the Triangulation and in the Topography shows a marked improvement over last season. Captain Austen's good arrangements have begun to tell, the party may now be said to be in thorough training, and in such a country it would not be desirable to see a larger out-turn of work.

The party had great difficulty in getting coolies and supplies; if they are not further impeded in this way, it is now to be hoped that the Survey will make steady progress every season.

Though working in very unhealthy districts in dense jungle, the health of the party has been on the whole good. Two Kalashies were however carried off by tigers, one being carried away from a hut, and the other having been struck down while on the march.

The improved health is no doubt due to Captain Austen's increased experience as to the proper seasons for the different styles of ground that his survey embraces, removing the Surveyors early out of the low ground, being the most effective measure for preserving the health of the party. The result is highly creditable to Captain Austen's judgment.

Eight standard sheets and 3 exaggerated sheets partly on the 1 inch and partly on the $\frac{1}{2}$ inch scale have been completed, giving 1,426 square inches of mapping in the former, and 288 square inches on the exaggerated sheets.

These maps have been well turned out, though there is room for improvement in the printing and general finish. This will no doubt be corrected when the Draftsmen have had more training with further progress.

Captain Austen concludes his report with an interesting memorandum on the Geological formation of the Jyntiah Hills and of the distribution of different races and tribes.

During the ensuing season, the Survey operations will be extended eastward into Munipore, and the parts already triangulated will be sketched.

No. 7.—TOPOGRAPHICAL PARTY.

RAJPOOTANA SURVEY.

No. 7. Party under Lieutenant Downing was employed in Rajpootana; the detail working being mostly about 100 miles west of Delhi in the States of Jeypore, Shekawatti, and

Bikaneer; the new triangulation was carried on further south near Tonk, Deoli, &c., some 250 miles south-west of Delhi.

The detail work was in a country where, besides the villages and roads, there was little but sand without any marked Topographical features. The triangulation includes the city of Tonk and the Cantonment of Deoli.

	Square Miles.	
*Mr. Banerjee	360	as compared with previous season,
" Atkinson	600	an increase in Topographical work
" Todd	438	and a decrease in triangulation, the
" Tappell	549	latter partly due to its including
" Kitchen	270	the triangulation for the large
" Stotesbury	764	plans of Deoli and Tonk.
" McNair	277	
" Native Surveyor Hur Lal Singh	636	
" " Kalka Persad	89	
Total	<u>3,900</u>	

The progress of both the Triangulation and the Topographical work was excellent.

The whole of the detail Survey was checked, the work of each Surveyor was examined separately and found to be thoroughly satisfactory.

The health of the party appears to have been good throughout the season.

Lieutenant Downing reports that on the borders of Bikaneer desert "the peculiar wave-like form of the sand is most striking, as you journey into the interior, they assume the more rounded form of hillocks, vegetation becomes more and more scanty until you find nothing but small stunted shrubs, yet this arid and unpromising tract is, as far as I have seen, well inhabited, not only a large number of villages but many well built and thriving towns. Cultivation is carried on to a small extent, and I was informed that after the rains the whole country is green and looks like a vast meadow, but when I visited it in March—April, there was very little of this verdure to be seen."

Lieutenant Downing refers to the anticipated scarcity, and the Officer in charge was consequently told to draw his supplies of grain from large places only if there was any difficulty about grain; fortunately the detail work of the present season was all to be in the more favored country to the south, which he describes as a great contrast to that of the above, the sand being almost entirely lost sight of, and in its place ranges of low hills covered with jungle, broad rivers, and well cultivated plains. Here it is hoped the scarcity will not be much felt, and that by liberal payment and the employment of some of the people the presence of the Survey Party may tend rather to diminish the pressure. Should, however, any pressure arise, the party have been ordered to move elsewhere, and if necessary, will be removed entirely.

The Maps consist of 13 sheets on the standard scale and 13 in the exaggerated style for reduction, besides 6 other exaggerated sheets that had partly been prepared previously, a large scale plan of Deoli and two sketch plans of the fort of Tonk.

The standard sheets have 3,816 square inches of mapping and the exaggerated sheets 5,416 done during the present season, and 510 square inches of the first, and 1,875 square inches of the second, partly prepared previously.

Altogether the field and office work has been well kept up to date, and there are no arrears; during the ensuing season the triangulation will be extended southwards. Minor triangulations will be made for the cities of Boondi and Kotah. The detail survey will be carried over the part already triangulated, and the large plan of the city of Tonk will be taken up if there is no objection to its being done.

PEGU TOPOGRAPHICAL SURVEY.

The charges on account of the Pegu Survey came to a close on the 30th of September, 1868, and as will be seen from Captain Edgcome's report, which is given in full, nothing remains but to print and publish the results.

T. G. MONTGOMERIE, *Captain, R. E.,*
Officiating Deputy Surveyor General and Superintendent of
Topographical Surveys.

REPORT ON THE SURVEYOR GENERAL'S OFFICE,

COMPILING AND DRAWING BRANCH,

From 1st December 1867 to 30th November 1868.

1. The various descriptions of work performed have been classified and arranged under distinct heads in the Tabulated Statement which follows, and the progress made has been briefly described in the column of remarks.

Statement shewing the nature of the work performed and the progress made from 1st December 1867 to 30th November 1868.

MAPS.	SCALE.	PROGRESS AND REMARKS.
COMPILATIONS.	Miles Inch	
INDIA.—Eastern Bengal Section between the parallels of 20° & 25° North Latitude and Meridians of 90° & 94° East Longitude.	10=1	Portions of the districts of Sylhet and Hill Tipperah completed, Chittagong district in progress.
INDIA.—Western Bengal Section between the parallels of 20° & 25° North Latitude & Meridians of 86° & 90° East Longitude.	10=1	Hills to be drawn, and portion of Chota Nagpore, insertion of names of districts and Sub-Divisions, all the rest completed.
INDIA.—Compilation in six sheets to shew the actual results of Surveys completed, based upon the Great Triangulation of India.	32=1	Projection of points on sheets 1, 3 & 4 completed, points under projection on sheet 5.
INDIA.—Shewing Financial Circles & Treasuries.	32=1	Based on the skeleton map of India in 6 sheets prepared under instructions from the Government of India, Financial Department, published for issue to Local Governments and Officers of the Accounts Department.
PUNJAB.—Index or Hand Map.	16=1	Numerous additions have been made to both the Eastern and Western Sections. Every known route with the stages has been inserted, also the principal ranges of Hills, passes and heights, &c., so as to make it a complete and useful Hand Map of the Punjab and its dependencies. In progress and will soon be sent to press.
PUNJAB.—General compilation in 8 Sections portions of sheets 5 & 8 from Surveys lately completed.	8=1	Sheets 2 & 7 have been published and issued during the year, making in all 5 sheets issued up to date; sheet 6 has been well advanced at press; compilation of sheets 5 & 8 await some additions.
PUNJAB.—Cis-Sutlej, Delhie & Hissar Divisions in 6 Sections.	4=1	Additions up to margin completed so as to embrace the greater portion of the Cis-Sutlej States, and all the protected States up to Simla. All the sheets have been photozincographed and proofs are under correction.
Kurrachee & Hyderabad Collectorate (Western Section.)	4=1	Completed portions of the Kurrachee and Hyderabad districts, awaiting materials, South of Hyderabad.
General Map of the Hyderabad Topographical Survey.	4=1	Upper Godavery Districts and portions of the Ramgeer and Mahore Circars added, completed.

MAPS.	SCALE.	PROGRESS AND REMARKS.
	Miles Inch	
General Map of the Ganjam and Orissa, Vizagapatam Agency and Central Provinces, Topographical Survey.	4=1	Completed up to the Survey of 1865-66. The work of 1866-67 inserted in outline.
General Map of the Chota Nagpore Division Topographical Survey.	4=1	Completed the work of 1865-66. Work of 1866-67 in progress in outline.
Compilation of the Central Provinces.	8=1	Completed as far as materials have been received.
Gwalior Survey Standard sheets Nos. 1 (a) & 2 (a)	1=1	Drawn for Photozincography and sent to Press.
Ditto Nos. 1 (b) 2 (b) 4 (b) 5 (a) & 5 (b).	1=1	In progress, partly traced.
Rewah Survey Exaggerated Sheet No. 32.	1=1	For reduction to $\frac{1}{4}$ Scale, completed.
<i>Miscellaneous Maps fair drawn for Zincography & Photozincography, &c.</i>		
Military Map of Hazarah	2=1	Completed in pen and ink and Photozincographed for sale and issue.
Map of the Province of Turkistan by C. D. Struve.		Fair drawn and Photozincographed. Copies supplied to the Government of India, Foreign Department.
Map of the Semirechensk District & basin of the Zai-San river.		Do. do.
Map of the routes from Leh to Khoten.	} 16=1	Drawn on transfer paper and zincographed.
Routes from British India into Thibet & Lassa Territory.		550 copies of each map supplied to the Government of India, Foreign Department.
Map of the boundary between Bustar & Jeypoor demarcated by Col. Saxton & Captn. Glasfurd.	1=1	Drawn on transfer paper and zincographed.
Route Surveys in Bustar & Jeypore.	8=1	Ditto Ditto.
Route Surveys in Abyssinia.—		
From Massowah to Antalo.	4=1	} Fair drawn & photozincographed for the Government of India, Military Department.
From Antalo to Magdala.	4=1	
From Zoolla to Antalo.	4=1	2 Copies on tracing cloth.
Index map to the sheets of the Rajpootana Survey.	16=1	Fair drawn and Photozincographed.
Ditto to the sheets of the Khasia & Garrow Hills Survey.	32=1	Ditto Ditto
Ditto to the maps of the Ganjam and Orissa, Vizagapatam Agency and Central Provinces Topographical Survey.	16=1	Four copies prepared illustrating the work of each season.
Index to the 1 inch and $\frac{1}{4}$ inch sheet maps of Oudh.	16=1	Drawn and Photozincographed.

MAPS.	SCALE.	PROGRESS AND REMARKS.
	Miles Inch	
Preliminary map of the Hazarebaugh District.	4=1	Corrected the re-surveyed Circuits North of the Trunk road, Hills revised and sent to Press to be Lithographed.
Hand Map of India.	128=1	Revisions up to date completed. Hill drawing in progress.
<i>Fair copies of Charts and Extracts.</i>		
Chart of the Aboo Series G. T. Survey in 8 sheets.	4=1	For Office record 4 sheets completed, 2 sheets partly drawn.
Chart of the Chota Nagpore Division Topographical Survey.	4=1	} Fair Copies for Office record.
Ditto Ganjam, Orissa and Vizagapatam Agency Topographical Survey.	4=1	
Ditto Khasia and Garrow Hills Topographical Survey.	4=1	
Ditto Gwalior and Central India Topographical Survey.	4=1	
Ditto Rajpootana Topogl. Survey to accompany Degree sheet 1.	4=1	
Extract from Chart of the Budhon Series G. T. Survey.	4=1		} For the Revenue Survey Branch with Trigonometrical data.
Ditto Great Arc Series Ditto.	4=1	
Ditto Assam Longl. Series Ditto.	4=1	
Ditto North West Himalya Series G. T. Survey.	4=1	
Extract from Chart of the Sutlej Series G. T. Survey, shewing the Triangulation through the Bhawalpore State.	4=1	For the Political Superintendent Bhawalpore
<i>Tracings of Maps for Government Officials, Office Record, &c.</i>		
Plan of the Civil Station, Town and Suburbs of Mymensing.	8=1	For Superintending Engineer South East Circle.
Tracings from the Pergunnah Maps of Dist. Hijilee, shewing the country along the coast from the Rusoolpoor River, to the Deegah River.	1=1	For the Superintending Engineer South West Circle Irrigation Department.
Boundary between Nepal and Oudh, from Bhugora Tal to the Sardah River.	4=1	Trace for the Officer in charge Kumaon and Gurhwal Survey.
Extract from Rennell's and Martin's Map of Rungpore, Kooch Behar, &c.	5=1	Trace for Commissioner Kooch Behar division.
Sketch map of the boundary between Bengal and Bhootan and Sikhim and Darjeeling.	2=1	Ditto Ditto Two Copies.

MAPS.	SCALE.	PROGRESS AND REMARKS.
Survey for the new Cantonments at Benares. Sketch map shewing the City of Benares & Ganges River.	Miles Inch } large	Tracings for the Secretary to Government Military Department.
Plan of the Cantonments at Dorundah.	1 = 8	Trace for the General Commanding Presidency Division.
Plan shewing the boundary of Cantonments at Darjeeling. Ditto Ditto at Senchal	1 = 8 1 = 8	} Tracings for Office record.
Trace from Chart of the Aboo Series G. T. Survey.	4 = 8	Shewing the Coast line for the Superintendent Geological Survey.
Extract from the maps of the Hooghly Dist. shewing the country along the Railway.	1 = 1	For the Director of Vaccination.
Trace of the field sections Chota Nagpore Division Survey, shewing the Patkoom Pergunnah.	1 = 1	For the Supdt. of Topographical Surveys.
Tracings to shew the positions of the Principal Stations Rangir Series G. T. Survey.	various	For the Superintendent Great Trigonometrical Survey, completed.
Ditto Do. of the Amua Series G.T. Survey	Do.	Ditto in progress.
<i>Cantonments and City Plans.</i>		
Plan of the Cantonments and Environs of Lucknow.	1 = 6	Reduced and fair drawn. Photozincographed
Do. of the City, Civil Station and Environs of Lucknow.	1 = 6	Suburbs added from re-survey. Examination in progress.
Plan of the Cantonments, Town and suburbs of Dinapore.	1 = 6	Fair copy for photozincography completed. Under examination.
Plan of the Cantonments, Civil station, City and Environs of Cawnpore.	1 = 12	Being copied for reduction and publication by Photozincography.
Plan of the City and Cantonment of Deolee in Rajpootana.	1 = 10½	Ditto Ditto
Plan of the Cantonments at Alipore and Balligunj.	1 = 6	Photozincographed.
Plan of the City of Moorshedabad.	1 = 8	} Fair copies prepared and Photozincographed.
Plan of the City and Civil Station of Myensing.	1 = 8	
Plan of the Cantonment, Civil Station and Town of Dorundah.	1 = 6	Fair copied and zincographed—Trace prepared for the Quarter Master General's Department.
Infantry Lines at Nowshera (Punjab.)	500 ft. = 1	On transfer paper for zincography, 3 sections transferred, others in progress.

SURVEYOR GENERAL'S OFFICE,
PHOTOGRAPHIC & LITHOGRAPHIC BRANCHES.

Calcutta, 1st December, 1868.

FROM

CAPTAIN A. B. MELVILLE,

In charge Press and Photo. Branch.

Surveyor General's Office.

TO

THE SURVEYOR GENERAL OF INDIA.

SIR,

I have the honor to submit for your information two Tabular Statements shewing the amount, progress, and nature of the work performed in the Lithographic and Photographic Press Branches of your Office during the past year, extending from the 1st December 1867 to the 30th November 1868. The amount of work performed in both branches, exclusive of Departmental forms and Circulars, may be briefly stated as follows; 650 originals have passed through the offices and 92,595 complete copies of maps have been struck off.

2. In the Lithographic Branch, I am happy to state that there has been steady and decided improvement both in the Drawing and Printing, and that the outturn is considerably in excess of last year. The money balance in favor of the Department is less than in former years, but this arises from two reasons: first, that in consequence of the objection raised last year, no money credit has been taken for the Departmental forms and circulars printed, which form a heavy portion of the work at Press. Many of these are forms of a large size and printed on both sides, and represent a very considerable amount of time and labour. The 2nd reason is that, the prices of maps have been still further reduced, and, as far as possible, charged at absolute cost of reproduction and material, while the number of impressions printed off, of several important maps, has been limited to a minimum to meet immediate demands only, the stones being preserved for a second edition with such additions up to date, as may be rendered necessary owing to the construction of roads, canals, Railways, &c. and alterations in the boundaries of districts and internal sub-divisions, subsequent to survey.

3. During the year 136 sheets of Lithographic drawings have been executed. A good many of these have been drawn direct on stone which is very superior to the transfer system, and which, as we get men trained up to it, I hope to see supersede transfer drawing altogether, for standard maps. A considerable number of one inch sheets of Oudh and Sindh have been completed and copies struck off, and nearly the whole of the Geographical materials in hand consisting of District maps on the scale 4 miles = 1 inch are ready for printing.

4. The premises at present occupied by the Lithographic Branch have not nearly the accommodation that is now required for the establishment, and the make-shifts that we have to resort to, tend very considerably to delay rapid progress. There is at present no suitable place for preserving Litho. Drawings on stone and for storing Paper for printing, consequently both stones and paper have to be stowed away wherever there is a spare corner. Extra space is greatly needed.

5. This Branch of your Office having been placed under my Superintendence a considerable portion of my time has been devoted to it, and both the attention of Mr. Lawrence, the Head Assistant, and myself has been specially given to the training of young draftsmen and apprentices to work direct on stone, so as to have a competent staff of stone and zinc draftsmen and correctors. Several have been employed solely on this duty and have made fair progress. Some of the old hands have also evinced great aptitude in work of this description. I am happy to be able to report very favorably of the whole establishment who have without exception worked steadily and industriously.

Mr. Lawrence has been most useful in general supervision and in improving the style of Lithographic drawing, which his previous experience in England well enabled him to do; he has also introduced several improvements in the style and finish of our maps.

Mr. Niven, the Head Printer, is most painstaking and energetic, and the style of Printing has decidedly improved under his supervision. I would especially bring both these Assistants to your notice.

Photo. Branch. 6. The progress made in this branch is very considerable and the out-turn enormously increased as will be seen by a reference to the subjoined Table:—

Statement showing increase of Work in 1867-68 over 1866-67.

	Subjects received.	Negatives.	Silver prints.	Carbon prints.	Transfer to zinc.	Transfer to stone.	No. of complete copies.	
Dec. 1866 to Nov. 1867 inclusive.	132	942	2,730	1,095	23	61	8,442	* The transfers to zinc are generally sharper and better than those to stone, so that we put as many as possible on the former in preference to the latter.
Dec. 1867 to Nov. 1868 inclusive.	402	2,012	5,151	1,743	282	47	51,024	
Increase during the past year	270	1,070	2,421	648	259	*	42,582	

7. The Zinc Printers from Southampton sent out by the Secretary of State arrived on the 14th January 1868, and commenced work on the 23rd of January. The New establishment. increase of the establishment proposed by me and recommended to Government by Colonel Thuillier, vide "Report on Topographical Surveys for season 1866-67 page 17, para. 52", was sanctioned on the 1st April, and I immediately made arrangements to secure suitable candidates for the new posts. It is impossible to find trained Photographic agency suited to our requirements to hand, in Calcutta, and I have had regularly to train up all my assistants so that the out-turn is not so large as it would have been, could I have got ready trained men; however the new assistants both European and Native are making rapid progress, and I believe a much larger out-turn and better work may be expected shortly from them.

8. I am happy to report that the anastatic process was successfully introduced into this office last May, and that already several maps that were out of print, have been reproduced by this cheap and economical system. More maps would have been anastatised, but unfortunately both the Copper Plate Presses in use gave way, and have had to be sent for repair to the Cossipore Foundry. Anastatic work.

9. My remarks made last year about the difficulty of carrying on Photo-Carbon transfer work and of printing from zinc in the hot damp climate of Calcutta have been completely borne out by this year's experience. Gelatine, the principal substance used in Photo.-Carbon Transfer work is very hygrometric and absorbs moisture very rapidly, and, in the rains here, when there is scarcely half a degree of difference between the wet and dry bulb thermometer, it is almost impossible to get it thoroughly dry, and the work is heavy and coarse in consequence. Zinc printing is also very difficult in the hot weather and rains, as the plates get heated and the ink spreads, in fact we sometimes have to stop printing after 11 A. M. in the hot months. Difficulty of zinc printing.

If the Photo-Zinc Press could be removed to a dryer climate the work would proceed much more satisfactorily, and I am convinced there would be a considerable saving to Government. Advantage of a dryer climate.

10. As I have already had the honor to report to you in my letter of the 7th July 1868, the present Office accommodation of the Photo. Branch is quite inadequate and unsuitable, and working as we are obliged to do with all sorts of makeshifts, is very liable to render even the best assistants slovenly and careless. Present accommodation.

To work systematically and with due regard to the health of the Assistants in the hot weather and rains, we require at least double the space we at present occupy. The present state of things is getting worse daily, as of course in an office of this description the accumulation of negatives, &c., is constantly on the increase and proper space for storing them, & paper, and chemicals, is urgently required. A new glass house is also greatly needed, as the present one is unsuitable in every way for the amount of work that now passes through the office.

11. Close supervision has been exercised by myself over all the details of this Branch and there is a decided improvement in the sharpness and finish of the maps turned out, over those of last year. In India where the demand for maps of any particular part of the country for immediate use is often very pressing and urgent, and where manuscript work would cause delay, it often happens that we have to copy originals quite unsuited to the process, and prepared before Photo-zincography was invented; of course the best results cannot be expected from these, but there is a decided improvement in the drawing of maps now especially prepared for the process, though of course it will take time before Draftsmen get thoroughly accustomed to draw in a style which will meet all our requirements.

12. There is not a very large balance to the credit of the Department, but still it amounts to Rs. 20,041-1-1, which seems very fair, considering the number of assistants who are still under training and who can only work very slowly at present, and that as I have already stated the maps are priced at the bare cost of reproduction and material.

13. The conduct of the whole establishment has been satisfactory, and I can report very favorably of the industry and energy of Sergeant Mackenzie, Mr. Crossly, Serjeant Bruce Mackenzie and Serjeant Watson.

Serjeant Bruce Mackenzie, had passed the anastatic course at Southampton and his assistance was most useful in introducing the process into this Office.

14. As this is the first report since the new Photo-zincographic establishment has been sanctioned and formed, I attach an appendix describing at length our system of working.

I have the honor to be,
Sir,
Your most obedient Servant,

A. B. MELVILLE, *Captain,*
In charge Press and Photo. Branches,
Surveyor General's Office.

*ABSTRACT of the work executed in the Surveyor General's Office, Lithographic Branch from
1st December 1867 to 30th November 1868.*

Scale, &c.	New maps, &c. the Lithographic drawings of which were completed during the present year.	Size.	No. of Sheets.
2 Miles = 1 inch	* Jamoo Territories, sheets 1 & 3	Antiquarian	2
" "	* Saugor District in 6 sheets	Imperial	6
4 " 1 "	* Tipperah and Noacolly Districts, in 4 sheets	"	4
" "	* Chittagong District, in 3 sheets	"	3
" "	* Sylhet District, in 1 sheet	Double Elephant	1
" "	* Manbhoom District, in 4 sheets	Royal	4
" "	* Hazareebaugh District, in 4 sheets	Imperial	4
128 Miles = 1 inch	* India, Hand map in 1 sheet	Atlas	1
	India, illustrating lines of Telegraph 1868	Imperial	1
	Tenasserim and the Kingdom of Siam,	"	1
	India, shewing Financial Circles, 6 color stones	Double Elephant	1
	Coast of India, Wreck Charts 1865, 66-67, 3 color stones	Antiquarian	3
	City of Saugor, for incorporation with Photo-Transfer of "City and Cantonments, &c. &c."	Demy	1
	* Pubbee Hills (piece for incorporation with Photo-Transfer of "Goojrat District")	"	1
MAIN CIRCUIT Maps	Tipperah, Main Circuit No. 10	Double Elephant	1
1 Mile = 1 inch	Manbhoom District,	Double Elephant	3
	M. Cs. 11, 13 & 15, 17 & 18, 20 & 23, 21, 22, 24, 25 & 26	Comprising Atlas Imperial Super Royal	2 2 2
	Oudh Division, Revenue Survey sheets 9, 14, 15, 16, 17, 20, 21, 22, 23, 24, 30, 31, 32, 33, 34, 45, 46,	Comprising Double Elephant Imperial	14 6
	Sylhet District, sheets 5, 6 & 8	Comprising Double Elephant Imperial	1 4
	Sindh Division, Revenue Survey, sheets 1 to 8 inclusive	Comprising Double Elephant Imperial	1 14
	Miscellaneous Maps and Drawings of various sizes ranging from ½ sheet Demy to Imperial	Various sizes	22
	EXTRA WORK.— During the year the following Drawings were completed by special Draftsmen.		
8 Miles = 1 inch	Tenasserim and the Kingdom of Siam, in 4 sheets	Atlas	4
4 " 1 "	Do. Do. Do. 6 "	Antiquarian	6
" "	Belaspore District	Atlas	1
" "	Raepore District, Khalsa Portion	Double Elephant	1
" "	Do. Do. whole of the Khalsa area and that of the Zemindaries	Imperial	2
	Maunpore Purgunnah, Sketch Map	Atlas	1
	Lahore City and Environs, &c. &c. (reduced scale)	36 × 63	1
	Currency Diagram	Antiquarian	1
	Miscellaneous Maps, Drawings & Sketches, Diagrams, &c. of various sizes		9
	Total No. of sheets of Lithographic Drawings		136

Transfers made during the year.

Total number of sheets of Litho. Drawings completed during the year	136
Photo. Carbon transfers, Topographical and Revenue Survey Maps to Stone and Zinc	93
Do. Miscellaneous Maps, Plans and Drawings all of a large size	19
Total transfers	248

ABSTRACT of the printing performed during the year, shewing the value or selling price of the same.

	No. of Sheets.	No. of Copies.	No. of pulls or Impressions.	Value or selling Price.	
				Rs.	A. P.
NEW WORK.—Printed off					
District and General Maps on various scales from 2 miles to the inch and upwards	53	15,512	20,829	21,764	4 „
Revenue Survey Main Circuit Maps, scale 1 mile=1 inch	21	6,510	6,510	8,770	„ „
Do. Do. Sheet Maps „ „ „	44	6,820	6,820	8,285	„ „
MISCELLANEOUS MAPS.—Sketches and Diagrams	26	9,054	13,014	1,778	14 „
REPRINTS & REVISED EDITIONS OF MAPS.—the stones of which had been preserved					
	27	4,435	6,158	5,465	„ „
PHOTO. TRANSFERS.—Printed off					
Topographical Survey Maps	17	3,010	3,010	2,605	„ „
Revenue Survey Maps	35	5,610	5,610	3,464	„ „
Miscellaneous Maps, &c., &c. and Reprints	25	4,830	4,830	2,507	8 „
FORMS.*—For the use of Department					
Topographical and Revenue Survey	49	43,992	117,048		
Departmental Orders and Memos. &c. &c.	120	68,907	92,161		
	417	168,680	275,990	54,639	10 „
COST OF LITHOGRAPHIC BRANCH.					
Permanent Establishment				35,029	6 5
Contingent expenses				4,381	15 1
Do. Extra				1,812	10 10
Cost of Paper, &c. estimated				5,463	14 9
				46,690	14 3
Difference to Credit of Department				7,948	11 9
*In compliance with the orders of Government, no credit has been taken for these forms, they constitute a large portion of the work performed at press and have been moderately estimated at Rs.				17,360	„ „
This together with the above balance would shew a difference in favor of the Lithographic Branch of Rs.				25,308	„ „

It will be observed that after deducting the permanent and contingent expenses of the Lithographic Branch and allowing a large sum for cost of paper, &c. there is a sum of Rs. 7,948 to the credit of the Department, and which sum if taken with the estimated cost of the Departmental forms printed off, would show a balance in favour of the Lithographic Branch of upwards of Rs. 25,000. It should also be noticed that this balance has been arrived at after again this year taking the selling price of most of the maps at a much lower rate than formerly, to accord with the new Catalogue now being got up. Many of the sheets are this year priced as much as 25 per cent. less than was formerly charged for the same description of map.

*Statement of the work executed in the Surveyor General's Office, Photographic and Photo-Zincographic Branch
during the year 1867/68.*

	No. of Sections or Sheets.	Scale.	Negatives.	Silver Prints.	Carbon Prints.	Transfer to zinc.	Transfer to stone	No. of Pulls.	No. of complete Copies.	REMARKS.
Gwalior No. 1 Topogl. Party. ...	18	M. I. 1=1	98	„	98	17	„	1,200	1,200	10 Sheets not yet printed.
Do. reduced & Index to sheets ...	8	4=1 8=1 16=1	13	40	11	3	„	450	450	
	26		111	40	109	20	„	1,650	1,650	
Central Provinces No. 2 Topogl. Py.	9	1=1	42	„	18	5	„	750	750	4 Sheets not yet printed
Do. reduced	4	4=1	4	35	„	1	„	„	„	
Do. Triangulation Chart	1	„	6	„	12	1	„	30	30	
Do. Talook Meil Ghat	1	1=1	6	„	6	1	„	50	50	
Do. „ „ enlarged 4 times	1	4=1	93	305	„	„	„	„	„	
	16		151	340	36	7	„	830	830	
Central Provinces and Vizagapatam Agency, No. 3 Topogl. Party, Season 66/67	5	1=1	30	„	30	5	„	750	750	
Do. do. do. Season/63/64	9	„	58	„	58	10	„	1,530	1,370	
Do. reduced	7	4=1	7	32	7	2	„	20	20	
	21		95	32	95	17	„	2,300	2,140	
Chota Nagpoor Division No. 4 Topo- graphical Party	17	1=1	96	„	78	14	1	2,200	1,760	3 not yet transferred.
Do. reduced & Index to sheets.	9	4=1 16=1	16	35	15	2	„	250	250	
	26		112	35	93	16	1	2,450	2,010	
Rewah & Bundelkund Survey No. 5 Party.	16	1=1	94	60	30	5	„	600	600	5 Sheets not transferred. 1 Sheet not printer
Do. reduced	4	4=1	4	60	4	1	„	20	20	
Do. Indices to Sheets	2	16=1 8=1	3	„	3	1	„	320	420	1 Sheet, Negatives taken last year.
	22		101	120	37	7	„	940	1,040	
Cossyah & Garrow hills No. 6 Party	6	1=1	21	12	21	4	„	920	920	2 Sheets Negatives taken last year.
Do. reduced & Index to sheets.	4	4=1 16=1	5	6	5	2	„	240	240	
	10		26	18	26	6	„	1,160	1,160	
Rajpootana Survey No. 7 Party ...	6	1=1	36	„	36	5	„	900	900	
Do. Index to Sheets	2	16=1 32=1	13	„	13	3	„	600	400	
Do. reduced	5	4=1	5	42	5	1	„	30	30	
	13		54	42	54	9	„	1,530	1,330	
Hyderabad Topographical Survey (Reprint from old negatives)	„	„	„	80	„	„	„	„	„	
City & Cantonment Plans	35	„	134	30	124	24	1	3,195	1,520	3 Sheets reprint 6 Sheets not yet printed
REVENUE SURVEY.										
District Maps	20	4=1	133	1,982	55	9	1	2,728	1,596	4 Sheets reprinted, 1 counter ordered.
Upper Provinces M. C. Map	20	1=1	135	43	175	5	6	2,730	2,326	1 Reprint.
Lower Provinces „ „	46	1=1	221	8	225	35	10	9,144	5,617	1 Negatives taken last year, 4 not yet printed.
Central Provinces „ „	21	1=1	102	2	102	22	„	3,990	2,630	
	107		591	2,035	557	71	17	18,592	12,169	
Miscellaneous Maps, Plans, &c.	126	various scales.	637	2,399	612	85	24	16,752	23,910	3 sheets Reprint. 4 Sheets not yet printed. 1 Counter ordered.
Anastatised Maps	17	„	„	„	„	12	5	1,460	1,350	2 not yet printed.
Zincographs	8	„	„	„	„	8	„	1,725	1,715	

	No. of Section or Sheets.	Scale.	Negatives.	Silver Prints.	Carbon Prints.	Transfer to Zinc	Transfer to Stone.	No. of Pulls.	No. of complete Copies.	REMARKS.
ABSTRACT.										
Topographical Survey Maps	134	1=1 4=1	650	707	450	82	1	10,860	10,160	Double Elephants.
Revenue Maps	107	1=1 4=1	591	2,035	557	71	16	18,592	12,169	Do. and Antiquarian.
City and Cantonment Plans	35	1=10 1=6	134	30	124	24	1	3,195	1,520	Imperial, Double Elephants & Antiquarian
Miscellaneous Maps, Plans, subjects &c	126	various	637	2,399	612	35	24	16,752	23,910	of all sizes up to Antiquarian.
Total out-turn by Photography	402		2,012	5,171	1,723	262	42	39,399	47,759	

Deduct Copies printed at Press in the beginning of the year before Photozinc Press was started, and for which credit has been taken in Lithographic Press Statement

Total Photo-transfer work printed at Photo-zinco Press

Anastatised Maps

Zincographed Maps

Total outturn of Photozinco Press

*13,450 13,450

35,949 34,309

1,460 1,350

1,725 1,715

39,134 37,374

Imperial and Double Elephants.
Do. Do.

Estimated value and selling price of Work executed at Photo-zinco Press and in Photo. Branch.	No. of Complete Copies	Rs.	As.	P.
Topographical maps	10,160	10,160	0	0
Revenue Maps	12,169	14,169	0	0
City and Cantonments Plans	1,520	2,280	0	0
Miscellaneous Maps, &c.	23,910	18,240	0	0
Anastatised Maps	1,350	1,500	0	0
Zincographed Maps	1,715	1,715	0	0
		48,064	0	0
Deduct Estimated Cost of Paper		4,806	8	0
		43,257	8	0
Add value of Silver printing 5,171 Silver prints		3,000	0	0
Total value		46,257	8	0
* Deduct value of Copies printed at Press, priced at		8,576	8	0
		37,681	0	0
Cost of permanent establishment	11,606-7-87			
Contingencies	6,033-7-3	17,639	14	11
Balance in favor of Department exclusive of superintendent's pay and allowances		20,041	1	1

MEMO. on the working of the Photozinc-Branch, Surveyor General's Office, as existing in December 1868.

1. Nearly all the current work in the Head Quarter's Office of the Surveyor General, Calcutta, whether Revenue or Topographical Maps or Compilations, is now published by Photozincography or Photolithography. It may be here stated however that the Photo. Office has nothing to do with the examination of originals, that portion of the work, being performed in the Drawing branch of the Surveyor General's or Revenue Survey Office.

The maps are sent over to the Officer in charge of the Photozincographic Branch, who examines them and judges whether they are fit for Photography or not, and who regulates the sequence in which they are made over to the Negative Branch, for reproduction or reduction.

2. The Photozinc establishment is divided into four Branches, the Negative taking, the Carbon and Silver Printing, the Zinc correcting and the Press Branches; the assistants are told off each to an especial branch, but they are expected in the first two branches, to make themselves acquainted with the process of either, so that they may be transferred if necessary.

The negative taking branch consists of one Serjeant and three Assistants, at present two Cameras are regularly worked, but it is intended eventually to work three. The everage daily out-turn from the large Camera worked by the Head Assistant is 8 Negatives of first class work, (that is difficult subjects, very close maps covered with hill shading, &c.) of sizes from 15 x 12 to 16 x 18 inches and from the smaller Camera worked by one of the junior assistants six negatives of second class work, sizes varying from 10 x 12 to 15 x 12 inches. During the first six months in the present year, the failures in first class negatives were only about one per cent, but in the second class work performed by junior assistants still under training, the percentage was of course very much heavier, it will no doubt decrease as the assistants gain more experience. All negatives are daily examined and passed by the Officer in charge.

CARBON AND SILVER PRINTING BRANCH.

3. This is under an European Serjeant with four assistants, a Duftry, and a junior draftsman who is employed to douff out and clean the negatives preparatory to printing. The preparation of the Bichromate paper and the Carbon transfer washing is done by the head assistant himself, assisted by one or two of the junior assistants. The number of prints that can be daily washed, is about 24 to 30, though the average at present is not more than half that amount. The prints rejected in washing appear to be about one in eight for the last 12 months. More prints are generally washed than really required, so as to save time by making sure of a good set of transfers at once. It is difficult to judge of the quality of Carbon prints while they are wet, and duplicates are generally made of any there is the least doubt about.

Two or three of the junior assistants according to the amount of work on hand are told off to silver printing, and the head assistant of the printing Branch is expected, besides washing Carbon transfers to supervise the silver printing, and is held responsible for the quality of prints and to see they are properly washed.

The silver prints when dry are made over to the Duftry for joining up (after having been passed by the Officer in charge) and are sent over in complete sheets to be mounted at Surveyor General's Office.

The joining up of Carbon prints preparatory to transfer, one of the most important duties in this Office, has always since I have been in charge, been taken up by myself. The prints washed one day are as a rule trimmed, examined carefully with the originals and joined up the following day, after which if it is advisable to keep them back for a few days before transfer, (a heavy close subject is better and sharper by being

kept 4 or 5 days) they are preserved flat in a box made for the purpose. As a rule only one set of transfers of a subject is joined up except in cases where the work is very close and fine and liable to fail in transfer, or where a large number of copies are required when two or three sets of the same subject are joined up according to circumstances.

The average number of failures to the number of subjects transferred for the last year is shown in the statement below, it gives about a little less than 1 in 7.

1867-68.		Subjects joined up and transferred	Transfer failed and rejected.	
December	1867	20	5	Many of these transfers have been rejected from being too coarse, which a bad original has to be dealt with, it sometimes takes 2 or 3 transfers before a passable plate is secured.
January	1868	32	5	
February	"	25	3	
March	"	25	2	
April	"	0	0	
May	"	33	2	
June	"	40	4	
July	"	32	7	
August	"	39	5	
September	"	37	5	
October	"	16	2	
November	"	41	7	
		340	47	

PHOTOZINCO PRESS.

4. This consists of European Assistants, 5 Native printers and 6 Presses, at present the establishment is not complete, as it takes time to train men up to be good Zinc Printers.

The head printer is held generally responsible for the quality of the printing, seeing that the plates are properly grained, for giving out work according to the capabilities of the different printers, for registering file proofs with press orders, keeping the books, &c. his own more especial work being proving for press orders, though he assists in printing when he has no other work to take up.

7. All transfers Photographic or Anastatic are made by the Officer in charge himself, or in his presence.

Proofs are examined by the Officer in charge and then sent out to the Departments for which they are prepared, for revision, but the final press order is always given by the Officer in charge.

The out-turn of the different presses, is, as a rule, inspected by the Officer in charge, four or five times a day, and the impressions, as far as possible, are again examined before despatch.

The daily out-turn from one press, of subject covering a double elephant sized plate, with a good printer, varies from 60 to 80 impressions.

8. The Establishment sanctioned for Zinc correcting is 4 Draftsmen, it is not as yet complete, as it takes time to train men up to this work. Plates that are not likely to have many revisions, are touched up before etching and proving, but many Maps have very considerable corrections and alterations made on the 1st Proof, and these of course have to be made after the plate has been etched.

At first, there was some difficulty in teaching the Draftsmen to clean sufficiently those portions of the etched Plate that required revisions and alterations; but now they have got into the way of it, and we seldom have any difficulty, in printing from corrected, or revised Zinc

Plates. It is intended eventually that a certain portion of this establishment should be employed in making hand transfers, drawing on Zinc, direct, &c. as we now find that with care we can preserve unetched plates without injury to the design on them for six weeks or 2 months.

9. With the increase of establishment, the consumption of chemicals has become so considerable, and the stock in hands so large that it has become advisable to entertain a Baboo for the express purpose of acting as store-keeper, weighing out chemicals and checking stock; he also acts as writer.

Books kept in Photozinc Branch.

10. The Books kept in the Photo. Branch as it is now worked, are detailed below.

GENERAL.

1. Monthly account of expenditure of chemicals expended and received during the month and balance of stock in hand.
2. Weekly account of chemical expenditure.
3. Day Book, &c. Do.
4. Petty Contingent Account.
5. Contingent Bill Book.
6. Register of work and originals received for reproduction or reduction.
7. Officer in charge's order and Memo. Book.
8. Formula Book.
9. Letter Book and Files.

NEGATIVE BRANCH.

Diary of Negatives taken.
Monthly Account of do.
Register or Index of do.

CARBON AND SILVER PRINTING BRANCH.

Diary
Register of Carbon Prints.
Register of Silver Prints.

PHOTOZINCO PRESS.

- 1 Printer's Diaries.
- 2 Register of work.
- 3 Cleaning Order Book.
- 4 Paper Account Book.
- 5 Map Despatch Book.

ZINC CORRECTORS.

Each Draftsman keep a diary from which the monthly report is made out.

11. In a large Office, like the Surveyor General's, and in a country where the demand for maps is so constant and pressing, it often happens that to supply any thing, in the shape of a map, out immediately, however roughly executed, is better than the delay that would be caused by redrawing the map. It is on this account that we often get originals to reproduce, which cannot but give coarse results, but which satisfy the immediate demand, which is for cheap roughly executed, but accurate maps, and these are quite sufficient for the wants of the Civil officers, Public Works, Irrigation, Telegraph Department, &c. and for illustrating reports. In fact the maps now published by Photozincography may be called preliminary and well hereafter as the demand arises, be published in a much more elaborate style.

General remarks.

Of course it sometimes also happens that there is a great press of work and maps are urgently called for, and at these times mediocre work has to be passed to save time which would not be passed in the ordinary routine of work.

All negatives of the regular maps of the Indian Survey are registered and preserved, and files of all the out-turn printed at the Photozinc. Press are kept in the Office.

No formula are allowed to be altered or modified without sanction of the Officer in charge and the alteration being entered in the formula book.

12. The cost per square foot of publishing maps by Photozincography appears to be about what is shewn in the statement below, though of course it is liable to vary slightly more or less, according to the salaries of the Officer in charge and the assistants.

Cost of publishing Maps per square foot.

Cost of transferring to Zinc.			Cost of Printing 100 copies.	Cost for copy.	
Photo. Zincography or Photo. Lithography	First class	Negative	Rs. As. P. 3 3 0	Rs. As. P. 8 0 0	Roughly speaking 2 annas. As. P. 1 10 exclusive of supervision and cost of Paper and Ink. As. P. 3 6 say an ana 4 pie exclusive of supervision & cost of paper and ink.
		Carbon			
	Second class	Print...	0 12 0	It is as expensive to print one sq. foot as 2 or 3 up to certain size imperial.	
			3 15 0		
		Negative	2 9 0	5 0 0	
		Carbon			
		Print...	0 8 0		
			3 1 0		
			3 12 0		
Silver Printing	First Class	Negative	3 3 0		Rs. As. P. 3 12 0 3 0 0 Of course where more than one silver print is required from the same Negatives the 2nd and successive prints would only cost 9 annas and 7 annas respectively according to class.
		Silver			
	Second class	Print...	0 9 0		
			3 12 0		
		Negative	2 9 0		
		Silver			
		Print...	0 7 0		
			3 0 0		

13. As we have now to do a great deal of work for other Departments, and for which the Survey Department gets no credit. I propose to begin a regular system of Book debits with other Government Departments, debiting them for work done in the scale shewn above, but I shall report separately on this subject.

14. A very expeditious way of publishing common maps without any great detail is to trace them in pen and ink on tracing cloth, as we find we can get as good negatives from it as from maps drawn on paper, several maps and plans have been published in this way lately in Surveyor General's Office.

15. A list of the formula in use in this Office, is appended.

A. B. MELVILLE, *Captain.*
In charge Press and Photo. Branch,
Surveyor General's Office.

Formula in use in Surveyor General's Office Photo Branch, Calcutta December 1868.

NEGATIVES.

Thomas's and Mawson's mixed half and half, ought to be iodized at least a fortnight before use, but better if a month or two.

Nitrate of silver 25 to 35 grains according to temperature, to 1 oz. of distilled water,
Bath. Bath decidedly acid with nitric acid.

Developing solution.	{ Proto-Sulphate of iron 2 grains.
	{ Acetate of lead 10 "
* The amount of glacial acetic acid varies with temperature.	{ Acetic acid (Glacial) 15 "
	{ Spirits of wine 15 "
	{ Water (rain or distilled) 1 ounce.

Fixing solution. A weak solution of cyanide of Potassium.

Intensifying. After fixing flood the plate rapidly with, the following solution.

Iodide of Potassium	2 grains	} wash off
Iodine	1 "	
Water	1 ounce	

and intensify with 3 or 4 drops of Solution No. 2 added to 3 or 4 drachms Solution No. 1, until sufficient density is obtained and then wash well.

	Sol. No. 1	Sol. No. 2
Amount of citric acid varies with temperature.	Pyrogallic acid ... 4 grains	Nitrate of Silver ... 30 grs.
	Acetic Acid Glacial...15 "	Citric Acid ... 1 "
	Water 1 oz.	Water ... 1 oz.

Immerse negative into saturated solution of Bichloride of mercury, and leave it in Solution till it assumes a whitish cream colour. N. B.—For very fine lines solution should be weaker, and Negative carefully watched.

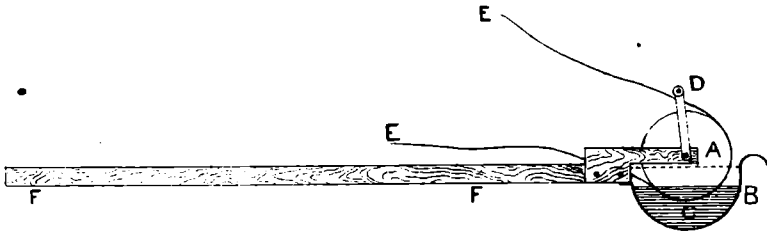
When negative is taken out of mercury bath, wash thoroughly and pour on Solution of Hydrosulphate of ammonia one part to 4 to 6 oz. of water. N. B.—The Hydrosulphate should be strongly charged with gas, or the lines will not remain clear and brilliant. The English Hydro-sulphate generally loses its gas in transit and is often useless; we use Hydrosulphate made specially for us at the Burranagore chemical works. When good Hydrosulphate cannot be obtained, 1 grain Solution of chloride of gold will give fair results.—

Either Thomas's varnish, crystal varnish or 4 oz. of gum mastic dissolved in 16 oz. of Spirits of wine. The first is the best when procurable, the crystal varnish is very apt to adhere to the print particularly in hot weather. The gum-mastic varnish acts well if the plates are well warmed both before and after application.

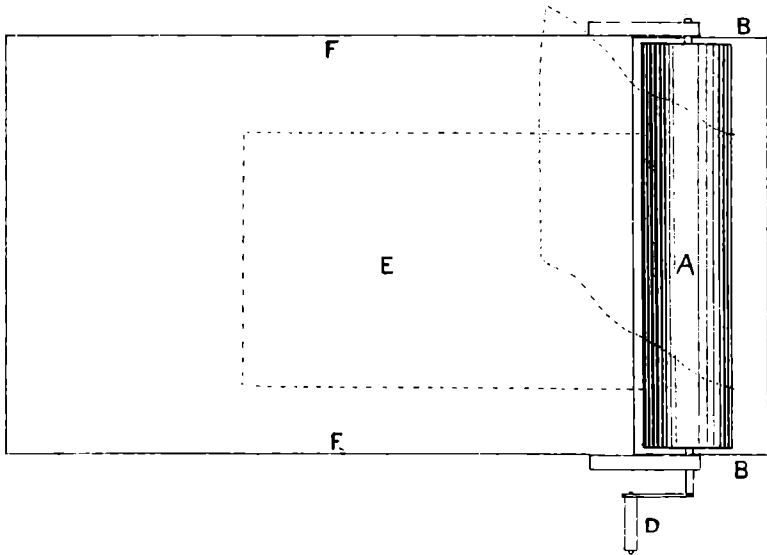
CARBON TRANSFERS.

Bank Post and German printing paper, both work well and give good clear transfers, but the sharpest results we have obtained, have been on Blue-wove Bank Post.

The proportion of water to gelatine varies, it may be roughly stated, as 1 to 10, in the cold and 1 to 8, in the hot weather, the paper is floated on the solution, when it is at about a temperature of 100 to 110. With most papers two coatings of gelatine are required, but with Blue Wove Bank Post one coating of the 1 to 8 solution is sufficient. We always used to sensitise the paper by hand, but now we generally use the small machine of which a Diagram is given, by its use the paper is more evenly and regularly coated, and there is a considerable saving in the expenditure of gelatine. The Machine consists of a plank of wood with a semicircle tin trough at one end with a roller working in it by a handle. This trough is partially filled with the gelatine solution.



- A* *Wooden Roller.*
- B* *Tin Gelatine Trough*
- C* *Gelatine Solution.*
- D* *Handle to Roller.*
- E* *Paper.*
- F* *Wooden Plank.*



The paper is pushed along the board till it is caught up under the Roller and pulled round with it when it is drawn off at the upper side and hung up to dry.

Excite by immersing the gelatinised paper in the following solution.

Exciting bichromate trans- fer paper.	Bichromate Potash	3 oz.
* Amount varies with temperature.	Water	45 „
	*Spirits of wine	4 „

This solution should never be beyond a temperature of 60 to 65 Ferht. and in the hot weather we use an outer dish containing ice or other cooling solution.

After the paper is excited it is glazed in a rolling or scraper press, and these exposed under a negative, the proper exposure can only be learnt by experience.

The print after exposure is inked in a Litho. scraper Press with transfer ink. The ink that has given us by far the best results is English Copper Plate stick transfer ink worked down with a little palm oil and turpentine to the proper consistency. The ink used in the Southampton Ordnance Survey Office, does not work well in this climate, it is far too soft, to remedy this when we are out of Copper Plate transfer ink, we add one part of Southampton made transfer ink to 2 or 3 portions of the following ink :—

1	lb	Wax
$\frac{1}{2}$	„	Soap
$\frac{1}{4}$	„	Shellac
$\frac{1}{4}$	„	Gum mastic
2	oz.	Pitch
4	„	Varnish
4	„	Lamp Black.

and find that work very fairly.

The print after being inked in is washed in the usual way, considerable practise is required to wash a print of a difficult subject properly. For a transfer to zinc the coating of ink left on the lines should be very thin, but for a transfer stone move body is required.

SILVER PRINTING FORMULA.

Paper	Albuminised on Plain paper prepared with.	
	Common Salt	7 grains
	Gelatine	15 „
	Water	1 oz
Silver bath	Nitrate of Silver	30 grains
	„ of Potash	30 „
	Distilled Water	1 oz
One dram of Sugar to 40 oz. of bath makes it work easier, and the prints tone quicker.		
Toning Bath	Carbonate of Soda	$\frac{1}{4}$ oz
	Chloride of Gold	30 grains
	Distilled Water	40 oz
The Bath lasts a long time, Gold being added as required.		
Fixing Bath	Hyposulphate of Soda	40 oz
	Carbonate of Ammonia	$\frac{1}{2}$ „
	Water	25 „

A. B. MELVILLE, *Captain,*
In charge Press and Photo Branch,
Surveyor General's Office.

CALCUTTA, 12th December 1868.

APPENDIX

APPENDIX.

*Extract from the Narrative Report of LIEUT. CHARLES STRAHAN, R. E., Surveyor in charge No. 1
Topographical party, Gwalior and Central India Survey for Season 1867-68.*

1. On the 2nd of October 1867 the office was closed, and on the 8th the camp left Dehra

	PERSONNEL.	
Lieut. Chas. Strahan, R. E., Offg. in charge.	| Mr. Hörst, Assistant Surveyor.	The party takes the field. on its march to Delhi, which place
Mr. Bolst, Civil Assistant.	| Mr. Murphy, Sub-Assistant.	was reached on the 19th. Here we halted for
Mr. Chill, Sub-Assistant.	| Mr. Esteve, ditto.	three days (one day being Sunday) in order to
Mr. Allnutt, ditto.	| Mr. Cornelius, ditto.	make the final arrangements, and on the 22nd
Jwala Pershad, Nat. Sur- veyor.	| Chúrámán, Nat. Surveyor.	of October the whole party (with the exception
Abdulsamad Khan, ditto.	| Golam Mohamad, ditto.	of Mr. Chill and myself) proceeded under Mr.
Abdulsblán, ditto.	| Mr. Harris, Writer.	Hörst towards Ulwar. The greater part of
		this season's work being in that State.

2. According to the instructions I received from the Surveyor General in September 1867, I went to Agra in order to fix points by triangulation for the large scale plan of that place, which was to be made during the recess by the Gwalior party. Mr. Chill to whom I had allotted this work, accompanied me, in order that he might receive a little instruction in triangulation, and at the same time, get an idea of what his work would be when he began the detail work in May. There being many high buildings and mounds about the city and cantonments, I had no difficulty in fixing a considerable number of points with an 8" Theodolite, to assist Mr. Chill in plane tabling or to be used as check points when it became necessary to traverse; but I had some little trouble in connecting my work with the Great Arc, the station at Secundra on one of the minarets having been so much broken that it was impossible to observe from it. In consequence of this, I had to make a new station on another portion of the building, which necessitated my going back another step, as this had again to be connected with Fatchpur Sieri, a long ray which I found very troublesome to observe, as the station was inside a "Mat" and the Heliotrope could only be flashed in the early morning.

3. Having completed the preliminary work in Agra, I marched through Bhurtpore to Ulwar, leaving Mr. Chill in the plane-table apportioned him on the Minor Δ^a round city of Ulwar. boundary between Ulwar and Bhurtpore. I remained in Ulwar about a week, fixing points around the city and fort to enable Mr. Bolst to make a large scale plan of the place.

4. The triangulation being 2 seasons ahead of the detail work, it was not necessary to take extend it this season, so I took up plane-table No. 97 myself. I reached on the 26th November and commenced work day. From the 26th November till the 14th December, requires practical plane-tableing, and then I returned to Ulwar to meet Colonel Keatinge, the Governor representing the Agent for Rajpootana; who was to visit the Rajah on the 16th; on the way I had during the Hörst, who had already completed his first sheet, which was not quite a full to and was well satisfied with his work.

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Mr. Bolst, Civil Assistant. Mr. Chill, Sub-Assistant. Mr. Allnutt, ditto.	Mr. Murphy, Sub-Assistant. Mr. Esteve, ditto. Mr. Cornelius, ditto.
Jwala Pershad, Nat. Surveyor. Abdulamad Khan, ditto. Abdulsulhán, ditto.	Chúrámán, Nat. Surveyor. Golam Mohamad, ditto. Mr. Harris, Writer.

The party takes the field. on its march to Delhi, which place was reached on the 19th. Here we halted for three days (one day being Sunday) in order to make the final arrangements, and on the 22nd of October the whole party (with the exception of Mr. Chill and myself) proceeded under Mr. Hörst towards Ulwar. The greater part of this season's work being in that State.

2. According to the instructions I received from the Surveyor General in September 1867, I went to Agra in order to fix points by triangulation for the large scale plan of that place, which was to be made during the recess by the Gwalior party. Mr. Chill to whom I had allotted this work, accompanied me, in order that he might receive a little instruction in triangulation, and at the same time, get an idea of what his work would be when he began the detail work in May. There being many high buildings and mounds about the city and cantonments, I had no difficulty in fixing a considerable number of points with an 8" Theodolite, to assist Mr. Chill in plane tabling or to be used as check points when it became necessary to traverse; but I had some little trouble in connecting my work with the Great Arc, the station at Secundra on one of the minarets having been so much broken that it was impossible to observe from it. In consequence of this, I had to make a new station on another portion of the building, which necessitated my going back another step, as this had again to be connected with Fatehpur Sieri, a long ray which I found very troublesome to observe, as the station was inside a "Mat" and the Heliotrope could only be flashed in the early morning.

3. Having completed the preliminary work in Agra, I marched through Bhurtpore to Ulwar, leaving Mr. Chill in the plane-table apportioned him on the boundary between Ulwar and Bhurtpore. I remained in Ulwar about a week, fixing points around the city and fort to enable Mr. Bolst to make a large scale plan of the place.

4. The triangulation being 2 seasons ahead of the detail work, it was not necessary to extend it this season, so I took up plane-table No. 97 myself, which I reached on the 26th November and commenced work on that day. From the 26th November till the 14th December I was plane-tabling, and then I returned to Ulwar to meet Colonel Keatinge, the Governor General's Agent for Rajpootana; who was to visit the Rajah on the 16th; on the way I visited Mr. Hörst, who had already completed his first sheet, which was not quite a full table. I had previously visited Mr. Cornelius, who was surveying in the plane-table adjoining mine on the west and was well satisfied with his work.

5. During my first visit to Ulwar, I had visited the Rajah, who was exceedingly civil, and did all in his power to assist us; every man at work in his State expressed his entire satisfaction with the treatment he received from all the officials, and during the whole season, I hardly heard of any complaints made against the Vakeels detached with each man. On my meeting Colonel Keatinge, I had much pleasure in telling him of the uniform civility we had met with in Ulwar. This was more marked, as from those at work in Jeypore, complaints were constantly sent to me, and I am sorry to say I could hardly ever get any redress, although I repeatedly wrote to the Political Officer. I am thankful to say we have nearly finished the portion of Jeypore that falls in our work, as every season that we have had occasion to enter that State we have met with constant trouble and annoyance.

6. After meeting Colonel Keatinge in Ulwar, I returned to my plane-table, and continued working at it until the 14th March; when I commenced inspecting the plane-tables in Jeypore, and on the western side of Ulwar: leaving Mr. Hörst to inspect the plane-tables in the eastern portion. Native Surveyor Churaman Lall was left to finish 2 sections of my work, which I had been unable to complete. As he had done his first table so badly, that I foresaw that nearly half would have to be rejected. I worked with him all the difficult jungly ground that remained, leaving only comparatively easy and open country to the amount of $1\frac{1}{2}$ sections to be filled in by him, which he did very well, his first table evidently being bad, through carelessness and not inability. For this I obtained leave to cut him one month's pay.

7. I commenced my inspection with Mr. Bolst's work, which I checked both by traversing and intersection. As I had anticipated, I found it very carefully and accurately surveyed, the detail being well shown.

Then I marched through Mr. Allnutt's section, but the ground was so unfavorable for traversing that I was forced to check by intersections only. I marched along the diagonal, fixing at intervals on commanding points, taking rays to every village in sight, and tangents to all the hills and features I could; I found it fairly correct but the hills were coarsely drawn, and in many places detail was not carefully put in. The fault lay more in bad drawing than in careless survey.

Mr. Cornelius' table came next, and I found this very accurate, the ground was well shown, but there was hardly sufficient difference made in the relative heights of the hills. I then took up Native Surveyor Churaman Lall's work, which as I expected was so badly done in the hilly portion that a great part of it had to be rejected. I took up the most difficult part of this myself as I had no one to spare at the time, and I was unwilling that a gap should be left, if it could possibly be avoided. The work in the plains seemed fairly good and was neatly drawn.

I then marched into Ulwar, visiting Messrs. Allnutt and Esteve on the way, they were engaged on their second sections. I inspected Native Surveyor Abdúl Samad Khán's work, comprising the easy part of the large scale plan of Ulwar City, the hilly portion and all round the fort had been previously done by Mr. Bolst.

Thence I proceeded to inspect Native Surveyors Abdul Subhan and Golam Mohamed, who were both getting on very satisfactorily. I closed my tour of inspection in Mr. Chill's second section near Patan.

Mr. Chill had very hard work to finish this table in the hottest part of the season, as Mr. Murphy whom I had sent to assist him, was laid up with a bad attack of remittent fever.

8. Mr. Hörst, having finished his work, proceeded to inspect and check the remaining sections, viz. those of Messrs. Chill, Murphy, Esteve, and Native Surveyors Jwala Pershad, Abdúl Samad, Abdúl Subhan and Golam Mohamad. Of Mr. Chill's work he gave a very favorable report, more especially for its

The work of the others was fairly done with the exception of that of Mr. Esteve, more than half of his section had to be rejected. I have already reported on this in a letter to the Surveyor General, dated the 25th April.

9. On the 19th April I closed work and marched with Messrs. Chill and Murphy (who was still very weak from fever) reaching Delhi on the 25th, and found that the remainder of the party with the exception of Jwala Pershad had just arrived. I left Jwala Pershad to finish that portion of Churaman Lall's section, which had been rejected, and which would have been finished before this, had Mr. Allnutt, whom I had sent to assist him, not broken down with fever. On the 27th the camp left Delhi to march into recess quarters, and office was opened on the 15th May under Mr. Hörst.

10. From Delhi I went by rail with Mr. Chill to Agra, in order to finish some details of triangulation that I found necessary, and to start him and the 2 Native Surveyors whom I had told off to assist him in the detail work. I completed the triangulation and ran some Theodolite traverses, along the principal roads, both as an assistance and also as a check on Mr. Chill's work, and having fairly started the party, I joined the office on the 20th May.

11. The statement accompanying will show the work turned out during the recess. In consequence of there being no triangulation this season, the whole party was put on detail work, and although the country was full of detail and difficult to survey, we have turned out a large area. Mr. Chill, one of the best draftsmen, has been in Agra the whole of the season, and this has thrown a great deal of mapping on the rest of the party. We have finished all the general maps and exaggerated maps of this season, and also worked off some of the arrears, all of which might have been finished this season had the whole party been employed. The large scale plan of Ulwar has been commenced, but I am afraid it will not be completed this year. It will, however, be sent in the first thing next recess.

12. Mr. Hörst has rendered great assistance both in the field and in quarters. He surveyed rather more than a table and a half in difficult jungly ground, and inspected and checked half the season's work. He has worked unceasingly during the recess at the general maps, and without his and Mr. Bolst's valuable assistance we should have been greatly in arrears in mapping.

Mr. Bolst finished a very good section partly in Ulwar and partly in Jeypoor, and surveyed all the hilly and difficult ground in and around the city of Ulwar. He has been employed almost the whole recess on the general maps, which he has executed with his usual skill.

Mr. Chill was detained in Agra at the beginning of the season, and his work lay in flat ground, much covered with trees, which necessitated his traversing, consequently the area turned out by him is smaller than it otherwise would have been. His work, as I have mentioned above, was found to be very accurate. During the recess he has been employed on the survey for plan of Agra; the season has been unfortunate for out-door work on account of the extreme heat.

I trust, however, the map will be ready by the time it is necessary for Mr. Chill to take the field.

Mr. Allnutt turned out a large quantity of very fair plane-tabling, but he requires practice in drawing, and is not quite careful enough in representing the smaller features of ground. He has worked very hard during the recess at the exaggerated maps.

Mr. Murphy was unfortunate in meeting with an accident at the beginning of the season, which rendered him unfit for out door-work until January; he was again at the end of the season laid up with fever, so that his out-turn is small.

Mr. Murphy.

Mr. Esteve finished rather more than a plane-table, a large portion of which turned out on inspection to be unreliable, and was rejected. Mr. Esteve has worked hard in recess and attended office very steadily, but he still requires a little instruction in hill survey.

Mr. Esteve.

Mr. Cornelius did a plane-table and a half in difficult and hilly ground. The work was accurate and showed the ground well. He has been employed during the recess on the general and partly on the exaggerated maps. He has improved much in his drawing, and I hope with a little more experience and practice, will turn out a first-rate surveyor.

Mr. Cornelius.

The Native Surveyors, with the exception of Churaman Lall, of whom I have written above, have all done good work.

Native Surveyors.

13. The whole of the centre of Ulwar is very hilly; the hills being for the most part about 800 to 1,000 feet above the plain, very rocky and covered more or less with jungle; bamboo grows thickly in some parts, and is very strictly preserved. Through these hills run large valleys, sometimes 2 or 3 miles wide; down the centre of these, there is generally a good stream of water; on either side of the streams in the large valleys, a good deal of wheat and barley is grown; the crops that I saw appeared excellent. In several cases small canals have been built to carry the water from the hills out into the plains beyond. The city of Ulwar itself is watered by two canals which take their rise from a large lake about 10 miles from Ulwar, known as the Siliser lake. It is formed by a large masonry dam thrown across a narrow portion of a valley; during the rains this bund must hold up a very large supply of water; it decreases of course during the hot weather, but never dries up completely, as there is a small stream flowing into it, which goes a good way to make up for the waste by the canals and evaporation. During the cold weather large herds of cattle are taken to graze amongst the hills, the men building rough sheds for themselves and the cattle in any convenient place near water; during the rains they return to their proper villages in the plains.

Description of Ulwar.

The tigers, which abound all over the hills, create a good deal of havoc amongst the cattle, and the men themselves do not always escape. All the game in Ulwar is strictly preserved, the consequence is that in many places the Nilgáo and Sambar literally swarm. The Nilgáo do great damage to the crops at foot of the hills, and I was more than once begged by the owners of the fields to shoot them.

There is a large fort covering the hills over the city of Ulwar. The hill on which it is built is very steep, in fact almost inaccessible except along the paths which of course are well flanked. The fort itself like almost all hill forts in Rajpootana consists of nothing more than a curtain wall built round the top of the hill; it has, however, advantages over most of them, as in the centre of the hill there is a small valley which affords ample shelter for the garrison, and in this there is a plentiful supply of good water.

Ulwar Fort.

At Kankwari there is another very well known fort. The fort itself is very small and of no importance except from its position. It is situated on a low rocky hill in the centre of a large valley; the hills on all sides of it are much higher than that on which the fort is built, and if artillery could be taken up any of the hills to the north and west, the place would be quite untenable. It is now used as

Kankwari Fort.

a prison for criminals who have been guilty of some capital offence ; a few sepoys always live there.

It is a most difficult place to get to except on foot, so much so that, although I was not more than 3 miles, as the crow flies from the fort, it was 3 marches for laden camels ; on the north and west there are no passes over which anything but coolies, or perhaps lightly laden bullocks and elephants can march ; from the south and east it is much easier of access, and roads might without much difficulty be made along the valleys passable for wheeled vehicles. The water is said to be very bad at Kankwari, especially that in one well which it is said is sure to kill you in the course of a year or less. It is given to the prisoners if they prove refractory.

Whilst plane-tabling a few miles south of Kankwari, I came on the remains of an old city called Ramnagar close to the site of which is a very old Jain temple known by the name of Lilkant dedicated to Mahadeo ; the temple is 1815 years old. The whole building is covered with carving which is in wonderful preservation ; all the other buildings of the city are completely ruined, nothing remaining but heaps of stone, many of them most elaborately carved. Amongst them a large figure supposed to be that of the old Hindú God Nogja has been discovered. It is cut out in relief on a slab of stone about 15 feet long by 5 wide.

At Bhangarh, too, there are extensive ruins. It was formerly evidently a place of considerable importance ; numbers of temples are still standing in pretty good repair, and the principal streets of the city can still be traced. It is a good site for a city with a plentiful supply of water from a small running stream. It is deserted from some superstitious idea.

At Talbrich there is a group of very old temples built round some hot springs ; their date is not known ; the water wells up into two small cisterns, and then flows into a third ; these cisterns are about 8 feet below the surface of the ground. The hottest water I could obtain, showed a temperature of 108° Fahrenheit.

Iron ore is found in the southern part of the State ; some of it is smelted close to where the ore is found, but the greater part is taken to Gazika Thana, about 20 miles distant, and smelted there. At Akbarpúr, a march south of the Ulwar city, a good deal of iron ore is smelted.

Copper ore is also found near a village called Judáwas, and is smelted on the spot. It yields from 1 to 5 seers of pure copper per maund of ore, one fourth of the produce is paid into the treasury, and the remainder goes to the miners.

The portion of Jeypúr in which we were working this season is hilly, but the hills are in ridges not in masses, and are with a few exception almost free from jungle. The ground between the hills is nearly all cultivated, but the soil is very sandy, and the crops did not appear to be nearly so good as in Ulwar.

14. My proposed plan for next season is as follows :—

Mr. Bolst and Native Surveyor Abdúl Subhan will take up plane-table No. 124 in the Boondi State, on completion of which Mr. Bolst will march southward to continue the triangulation, the Native Surveyor accompanying him as recorder.

Mr. Chill will take up plane-table No. 125 and half of 126.

Mr. Allnutt will commence on plane-table No. 127, and then take up half of No. 58.

Mr. Murphy will commence with plane-table No. 131, and on completion of that will do as much as possible of No. 129.

Mr. Esteve will commence with plane-table No. 130.

Mr. Cornelius will take up that portion of plane-table No. 85 in Ulwar which was rejected this year, and will then do as much as possible of plane-table No. 123 in Jeypúr.

Native surveyor Jwala Pershad will commence with plane-table No. 122 and then assist in plane-table No. 53.

Native Surveyor Abdúl Samad Khan will work in plane-tables 52 and 50, and a portion of 126.

Native Surveyor Churaman Lall in 121 and half of 122.

Native Surveyor Golam Mohamed in half of 129 and 132.

The camp will march through Agra to the field, and I shall take the opportunity of inspecting Mr. Chill's work before the arrival of the camp. After which, I shall march towards Sipri, near which I shall commence triangulation, working westwards towards the plane-tablers, whose work I shall inspect at the end of the season.

●

Extract from the Narrative Report of J. MULHERAN, Esq., in charge No. 2 Topographical party, Central Provinces' Survey, for Season 1867-68.

Mr. C. Neale, Civil Assistant, 2nd grade.
 „ J. B. Smith, Sub-Assistant, 1st „
 „ C. A. Scanlan, ditto, 3rd „
 „ A. Chennell, ditto, 3rd „
 „ B. Maine, ditto, 3rd „
 „ J. Chennell, ditto, 4th „
 Ramchunder, Native Surveyor.
 Pandarao, ditto.
 Baparno, ditto.
 Janardhan Rao, ditto.
 Sheik Omar, ditto.

1. The party, consisting of the Assistants and Native Surveyors noted in the margin, took the field on the 11th November, and completed before the 5th June, the date on which the whole of the Assistants returned to recess quarters, the following extent of work, viz. :—

Principal and Secondary Triangulation	...	...	sq. miles	3,008
Topographical details	...	...	"	2,131
Survey of the boundaries of the Forest Reserves of Raja- barari and Saoligarh	...	...	linr. miles	165

2. The triangulation completed by myself and Native Surveyor Sheik Omar, consists of the following number of Principal and Secondary Triangles :—

Principal triangles	...	...	...	13
Secondary triangles, 1st class	...	...	...	209
Ditto, 2nd „	...	...	...	319
Principal and Secondary heights	...	...	...	329

3. The average discrepancy exhibited in apportioning the angular errors of the Principal Triangles is 1"58.

4. The Secondary triangulation based upon the above, gives an average error of 0.37 feet per mile on 249 common sides, or upon—

101 sides of 1st class triangles	...	...	0.25 feet per mile.
148 sides of 2nd ditto	...	...	0.45 ditto.

5. The following are the average differences exhibited in 329 deductions of Trigonometrical heights of Principal and Secondary Stations :—

Average difference in 23 deductions of principal stations	...	0.84 feet.
Ditto in 163 ditto of 1st class „	...	1.49 „
Ditto in 143 ditto of 2nd „ „	...	1.55 „

6. Several stations of Mr. Shelverton's Secondary series to Chindwara were used as Principal stations in extending the triangulation into the Chindwara and Seoni Districts, and the difference exhibited on 10 sides, averages about 0.25 feet per mile. At 8 Stations the average difference in latitude is 0"6, in longitude 1"4 and in azimuth 5."

7. Last year, while employed in triangulating the ridges adjoining the Gharaghat Pass, I noticed that a number of eligible hills had been left uncleared by the flagmen detached to erect staves, and on enquiring into the reason of this, was informed that owing to the ravages committed by the man-eating tigress of the Gharaghat Pass, the whole of the villages within the tract frequented by the tigress, had been deserted by the people. Believing that the underwood of the ridges would afford less cover during the hot weather, I deferred the triangulation of this portion of the Baitool District, until I entered the Towa Valley later in the season. So many men, however, had been carried away by the tigress, and the Gonds living in the neighbourhood had become so alarmed, that I only succeeded in erecting eight staves on the principal peaks.

8. This season, after completing the triangulation of the hill jagheers of the Chindwara District, I was desired by the Chief Commissioner of the Central Provinces to assist Major Priestly in determining the heights of the most favorable passes into the Chindwara and Towa Valleys, and as this involved the examination of the tract frequented by the tigress, it affords me great pleasure in being able to add that Major Priestly succeeded in slaying this scourge of the people. The number of men and women killed by this horrible beast during the last three years is variously stated, at from 50 to 150, and judging from the official reports, the number of deaths appear to have exceeded 50.

9. The following are the villages that have been depopulated by the ravages of this scourge of the Gharaghat Pass and the ridges adjoining, embracing an area of 250 square miles, over which, during particular portions of the year, the tigress appears to have roamed, viz., Rajra, Biehkan, Patargao, Naiagao, Bithu Asola, Kodri, Persadana, Bisighat, Dhangwa, Boldai, Bodur, Sitagang.

10. The Gowli, whom the tigress attempted to kill three years ago, is residing at the village of Sornadai. He has the marks of 2 teeth on the back of his head, and the scars of a claw on his back. He stated that he was out grazing buffaloes, and that while following them home in the evening, he suddenly heard a rustling behind him, and on turning round saw the tigress rapidly approaching him. Before he had time to move away, he was seized by the head and thrown upon his face perfectly senseless. When he was able to sit up, he found himself bleeding profusely, and surrounded by the herd of buffaloes, the tigress looking on at a short distance. Watching his opportunity he fled home, leaving the buffaloes between himself and the tigress. Subsequently a lad bringing home cattle late in the evening, while half of the herd were within, and half beyond the bounds of the village, was seized and carried away.

11. The above seem to show that although the tigress had the choice of food, she preferred on both occasions a human victim.

12. On the 2nd May she killed a Gond while watching cattle below the village of Sornadai, and on the 11th of the same month, while Major Priestly and myself were encamped at Sornadai, she killed a Rajpoot employed with three others in cutting bamboos below the village. One of the latter, after witnessing the death of the Rajpoot, and joining the other two in scaring away the tigress, ran up to Sornadai to give notice of what had occurred, and point out the spot to Major Priestly. A very interesting account of the pursuit and slaughter of the tigress was given by Major Priestly.

13. Whenever a Gond or Kurku is killed by a tiger, his wife and children, and father and mother if living, are thrown out of caste; all intercourse between them and the rest of the inhabitants being interdicted, on the ground that they are laboring under the displeasure of the Deo. What makes this belief most distressing is, that the tiger is one of the principal Deos of both Gonds and Kurkus, and if a man-eater is the Deo to whom the propitiatory sacrifice and feast prescribed on these occasions, is invariably offered, often by taxing to the utmost the scanty means of the poor creatures afflicted by his ravages, and occasionally involving their proceeding upon begging expeditions to collect the amount required.

14. Prior to our arrival at Sornadai, the people intended to desert the village, and would have left after our departure had the tigress not been killed. The relief to the whole country has been very great; the sudden way in which men were carried off and devoured from different portions of the forest between Batune and Kalmesra, having rendered the whole of the intermediate ridges unsafe. Indeed, the dread of the tigress was so great that Gonds, who could furnish information regarding her locality, were afraid to do so, lest they should be asked to assist in tracking her. Before we left Sornadai, we had the satisfaction of learning that the whole of the villages would be re-occupied as soon as the old inhabitants could arrange for their return.

15. The following is the extent of topographical details completed by each of the Assistants employed :—

Mr. Civil Assistant C. Neale	sq. miles	194
„ Sub-Assistant 1st grade J. Smith	„	0
„ Sub-Assistant 3rd ditto C. A. R. Scanlan	„	272
„ Do. ditto A. Chennell	„	318
„ Do. 4th ditto J. Chennell	„	189
Native Surveyor Ramchunder	„	250
Do. Pandarao	„	317
Do. Baparao	„	316
Do. Janardan Rao.. ..	„	275

16. The check lines for testing the above were entrusted to Messrs. Neale and Smith, who were furnished with two small Theodolites and two Perambulators to enable them to connect the most convenient stations, with particular portions of the check line of each plane table; but the country surveyed was so over-run with forest and so hilly in character and broken by ravines as to render this method of surveying not only difficult and expensive, but requiring more time than could be spared by either assistant. Mr. Neale in consequence adopted the method of testing each surveyor's work by independent fixings of the same plane table, and so ascertaining, in a given distance, the errors and omissions of each. These were in all cases marked in red ink upon each table, and are here given to afford an idea of the accuracy of each assistant in working :—

NAMES.	Nature of ground.	Number of errors.	Number of omissions.	Greatest difference in miles.	Area surveyed.	Number of plane table stations.	Number of plane table stations per square mile.	General average for whole party.	REMARKS.
Mr. Civil Assistant C. Neale	Hills & Jungle	194	474	3.29	2.57	* Rejected, there being less than one station in each square mile.
„ 1st Grade Sub-Assistant J. Smith	Do.	64 detected	Too numerous to mention.	0.55	316*	242	0.77		
„ 3rd Grade C. Scanlan...	Do.	1	5	0.10	272	777	2.85		
„ „ Sub-Assistant A. Chennell	Do.	9	2	0.22	318	615	1.93		
„ 4th Grade Sub-Assistant J. Chennell	Do.	1	...	0.15	189	408	2.16		
Native Surveyor Ramchunder tested by Mr. Smith†	...	...	...	...	250	736	2.94
Native Surveyor Pandarao, tested by Mr. Smith	...	...	...	...	317	764	2.41
Native Surveyor Baparao, tested by Mr. Smith	...	38	16	0.45	316	757	2.39		
Native Surveyor Janardan Rao, tested by Mr. Smith..	...	1	...	0.18	275	720	2.60	† A small portion of Mr. A. Chennell's work, as well as portions of native surveyors Ramchunder and Pandarao's work have been tested by Mr. Smith, but the results have not been recorded as there is reason to distrust the correctness of Mr. Smith's check lines.	

17. The work completed this season by Mr. Smith is so incorrect in details as to leave me no choice but to reject the whole.

18. The work completed by Mr. Sub-Assistant Scanlan has been accurately surveyed and very neatly outlined. His work shows the most finish and care in detail of all completed this season. The ground surveyed was difficult, the ridges being broken, and the low ground over-run with forest.

19. The work completed by Mr. Sub-Assistant A. Chennell is not quite satisfactory as regards the mode in which he has contoured the ridges forming the head of the Towa Valley. The errors detected in his outline of some of the lower scarps peculiar to sandstone formations, as well as in the course of the principal tributary of the Towa, are the result of his not having fixed a greater number of stations and made a freer use of his ruler prior to outlining details. It is, however, only just to add that the valleys in his table were very broken and jungly, and difficult to outline with accuracy; the streams early in the season having been almost hidden by the dense foliage of the forest. The errors of his work are due chiefly to want of experience, and to his desire to bring in a large area.

20. The work completed by Mr. Sub-Assistant J. Chennell, although defective in style, is very satisfactory as regards the careful way in which he has outlined the features of ridges. The details of the low ground outlined by him and Native Surveyor Janardan Rao in the Towa Valley, could not be laid down with the same accuracy as that adjoining the ridges, on account of its being so over-run with forest as to preclude the possibility of their tracing the course of rivers without opening rays. Even on the high road between Hashangabad and Baitool which runs through this portion of the Towa Valley for a distance of 15 miles, and is 50 feet in width, and cleared of jungle in its whole extent, only four stations could be fixed by the plane table. The intermediate distances it was necessary to measure by the Perambulator, using forward and backward rays for the direction of the road between the points fixed by the plane table. Agreeably to departmental orders, the course of such streams as could not be satisfactorily traced in the forest, have been marked by dotted lines.

21. I regret having to report unfavorably of the greater portion of the work completed this year by Native Surveyor Baparao, who, although generally correct in the positions of villages and in the main drainage of the ridges, has in a large portion of his work taken very little pains to outline with sufficient detail the under-features of the ridges themselves.

22. Native Surveyor Janardan Rae has greatly improved in field drawing. His work has the least errors of any submitted, and is far superior to that completed by any of the other Native Surveyors. Only one mistake was discovered by Mr. Neale in a distance of 32½ miles examined by him. His style of delineating ground is so good and truthful that he only requires a little more time to become an excellent draftsman and topographer.

23. The work submitted by Native Surveyors Ramchunder and Pandarao, although fair in character and detail, and agreeing very satisfactorily with each other on the line common to both tables, and with the adjoining board completed by Mr. A. Chennell, has not been examined like the rest of the work completed this season; the test line carried through their boards by Mr. Smith having been rejected with the rest of the work completed by that Assistant.

24. The survey of the Forest Reserves of Rajabarari and Saoligarh was entrusted to Mr. Maine; he completed—

Of the Saoligarh Reserve Forest's outer boundary	... miles	67
Of the internal boundaries—		
Of Tokra and Panchi Malguzari	... miles	12·3
Burbua ditto ...	... "	2·4
Patalda ditto ...	... "	5·4
Dolaragarh ditto ...	... "	2·5
Matigarh ditto ...	... "	4·0
		26·6
	Total completed	... " 93·6
Remaining to be cleared and surveyed	... "	12·
Of the Rajabarari Reserve Forest's outer boundary—		
He cleared and surveyed	... miles	71·4
Remaining to be cleared and surveyed	... "	80·0

25. Owing to disputes between the Forest Authorities and the Malguzars holding land within the boundary of the Rajabarari Reserve, Mr. Mainc, after completing nearly half of his survey of that Reserve, was desired by the Deputy Conservator to take up the survey of the Saoligarh Reserve.

26. The whole of the Saoligarh Reserve, with the exception of about 12 miles of the outer boundary, has been surveyed by Mr. Mainc. The portion remaining to be surveyed consists of the most precipitous portion of the Mohrau river, and will involve the opening of rays along one or both banks of that river, and the selection of subsidiary stations to determine such distances as cannot be measured by the Perambulator.

27. Arrangements for the completion of the survey of the above Reserves, as well as for that of Jamgarh will be made at as early a date as possible.

28. The following is the extent of work completed by Mr. 2nd grade Sub-Assistant Farrell, who has been employed since November last upon the fair copy of the General Report of the Hyderabad Survey :—

Copied fair.

Triangles	...	...	...	sheets	54
Abstract of horizontal angles	...	...	...	„	37
Alphabetical list of villages	...	...	...	„	60
Triangulation charts	...	...	...	completed	2

Remaining to be completed.

Abstract of horizontal angles	...	...	...	sheets	40
Comparing and examining	...	...	...	„	300
Triangulation charts	...	...	...	...	2

29. The following is the extent of work that will be completed before the party takes the field :—

- 11 Standard maps, Nos. 1, 2, 3, 4, 5, 6, 7, 8, 15, 16 and 17. Scale 1 mile = 1 inch.
- 10 Exaggerated maps, Nos. 1, 2, 3, 4, 5, 6, 7, 15, 16 and 17. Scale 1 mile = 1 inch.
- 13 Principal triangles.
- 209 1st class do.
- 319 2nd „ do.
- 24 Deductions of principal Latitudes, Longitudes and Azimuths.
- 416 Ditto of Secondary ditto ditto.
- 23 Ditto of Principal heights.
- 306 Ditto of Secondary ditto.

General Report, Season 1867-68.

- 1. Title page.
- 2. General skeleton plan on scale 8 miles = 1 inch.
- 3. Table of contents.
- 4. Introduction.
- 5. Description of stations.
- 6. Computations.

{	Deodangar and Ghutera Polygons.
	Principal triangles.
	1st class Secondary triangles.
	2nd „ ditto.
- 7. Abstract of heights of Principal and Secondary stations.

8. Synopsis of Latitudes, Longitudes and Azimuths of Principal and Secondary stations.
9. Alphabetical list of Latitudes and Longitudes of Trigonometrical stations.
10. Alphabetical list of Latitudes and Longitudes of towns and villages.
11. Abstract of horizontal angles and approximate Azimuths.

Chart of the triangulation with numerical data. Scale 4 miles = 1 inch.

30. The following fair and exaggerated maps of the Baitool District cannot be submitted before the close of the approaching field season, on account of the rejection of Mr. Smith's work, and discrepancies between the old survey of Hyderabad and the present survey of the Central Provinces :—

Standard maps, Nos. 10, 11, 13, 14, 16, 17.

Exaggerated maps, Nos. 3, 8, 10, 11, 13, 14, 16, 17.

31. In several cases there is no similarity whatever between the old and present boundary of Berar, and this appears to be the result of encroachments, varying from half a mile to 3 miles, on the part of the Berar people during the last 20 years ; it will be necessary to bring the subject to the notice of the authorities with the view of having the present boundary finally settled, before submitting the fair maps of the same.

32. I may add that the drainage of several of the ridges outlined on the maps of the old Hyderabad survey differs so much from the surveys submitted by Mr. A. Chennell and Native Surveyors Ramchunder and Pandarao, as to render a re-survey of a slip of 3 miles south of the hills and extending from Bairam to the Warda essentially necessary.

33. I have arranged for this with Mr. A. Chennell whom I intend to employ on the 15th October in extending a Secondary Series to the Warda, the stations of which will be used at the close of the field season for the re-survey referred to. This will allow ample time for any new settlement of the present boundary that the Commissioner may consider necessary, and will not interfere meantime with the progress of the rest of the work.

34. In submitting the above report of the work completed and in progress, it affords me much pleasure in bringing to your favorable notice, that I am greatly indebted to Messrs. Neale, Farrell and Scanlan for the satisfactory way in which the standard and exaggerated maps of the present season have been completed.

35. I beg to submit a sketch map showing the extent of work completed and in progress, and what I propose to entrust to each assistant during the approaching field season. The check line marked in red will be taken up by Mr. Neale as soon as he has completed his own portion of work, and arranged for the survey of the tract recently transferred from Chindwara to Hoshungabad.

36. The triangulation of the tract south of Umarpathar and extending east from Deogar to the boundary of the Seoni District, will be taken up by myself and Mr. A. Chennell, whom I intend to detach in advance to extend the secondary series referred to in para. 33.

Extract from the Narrative Report of LIEUT. COLONEL G. H. SAXTON, in charge No. 3 Topographical party, Central provinces and Vizagapatam Agency Survey, for Season 1867-68.

1. The recess duties of the previous season having been closed, the party left Ootacamund on the 21st November and proceeded to the Vizagapatam District, where arrangements for field equipments were made; the strength of the party, materially reduced, as will be shown hereafter, is given in the margin.

Lieutenant Colonel G. H. Saxton.	Mr. R. W. Chew.
Close of recess and strength of party in taking the field.	" J. A. May.
	" F. Adams.
	" T. Claudius.
	" W. Pettigrew, 2nd Season.
	" A. Cooper, 1st Season.
	" R. Trowman, 2nd Season.
	" E. Atkins, 1st Season.
Assistant Apothecary	R. Dawson.

2. As usual, there was considerable difficulty in obtaining suitable carriage and other equipments for field service. By indenting upon the neighbouring district of Ganjam, through the Collector, bearers were obtained; and the Maharajah of Vizianagram kindly lent me two elephants, and the party was thus able to enter the jungles in time to reach their respective grounds by the proper date—1st January.

3. The plane tables were projected and instructions for the distribution of the party were given before leaving Vizianagram. Mr. Chew, as senior, was given a central position; and Mr. May and Mr. Adams, next seniors, were placed on each flank, and the new hands distributed so as to be within reach of any needful assistance from the seniors. Mr. Atkins was placed under the direction of Mr. Chew for instruction, and Mr. A. Cooper, just transferred to us from the Pegu Survey, where he had no experience or knowledge of plane tabling, accompanied me.

4. On taking the field my own duties were, in the first instance, to complete the junction of my principal triangulation with the Coast Series. After completing this, I proceeded to carry on my triangulation westward, to connect with the Hyderabad Survey points. Whilst employed on this duty I received orders to take up extra departmental duties. I connected my work with the Hyderabad Series, but shall hereafter extend my observations, and, in the mean time, as this portion of country about Lat. 18° and Long. 81°30'—*vide* sketch map—is far in advance of the present detail survey field, I have deferred the computation of the work done. The fresh portion of country triangulated is of the wildest description and notoriously unhealthy. It was altogether impracticable to take my camp, with which, for twelve days at one time, I had no communication whatever, though, neither myself in the hills, nor the camp elsewhere remained two nights in the same place. My progress was along the boundary between Vizagapatam and Rajamundry Districts, through hills about 4,000 feet high. Later in the season I executed a quantity of interpolating triangulation, filling in points partly for the then current, and partly for the approaching season's plane tables. This portion of my work has been computed, and forms the only computations sent in this season.

5. The amount of detail survey executed this season is unusually small. The reduction of the strength of my party has formed the subject of correspondence, and the Surveyor General intimated that allowances would be made for the reduced out-turn to be expected from the party. The area surveyed is as much as could be expected in one short field season. The sketch map gives the extent of each Surveyor's work, as per margin.

Mr. Chew,	234.8 - 6.3
" May,	213.6 - 7.1
" Adams,	280.8 - 7.2
" Claudius,	219.6 - 1.6
" Pettigrew,	167.7 - 6.4
" Cooper,	51.2 - 10.7
" Trowman,	160.0 - 6.0
" Atkins,	149.5 - 6.8

Mr. Chew executed 234.8 square miles. In the early part of the season he was occupied with the instruction of Mr. Atkins, and late in the season, he fell sick from fever complicated with a virulent ulcer, and was compelled to give up further work. Under these

circumstances his out-turn is as much as could be done. During the latter part of March, Mr. Chew accompanied me and assisted in keeping up the Angle Book and other office duties, as my writer was too ill to do anything.

Mr. May has produced work in his usual superior style. A portion of the country, surveyed by him this season, exhibited difficulties of almost every kind. He is a most careful surveyor. Just as I was about to visit Mr. May, the backward state of the work, from Mr. Chew's illness, &c., made it necessary for me to withdraw him from his own portion, and he joined my camp, when I placed all the hands I could collect under his direction, and thus secured the completion of one sheet of 30' Long. by 15' Lat. Mr. May's progress was thus somewhat interfered with. The quantity done by him 243.6 square miles is as much as such careful surveying will admit of.

F. Adams.—I visited this Surveyor on 25th February, and remained with him till 2nd March. He has executed the largest quantity of work this season 280.8 square miles. He remained plane tabling longer than any other Surveyor, and brought in his boards completed. His survey is chiefly in very wild, difficult country. An interesting old town, "Barsur," though at present consisting of only eleven houses, is the largest of the few villages in Mr. Adam's portion of country. At this place are several fine temples built in very peculiar style; a temple of any kind is seldom met with in the part of India I have, for so many years, been employed in.

T. E. M. Claudius has executed 249.6 square miles. I visited him, and inspected and examined his work, and having interpolated several points for his board, I computed them with him, and thus gave myself an opportunity of testing his work; and I had reason to be quite satisfied with the result. Mr. Claudius has the smallest number of plane table stations per square mile, and should have given, perhaps, a rather larger out-turn. His maps do not show the same difficult country or close surveying as several of the others.

W. F. Pettigrew.—This was Mr. Pettigrew's second season. He took the field with fever which, from time to time, had attacked him ever since his return from the jungles the previous season. He suffered occasionally during the whole field season, and throughout the current recess. His out-turn of work 167.7 square miles is very creditable.

A. Cooper.—This Sub-Assistant joined the party from the Pegu survey just as we took the field. Although an experienced surveyor in another party, he had never used a plane table. He accompanied me at first, and was employed with a 5-inch Theodolite, first observing on a few subsidiary stations, and then in making a traverse for 37 miles along a disputed boundary. Whilst employed on that boundary Mr. Cooper got ill, and was longer detached from my camp than I had anticipated, and as I was entering a particularly bad tract of country, I by letter, directed him to proceed by a more practicable route and join Mr. Chew for instruction on plane tabling. I did not again see Mr. Cooper until 18th March, when I visited him in Mr. Chew's camp. I went out plane tabling with him, and found he had gained sufficient knowledge of the duty to enable him to work by himself; and he was continuing Mr. Chew's survey whilst that assistant was too ill to go out. Mr. Cooper executed 51.2 square miles, and will, another season, prove an efficient plane tabler.

R. Treverman.—This Sub-Surveyor was under Lieut. Downing's instruction the previous season, and for a new hand did a large quantity of plane table surveying which, however, I did not think it right to pass as final. He was, this season, put on the same ground, and I visited and inspected his work, remaining with him, on two occasions, for several days. I made several new stations, computed and projected them on his boards, and pertalled for several miles to test his survey. He was warned to be careful and accurate, and told not to mind his outturn being small. His fault, the previous season, had been unmistakeably doing too much for a new hand. His map this year is very superior in every respect. The portion of country he has surveyed, has few marked or important features, and though the work

is not of a superior class, I think it will meet the requirements of a topographical map of such a district.

E. Atkins.—This Sub-Surveyor joined the party last recess and received some instruction before taking the field. He was placed under Mr. Chew, who was made responsible that he was not put to any independent work before qualified to undertake it. I made a particular inspection of this Surveyor's work, going out with him for several days. I discovered one important error which made me anxious, and I took considerable trouble, but was unable to detect any other instance which evinced the least carelessness. The country surveyed by Mr. Atkins was easy, and he executed 149.5 square miles in this his first season. He seemed to like the work and kept his health, and promises very well.

Assistant Apothecary R. S. Dawson.—I may here allude to Mr. Dawson's services. He is always professionally efficient and attentive. He frequently availed himself of opportunities of treating cases amongst people of the district, and in some instances, during this season, was eminently successful in giving aid where, but for his skill, the patients' state was hopeless. Mr. Dawson is always willing to assist me in office, and frequently in field and quarters takes the place of writer or other assistant. He now constantly suffers from attacks of fever.

6. On my visits of inspection to each Surveyor, during this field season, I noticed a marked improvement in the manner of the finishing up of the maps; in the case of nearly all the Surveyors, the drawing, &c., being well advanced towards completion. To this Mr. Adams was the only exception; and whilst singling out his name, it is only right to add that, to secure the squaring up of his work, he remained out longer than any other Surveyor. The country surveyed in detail is better, in some respects, than this party has been generally employed upon. The River Indrabati, an important tributary of the Godavery, running from east to west, passes through some of the boards, and is not far on south of the others, and the country along and near its course is cultivated and populated to a far greater extent than any other tract between the Godavery and Mahanadi Rivers, between which we have been employed so many years. The country is full of large game. Tigers, bison, and buffaloes, and all kinds of deer being very abundant. The Surveyors killed numerous specimens of all these animals whilst returning from plane tabling.

7. During the field season I was called upon to execute extra professional work on the boundary between Bustar and Jeypore. These duties were performed under direct orders from the Government of India. The decisions given by me and Captain Glasford, who was associated with me, have been sanctioned, and the thanks of Government accorded to us in G. O. No. 680 of 30th June 1868.

8. The recess duties have, with the exception of my own case from sickness, been carried on with regularity; and all maps, &c., will be completed without any difficulty. All the new hands are now under instruction with the plane tables, and are deriving much benefit from Lieut. Sale's directions; and I anticipate a better out-turn of work next season.

The maps are, I think, got up in very good style. Lieut. Sale's remarks and suggestions have been taken every advantage of in endeavouring to improve them. The computations have been done under my own immediate arrangement. Mr. Chew has computed the triangles with me, and the latitudes and longitudes and azimuths with Mr. Pettigrew. The heights have been done by myself and Lieut. Sale.

9. The health of the party has not suffered so disastrously the last few years as formerly, though I am almost, if not quite, the only exception of not having fever in the field, and even now several of my estab-

lishment are constantly suffering. There is no doubt the type of the disease is less virulent but the Assistant Apothecary says, there is scarcely a native in my establishment who has not enlarged spleen from continual fevers. My writer was very ill this season, and I have been compelled to employ a substitute all this recess. He is now about to rejoin. This man continued with me about two and a half years, and is the only instance of my keeping a writer for so long as even that moderate period. The difficulty of keeping an office writer has always caused me much personal inconvenience, as my own time is employed in much office routine, which an experienced writer would save me.

10. The changes in the party have been chiefly in the executive branch. The newly appointed Military Assistant, Lieut. Saxton, remained in the office a very short time, and was then, before he took the field, permitted to join the Abyssinian Expedition in a different department. Lieut. Sale, R. E., is now with me, having joined with the special object of taking charge during my intended absence on leave to England. He is now, on my change of plans, and to meet other departmental arrangements, under orders to relieve Captain Depree on his departure on sick leave. I regret much that I cannot have the advantage of his assistance for a season, and beg to report that I consider his short stay in my office has been a great benefit and satisfaction to the whole party. I regret the personal inconvenience he was put to in having to join this party, but in all other respects, I am very glad that he came. Civil Assistant D. Atkinson was transferred to the head office at Calcutta, and Mr. J. Harper, the next senior but one, took furlough, on medical certificate, to England. Mr. A. Cooper joined as Sub-Assistant, 4th Grade, as stated in para. 6, and Mr. Barnett has just now joined the party in the same grade. Both these Surveyors are from the Pegu Survey, and will, I trust, after acquiring a knowledge of plane tabling, do good service. Mr. Atkins joined the party as Sub-Surveyor and Draftsman just before taking the field, and promises to turn out well. I have just now two other youths "F. Atkins," and "J. McCay,"—they are under instruction pending sanction. The party though young and inexperienced as here shown, is not in an unsatisfactory state for taking the field.

11. The programme for the coming season will be based on the necessity for carrying out the orders of Government in the Foreign Department, regarding duties entrusted to me as Boundary Commissioner. I am instructed to demarcate something like fifty miles of boundary, every bit of which passes through jungles, the greater part entirely unexplored. No disputes exist heretofore, but I am quite convinced that every portion must be fixed by arbitrary authority, as no defined boundary exists, and no manner of evidence to support any claim on either side will be forthcoming. I proposed a plan to obviate the difficulty I anticipate, but Government has decided not to adopt it. Under these circumstances I intend employing my whole party along the country adjoining the actual boundary, which will be fixed, demarcated and mapped in a complete, and, I hope, satisfactory manner during the season. I shall be able whilst employed on this extra departmental duty to supervise the working of the whole party. The country I propose thus surveying is well prepared with triangulated points, and the only portion of the Bustar and Jeypore boundary which will be left unsurveyed, is on the extreme south, and where the river Kholabor Saveri forms well defined limits. My position will be, at the same time, favorable for completing the observations alluded to in paragraph 4, *i. e.* about Lat. 18° and Long 81° 30', joining on to the Hydrabad Series. The only material difference these arrangements will make in my intended plans, will be the impossibility of taking up the Saora Gap in Ganjam and Vizagapatam Coast districts. I have succeeded in getting the hills in this portion cleared, but the triangulation, &c. must be deferred till another year.

Extract from the Narrative Report of CAPTAIN G. C. DEPREE, in charge No. 4 Topographical party, Chota Nagpore Division Survey, for Season 1867-68.

1. The Civil assistants and Sub-assistants took the field on the 4th November and I followed on the 6th idem. The whole of the party had returned to quarters on the 10th May following.

2. On taking the field I marched for about two hundred miles *viâ* Pertabpur and Korea, through a very wild country latterly, and commenced the work of observing on the 5th December at a village station a few miles south of Basin H. S. I then proceeded westwards into Chang Bhokar, fixing and observing stations along the boundary of Rewah. I then turned south for a couple of marches, and observed on Chamki Great Trigonometrical Survey Station. I then visited Muregurh G. T. Stn. finally fixing a trigonometrical station in the jungles at a spot about 100 yards removed from the triple junction point between the boundaries of Bengal, the North-Western Provinces, and the Central Provinces.

3. The Secondary Triangles, which emanate from the side Lul, G. T. Stn. to Deogurh H. S. of the Korea Series, are five in number and of good symmetry. They run westwards, and close upon, and are checked by, the side Chamki to Muregurh H. S. of the Calcutta Longitudinal Series. Again emanating from the latter side, is another set of triangles of not great symmetry, arranged so as to conform to the boundary of Chota Nagpore and Rewah. They are arranged so as to form a partly double series, and running in a south-easterly direction, they are checked by the principal station of Koreargar H. S. The series is again extended towards the south-west by a pentagon, the angles at the base and centre of which have been observed,—for the purpose of affording a convenient base from which the triangulation can be extended, should it be intended that this party shall undertake the survey of the adjoining tract of the Central Provinces.

Instrument and zeros used.

4. The angles were all observed with a 10 inch Theodolite on the usual two zeros.

5. Every peak and prominent hill has had its top cleared of forest, and a single large tree, visible to the naked eye for twenty-five miles round, has been left as the signal for the use of the detail surveyors.

Area of Triangulation.

In the case of stations of observation there is the usual station mark, cut on the rock if possible, otherwise on an embedded stone, placed as near the signal tree as possible, and protected by a pile of stones erected round a staff and brush.

6. The area of triangulation completed in advance of the detail survey is 4,690 square miles or sufficient to occupy the full party during one and a half season. It consists of a part of Sirgoojah, and Korea and all of Chang Bhokar, a very wild, hilly, jungly, thinly inhabited tract, the home of the wild elephant.

Area of Triangulation in advance of detail.

7. The Secondary heights observations were all made to luminous signals, generally at reciprocal times, and two intersections were always made on both faces. The tertiaries had one intersection only taken on both faces, and the signals were the ground levels, *i. e.*, the tops of the hills where the jungle had been fully cleared about the signal tree. The village stations determined for the purpose of calculating the various ground plain levels, were always observed with the aid of Heliotropes.

Heights.

Percentage of heights to Trigonometrical points.

8. Altogether 74 heights were determined, consisting of 9 village and 65 hill stations, or nearly sixty per cent. of all the trigonometrical points fixed during the season.

Average discrepancy of heights.

9. The mean difference between the pairs of deductions of the six Secondary heights is 11·5 feet; and in the case of the thirteen tertiary points the figures are 11·7 feet.

10. The Surveyors progressed well and steadily with the detail plane tabling. The only interruption to the smooth working of all the arrangements planned in quarters, was in E. Shareef finding the ground allotted to him to be beyond his powers; he was therefore transferred to a nearly level tract of country originally falling in the section of Mr. McGill; and in this he succeeded, his map proving on examination to be remarkably accurate. Mr. McGill meanwhile undertook the survey of the difficult bit with alacrity, although it involved a good deal of extra marching, and the change from a good to a decidedly bad and difficult ground. Mr. James revised a good deal of, and eventually passed some of, the detail survey executed by Mr. Low, and H. D. Dutt during the previous season, and the latter has now been incorporated with the detail of the present season under report. Mr. Rae, H. Dutt, and E. Shareef after being carefully trained in quarters, were put under Messrs. Wilson, Senior, McGill and Vanderputt respectively for a further course of teaching in the field, and upon being reported competent, and after re-surveying small areas, they commenced working independently.

Area.

11. The area surveyed in detail covers 2,865 square miles. Of this total, however, 50 miles were done last season by Mr. Low and H. D. Dutt.

12. The average number of plane table fixings per square mile is 7·4, or 0·8 stations in a mile in excess of last year's survey.

Names of Surveyors.	Area in Miles.	Average number of P. T. Fixings per Square Mile in each Surveyor's work.	Minimum number of P. T. Fixing per Square Mile.
Mr. McGill	394	5·13	4·83
„ Vanderputt	383	8·25	8·00
„ Wilson, Senior	374	5·77	5·20
„ James	389	6·69	5·90
„ Barker	311	5·34	4·90
„ Rae	94	11·00	11·00
„ Wilson, Junior	330	4·46	3·90
Baboo M. S. Dutt	338	8·36	7·20
„ H. D. Dutt	168	5·60	5·60
„ E. Shareef	84	9·30	9·30
Total & average Square Miles	2,865	6·99	

13. The nature of the ground surveyed varies greatly. On the south is the curious plateau called Manipat, having a mean elevation of 3,700; in the centre of the work is the plain country about Bistrampore and Pertabpur elevated 1,800 feet above sea; on the north of this again the ground slopes off to a lower level by a succession of undulations and hills all covered with jungle, where except in a few valleys more favoured by nature than usual, villages are few and far between.

14. The Odeypur boundary is just touched on the south, and with this exception, the Sirgoojah estate only came under survey: about one-third still remains to be completed.

Names of countries surveyed.

15. The outcrops of the Sirgoojah coal field have been shown on the maps.

16. On the completion of the triangulation on the 15th January, I took up, proceeded to test the accuracy of the detail survey by means of test lines and examination in situ. I ran altogether 284.5 miles of chain lines traversing the work of every assistant. Commencing on the S. W. of the block of detail, I worked eastwards up to the eastern row of tables, I then turned north and ran my lines through all the eastern boards until the northern limit was reached. Wishing to prove the accuracy of the Topographical maps where they overlapped that of the Revenue survey of Mirzapore, I ran a line from east to west right along the boundary. On reaching the western limit of survey I turned south, and traversed all the western row of field sections, and completed the work simultaneously with the closing of the detail survey by the assistants.

17. While running the above check lines I took every opportunity of examining the field sections of all the Surveyors by the in situ test, *i. e.*, by placing the plane tables on the ground, or on commanding hills, where the country depicted below me in nature could be compared with the map.

18. The coincidence of the work of this year with that of the last is excellent.

19. The computations consist of the following:—

12 Secondary triangles	}	In triplicate.
21½ Tertiary do.		
6 Secondary heights (double deductions)	}	In duplicate.
69 Tertiary heights (single do.)		
7 Secondary Lat. and Long. (double deductions)	}	In duplicate.
116 Tertiary do. (single do.)		
9 Pages of Synopsis		In triplicate.
6½ Pages of Alphabetical List		In quadruplicate.
83 Pages of Horizontal angles		In duplicate.
20 do. Vertical do.		do.
35 Pages of Village Alphabetical List		do.

20. The maps which have been completed and submitted to your Office, are as follows:—

- 5 Standard Sheets, Nos. 55, 56, 57, 58, and 59 of the Atlas of Chota Nagpore 30' x 15' Scale 1 mile = 1 inch.
- 5 Exaggerated Sheets, Nos. 55, 56, 57, 58, and 59 of the Atlas of Chota Nagpore 30' x 15' Scale 1 mile = 1 inch.
- 1 Test Chart Scale 4 miles = 1 inch.
- 1 Chart of Triangulation.
- 23 Field Sections.
- 2 Check Line Sheets.

21. Two field sections are still retained in this Office for future compilation. No arrears of mapping or computations exist.

22. The field sections are submitted just as they were drawn in the field, all alterations have been made in red ink only, and the check lines have been plainly laid down on each sheet, and discrepancies where they exist will be at once apparent by examining the red lines. The two original check line sheets are submitted together with the one sheet of the prior year, lately borrowed from the Surveyor General's Office.

23. The test chart shows the outlines and areas of each Surveyor's detail survey together with the number of P. T. Stations, and the average per square mile of the latter; the direction of the check route lines, and the number and position, and nature of stations, from which the work was tested in situ. This shows at a glance a record of what has been done to secure accuracy, and what left undone.

24. Five sheets of the Atlas of Chota Nagpore, Nos. 55, 56, 57, 58, and 59 of the size of 30' x 15' have been submitted. I trust the execution of these maps will be approved of, for, consistently with the endeavour to make them fac similes of the original sections, every care has been observed in making them clear and uniform, by employing one assistant, Mr. A. J. Wilson, on the shading, another on the writing, on the outlining, and the junior hands only on the pencil tracing. The heavy duty of examining these sheets has been performed by Mr. McGill, the senior assistant.

Fair copy Sheets,
Exaggerated Sheets. 25. The same five sheets have been copied in the exaggerated style for photographic reduction.

26. I have found it necessary for my health to seek a change of climate, I propose therefore to make over to Lieutenant M. T. Sale, R. E., who has been appointed to succeed me, the charge of this party, about the first week in November.

27. It is but right that I should record the high opinion I entertain of the characters of the Civil Assistants, Sub-Assistants and Native Surveyors of this party. I have only to add that Mr. McGill has been of the greatest service as the senior assistant of the party, and he has shown much intelligence as well as zeal.

28. The health of nearly all hands has been unusually good during the past year, notwithstanding that the country under survey was of a more than ordinarily jungly character, and that the field season of more than six months was the most protracted that the party ever passed. This is attributable to the salubrity of the climate of Chota Nagpore about Ranchee, which enabled the Surveyors to recruit their strength quietly after the hard work of the camp life.

29. The triangulation is one and a half years nearly in advance of the detail survey, and the stations for all the triangulation, that requires to be done to complete the survey of the division, are cleared, and the principal stations are selected. Of the original field maps, all have been copied as standard and exaggerated sheets, except two outlying sections which are retained in the Office for compilation next year.

30. Referring to the Index chart, it will be seen that the country prepared for survey lies westwards of last year's work, extending to the extreme west corner of our limit, or through the north of Korea and all Chang Bhokar, also including a considerable part of Sirgoojah. The boards have therefore been arranged so as to embrace all this area, and every endeavour should be made to complete the survey of this distant tract, so as to avoid the necessity of detaching a Surveyor next season to fill up a gap,—if necessary one of the hands on the south should be ordered up to assist. On the principle of working evenly from west to east, the country on the west of 84° meridian should be filled in next, consequently the triangulation should be taken up at once, and to prevent unnecessary marching and loss of time, the Kolhan series should be continued along the stations already fixed and prepared, until a junction be effected with the completed work of the Korea series, and thus the quadrilateral-figured-series, based on the revised values of the Calcutta Longitudinal Series, would be completed, and the new observations could be computed out on the data obtained from the side Koreagar to Ras No. 3 H. S. Besides the principal observations a heavy amount of tertiary work will have to be done, but no more than can be done in one successful season. Should however it be found impracticable to fill in the whole area this season with tertiary points, I should recommend that the triangulating Sub-Assistant should be detached to fill in the eastern portion; he will be able to continue at this work after Lieutenant Sale has completed the principal observations.

Strength of the Party.

I. The strength of the party was as follows:—

- Lieutenant R. V. Riddell, R. E., Surveyor, 3rd Grade Officiating in charge.
 „ W. F. Badgley, Assistant Surveyor, 2nd Grade.
 Mr. A. Chamarett, Civil Assistant, 3rd Grade.
 „ C. F. Hamer, Sub-Assistant, 3rd Grade.
 „ A. D. Howard, Sub-Assistant, 3rd Grade.
 „ C. Kirk, Sub-Assistant, 4th Grade.
 „ T. D. Ryan, Sub-Assistant, 4th Grade.
 „ E. A. Wainright, Sub-Assistant, 4th Grade.
 „ H. T. Kitchen, Sub-Assistant, 4th Grade. (Appointed on 1st November and joined Camp on 14th).
 Native Surveyor, Sheikh Nabbi Buksh.
 „ „ Prem Raj.
 „ „ Abdur Rahim.
 „ „ Abdul Rahman.
 „ „ Alli Ahmed.

2. The completion of the whole of the unfinished portions of the Rewah territory was to be considered the special object of the season's work, and with this in view, an expedition to Ummerkuntack, for the purpose of making a report on that place, which had been long postponed, was again considered of minor importance, and had to be abandoned.

3. The party marched from Myhere (at which place all the camp equipage had been stored during the recess season), on the 30th October, and proceeded *via* Nagode and Kalinger to the field of operations. At Nagode Lieutenant Badgley separated to complete the triangulation of Sheets Nos. 31 and 33, which were very deficient in trigonometrical points, and at Kalinger I sent Messrs. Hamer, Howard, and Wainright with Native Surveyors Nabbi Buksh and Abdur Rahim to take up plane tables 58 and 59 (sheet 28), while I marched with Messrs. Kirk and Ryan, and Native Surveyors Prem Raj and Abdul Rahman to sheet No. 37. Mr. Ryan and Native Surveyor Abdul Rahman were set to work at plane table No. 56, and Mr. Kirk and Native Surveyor Prem Raj at 57; but Mr. Kirk having fallen sick before he could commence his work, the whole of his share of this work had to be done by Native Surveyor Prem Raj, who returned for this purpose at the close of the field season, and was detained about a fortnight longer than the generality of the party.

4. The triangulation to be done amounted to selecting some six or seven secondary stations to be connected with the western flank of the triangulation in Bundelcund, north of Lat. $24^{\circ} 30'$, and taking observations at these to supply a deficiency of points in ground west of the meridian of 80° .

5. Lieut. Badgley was employed from the 3rd November to about the middle of December, observing at stations and filling up gaps of the triangulation of 1865-66, extending over 490 square miles. Had time permitted, a larger number of points in that triangulation should have been fixed, but with a view to completing as much as possible of the survey of Rewah, Lieutenant Badgley was directed to do as much as he could up to the 14th December and then to march down to Rewah, where he joined me on the 23rd December south of the Soane River, and after assisting at the projection of the plane table sections, he commenced the detail survey of the southern portion of plane

table No. 44 on the 3rd January; this he completed by the middle of March, and then extended his work southwards to assist Native Surveyor Nabbi Buksh, who would have been unable to complete his work single handed. Lieutenant Badgley completed an out-turn of 165 square miles by the 3rd April, in very troublesome ground, very deficient in prominent points, covered with forest, jungle, and in many parts, broken up by nullahs and ravines, which made measuring of any kind an extremely tedious operation, while from the general level of the country, being so uniform, plane tabling and sketching was, as a rule, very difficult. A re-survey of the cantonments and environs of Nagode having been ordered to be executed during the early part of the recess season, Lieutenant Badgley undertook to instruct and start a Native Surveyor on this duty, and was so engaged from the 8th to the 22nd April, on which date he marched to Kirwee, where I had arranged to leave the camp equipage during the recess season.

6. Mr. Chamarett was transferred from No. 2 party, and reached Myhere on the 7th November, a week after this party had marched to the north of Mr. Chamarett. Bundelcund. There he received his plane tabling equipment, and instructions to take up the re-survey of that portion of plane table No. 71 which had been done by Mr. Ryan and rejected the previous season; of this he completed about 90 square miles by the 18th December, and marched down to the south of the Soane, where he joined my camp on the 22nd December. After projecting his board he started on the 23rd December with Native Surveyors Prem Raj, Abdur Rahim and Abdul Rahman to take up the unfinished portions of plane table No. 43, having under his charge the three Native Surveyors who took up the unfinished portions of plane tables 42, 47, and 50.

Mr. Chamarett at starting had but three trigonometrical points fixed over his whole table, it was therefore necessary that he should execute some minor triangulation, and compute the points on the spot before he could commence plane tabling. This was done, and the work completed early in March when Mr. Chamarett examined the work of the three Native Surveyors, and then assisted Mr. Ryan for about a week, enabling that Sub-Assistant to complete his work in time to leave by the beginning of April.

Mr. Chamarett then returned to his Bundelcund work, and although one week's work would have squared up all gaps, he was unable from sickness to complete his work for a month, or until the 8th May, after which date he left for recess quarters.

Mr. Chamarett completed an out-turn of 319 square miles during the whole season, the greater portion of this, in country very similar to that in which Lieutenant Badgley was engaged, but not quite so broken. Although suffering from ill-health during the greater part of the field season Mr. Chamarett displayed great energy and perseverance in overcoming his difficult work, and I was glad to be able to inform him that promotion had rewarded his labors.

7. Mr. C. F. Hamer took up a portion of plane table 53 with orders to instruct Mr. Kitchen as soon as he joined. The ground taken up by Mr. Hamer presented many difficulties, a scarcity of villages and poles, so that he only completed seven square miles before the 14th December, when it was necessary to march the party down to Rewah. On the march down Mr. Hamer assisted to project the Rewah tables, and on the 2nd January took up the northern half of plane table section No. 44, which he completed by the 18th March, and then was sent to the assistance of Native Surveyor Nabbi Buksh; but he no sooner got to his new ground than he got a slight attack of fever, and the unfinished portions, necessary to square up the season's work, being then very small, I sent Mr. Hamer to Mr. Kitchen to leave with him for Myhere, directly Mr. Kitchen should have finished his share.

From the 12th to the 28th April Mr. Hamer was occupied in finishing his Bundelcund work. The total area completed by him in the season was 160.6 square miles, all in difficult and intricate ground. The Rewah portion Mr. Hamer executed very satisfactorily.

8. Mr. Howard commenced a portion of plane table 58 and worked there till the 14th December, when he marched down with my camp to Rewah, assisting in projection of plane tables on the march. From Rewah he went with Mr. Wainright to take up an unfinished portion of sheet No. 18 on the extreme south-eastern corner of Rewah. The finished area turned out by him seems very small, but he had to work in very troublesome ground. Mr. Howard, having completed an out-turn of 78 square miles, returned to Bundelcund by the 12th April, and when on his march from his ground had a bad attack of fever, by which he was completely prostrated until he resigned on the 28th April.

9. Mr. Kirk fell sick before he could commence work, and was obliged to obtain leave of absence on medical certificate from the 10th November to the 31st December; he then marched down to the southern portion of Rewah in the neighbourhood of Bandogurh where he joined me on the 18th January. I took him out to work with me for two or three days to teach him the way to proceed in such ground, and then sent him to take up the southern portion of plane table No. 49, immediately adjoining the locality I myself was engaged on, so that I might be able to assist him. Mr. Kirk made very slow progress, and I cannot compliment him on his work in any way; it is very indifferent, and shows but poorly alongside of that of any other. His total out-turn amounted to 117 square miles. On account of his slow rate of progress and of some inattention to orders, I was unable to extend the survey of a portion of Mr. Kirk's work where it bordered on Sohagpore, beyond the actual boundary, which however is there marked by a well defined river "The Tohillia."

10. Mr. Ryan commenced work in the neighbourhood of "Gouriar" on the 10th November, completed the survey of 70 square miles in that neighbourhood by the 10th December, when he was directed to join my camp previous to marching to Rewah. He assisted in the projection of the plane tables on the march, and started again at work on the northern half of plane table No. 45 by the 3rd January, completing about 115 square miles of it by the 1st April, and then proceeded to take up a portion of plane table No. 58 in Bundelcund. His total out-turn was 211.6 square miles.

Almost all Mr. Ryan's work in previous seasons was rejected, but I found he was perfectly competent to work independently in moderately easy ground when provided with sufficient trigonometrical points, I therefore gave him the easiest portion of Rewah under survey. I examined this portion of his work twice during the season, and found it very fairly correct; the discrepancies which existed arose from insufficient attention to the details, and where in the difficult wooded tracts discrepancies appear, they were caused by Mr. Ryan's inability to select what were the more important points to delineate. Mr. Ryan's out-turn shows a marked progress on that of previous seasons, which I attribute to his having hitherto been set to too difficult tasks.

11. Mr. Wainright commenced work on the 8th November on the eastern portion, plane table 59 (sheet No. 28), in Bundelcund, and completed about 60 square miles very satisfactorily by the middle of December, I then sent him to the south-east corner of Rewah with Mr. Howard to complete the unfinished portion in that locality; this was completed about the middle of March when Messrs. Howard and Wainright returned to Bundelcund. Mr. Wainright resumed his previous work and finished his share by the 1st May. His total out-turn was 174 square miles, 93 of which were in tedious and intricate ground.

12. Mr. Kitchen was appointed to this party on the 1st November, and joined by the 14th when he commenced to learn plane tabling under Mr. Hamer's instruction in plane table No. 58, (sheet No. 28) Bundelcund. On the 20th November having started Mr. Ryan and Native Surveyors Prem Raj and

Abdul Rahman, I took Mr. Kitchen in hand myself, and when he seemed to have made sufficient progress to work independently, I left him to his own resources. He finished about 20 square miles by the 12th December, and then marched down with my camp to Rewah. On the 3rd January, I again took him under instruction, and worked with him for about 10 days on the south-west portion of plane table No. 45 (sheet No. 21) Rewah. Mr. Kitchen's share of this table was on the whole, one of the easiest portions I could have given him, but presented more difficulties than I should have selected for a beginner, had the ground under survey been more favorable; half his work lay in ground as difficult as that of the average. Mr. Kitchen worked well and carefully, and gives promise of being a useful surveyor. He finished 135 square miles between the 15th January and the 1st April, and then returned to his Bundelcund work. His total out-turn was 170 square miles, with which I was very well pleased.

13. Native Surveyor Nobbi Buksh commenced work on the eastern sections of plane table No. 49 (sheet No. 28), Bundelcund, about the 10th November, and completed an area of 70 square miles very satisfactorily before the time arrived for his marching to Rewah. Between the 15th January and 2nd April, Nobbi Buksh completed 191 square miles in plane table No. 48 (sheet No. 23), Rewah. Most of this ground was troublesome, and on account of the quantity of forest jungle, and even on cultivated parts of Mohwa trees, the work had to be carried on by measurement. His work was too much generalised to be strictly accurate, but in my opinion his style was more suited to the country than that of many.

14. Native Surveyor Prem Raj commenced the detail survey of plane table No. 57 (sheet No. 27), Bundelcund, on the 1st November and completed 65 square miles up to the 10th December; was employed on the march down to Rewah in assisting to project plane tables, and on the 28th December was sent to complete the unfinished portions of plane table No. 42 on which he had been detained the previous field season. This table contained a mass of hills and broken ground covered with jungle, which Prem Raj delineated very fairly. On completing this, he assisted Mr. Ryan for a few days, and then proceeded to resume his work in plane table No. 57, Bundelcund, which he finished by the 10th May. His total out-turn was 214.5 square miles.

15. Native Surveyor Abdul Rohim commenced plane tabling in a portion of plane table No. 58 (sheet No. 28) in Bundelcund, and completed a small portion amounting to about 20 square miles by the 12th December. On the 2nd January, he again started work in the unfinished portion of plane table No. 47 (sheet No. 22), Rewah, and completed this section (an area of about 113 square miles) by the middle of March, and then worked for a short time in plane table No. 48, Nobbi Buksh's work, which was completed by the 2nd April. After the party had left the Rewah territory, he was sent with Lieutenant Badgley to make a plan of the city and environs of Nagode; this he completed by the 15th May, and then followed the party to recess quarters. His total out-turn was 132 square miles and the plan of Nagode.

16. Native Surveyor Abdul Rahman commenced work on the 11th November in plane table No. 56 (sheet No. 27), Bundelcund, where he completed an area of 48 square miles on both banks of the Cane River by the 12th December, and afterwards between the 4th January and the end of April he completed 48 square miles of plane table No. 30 (sheet No. 16), Rewah. On the march up to Bundelcund, he fell sick and was only able to take part in the operations in Bundelcund for about 10 days. He finished during the season an area of 147.5 square miles.

17. Native Surveyor Alli Ahmed during the early part of the season recorded Lieutenant Badgley's observations, and afterwards accompanied Lieutenant Badgley for about a month to learn plane tabling, but on being tried on independent work he was found incompetent to do such complicated work; he was useful however as an office Moonshee.

18. The first portion of work I inspected was that taken up by Mr. Ryan and Native Surveyor Prem Raj across which the country being open, I ran a check line of about a mile in width. The work of the plane tablers tallied very well with this.

Plane table No. 59 taken up by Mr. Wainright and Native Surveyor Nobbi Buksh, I tested by taking their plane tables to several places and intersecting all prominent objects within sight. Mr. Wainright's work was very good, Nobbi Buksh's fairly accurate.

The portion done by Mr. Kirk exhibited a less amount of care and attention than any. Mr. Chamarett's work in sheet No. 34 in Bundelcund was not examined; I considered his standing and experience sufficient guarantee for the correct execution of his work.

In Rewah the ground under survey being mostly covered with dense jungle was not suited to pertain checks or to very rigorous checks of any kind. I inspected the work of Messrs. Hamer, Kirk, Ryan and Kitchen by fixing the plane tables on some prominent points, intersecting all features within view, and then paced straight to another point laying down in a note book every thing which came across the line, these were afterwards plotted by scale, and as the entire length of the line from one to five miles seldom differed by more than $\frac{1}{10}$ th of a mile from the true distances. I divided the discrepancy equally along the whole line, and was enabled to test a piece of ground much more rapidly than if I had used a chain for which I should have been obliged to clear the jungle, and in the particular country the check was equally accurate. Mr. Hamer's work was very good and the country was fairly represented.

Mr. Kirk's work was in some places very carelessly done, and here and there had to be revised by that assistant.

Mr. Kitchen's work was, on the whole, very creditable; in the more open parts it was carefully and accurately done and in the jungly portions as accurate as could have been expected; this was Mr. Kitchen's first season's work, and I think he promises very well.

Mr. Ryan's work was twice examined, and as I have stated in paragraph 10, showed a marked improvement on that of previous years.

I spent about three days examining each assistant's work.

Mr. Chamarett inspected the work of Native Surveyors Prem Raj, Abdur Rahim, and Abdul Rahman, and reported it in all cases fairly accurate. Nobbi Buksh's work was partially examined by Lieutenant Badgley, and was found less accurate than that of most; the streams were in some parts too much generalised for a survey of any ordinary country, but not more than allowable in a country so covered with forest.

19. Had not the work detained us in that part of Rewah a fortnight later than was anticipated, I should have made Mr. Kirk and Nobbi Buksh remain to extend their work across the Johilla and Sone respectively, but I did not like to risk the health of the party which up to that time had been very much better than usual. Signs of the sickly season were appearing and a number of blanks remained in the Bundelcund portion of the work. I therefore left with the last of the detail surveyors on the 3rd April as soon as all that was absolutely necessary to square up our Rewah sections had been done. Work was again resumed in Bundelcund on various dates between the 10th and 15th April and with the exception of two Native Surveyors, all hands had left the field for recess quarters by the 2nd May, having completed a season's work which will I hope be considered satisfactory.

20. The country over which the triangulation passed beginning at the north is flat and cultivated with small isolated hills of granite. The centre of the work is on the Punnah scarp, which is also well cultivated in this part and then crosses a plateau nearly covered with forest with some small hills rising above it, which form excellent trigonometrical points. From this the work passed into the valley, which runs south westwards from Nagode, and then terminated. This valley is well cultivated.

21. Sheet No. 27 of Bundelcund, embracing portions of Gouriar, Charkari and Banda Districts in a flat well cultivated tract of country, studded with isolated hills, some rising as much as 400 feet above the neighbouring country. The Cane River forms the boundary between the independent territory and the Banda District. Both sides of this river are here broken by ravines to the distance of about a mile and a half from the banks; with the exception of this strip, the topography is simple and easy. Sheet No. 28 contains more difficult ground. The southern portion contains the termination of a range of hills running from the south westwards of Punnah. In the neighbourhood of Kalinger and Marfa, the plateau is terminated abruptly by a scarp facing the north but at the eastern end, between Markundi (on the East Indian Railway,) and Chitterkote, the ground is a mass of small hills generally flat topped and all covered with dense forest jungle; the shrub undergrowth being usually confined to the slopes. In Rewah, plane table sections 34 and 42 contain the greatest mass of broken hills of any height and present a different appearance to the remainder of the ground surveyed in this season in which the only large hills which stand up prominently are Bandogurh and the surrounding group in plane table No. 49 and Kanondi in plane table No. 48, both of these are between 1,000 and 1,200 feet higher than the general run of neighbouring ground. Looking from any of the heights, the country presents the appearance of being slightly undulating and covered with dense forest, which is in many parts the case, but more generally underneath the forest is a mass of low plateaus rising abruptly from the plains and of difficult topography as in plane table No. 42, or else the apparent plain turns out on closer inspection to be a mass of ravines and broken ground as in some of Lieutenant Badgley's and Mr. Hamer's work—plane table No. 44. A strip of low hills run from the south-west corner of plane table No. 45 at first in a northerly direction, and then curve round to the north-east corner of plane table No. 44. Between these the Bandogurh hills, Kanondi H. S. and Kimdar (in plane tables Nos. 43, 44, 45, 47, 48, and 49) the ground varies very little in elevation, the general appearance being that of a gently undulating surface covered with forest. The lower portion of plane table No. 49 is more broken up by hills, a few of which such as Bulbul H. S. stand up rather prominently.

22. The only portions really cleared of jungle are narrow slips along the water-courses in which rice is cultivated, and these are generally swamps or bogs all the year round. The water-sheds are very rarely cleared entirely, the forest is thinned and cleared of undergrowth, and in these patches a coarse grain called "kodo" is grown.

Where the ground has been at all cleared, mowha trees predominate and in the large flat masses of forest, sâl, bamboo, mowha, and sarci, this latter seems to be of very little use. A good deal of the sâl timber from the western portion of the Rewah territory in sheets Nos. 21 and 23 is taken off for the railway. The east of the forests is very slightly disturbed.

23. The Soane River winds up in a northerly direction through the centre of sheets Nos. 23 and 21 and the Banas takes a north-westerly course through the western half of sheet No. 20. The Johilla forms the boundary between the Sohagpore and Bandogurh Pergunnahs, and meets the Soane to the east of Bamandeo H. S. in plane table No. 48. This portion of the Johilla has steep rocky banks, sometimes rising nearly 80 feet above the bed of the river, but during the rains the water rises nearly half way up the banks. The Rehr or Rehund is a large river running

through sheet No. 18 in a northerly direction, and then goes off towards the north-east into the Mirzapore District. No other rivers of any size come into the field of operation and none of these are navigable except locally. I have seen no boat on them larger than a fisherman's canoe.

24. The inhabitants are mostly Gohrs or Gonds and Koles, very poor and uncivilised. Their huts are often very neatly built and externally, at least, clean. Some of them resemble the Sherias of the Gwalior jungles.

25. The office was opened in recess quarters on the 14th May, the village books and plane table sections examined and compared, the maps projected and traced in as quick succession as the number of tracing glasses would allow, and then given out to the Native Surveyors and extra draftsmen to print and outline. Ten sheets of the general maps of Rewah and Bundelcund have been completed, of which two, Nos. 16 and 34 had been half completed in 1866; hence in these maps the rivers and tanks are shown in color, the villages are broken up into blocks and crossed with lines which is now contrary to orders, the number of houses in the villages were originally entered on these, which entailed a great deal of erasing. Six of these maps are only portions of the full sheet, but still double the amount of maps turned out in the previous seasons have been turned out.

Thirteen sheets of exaggerated maps have been finished chiefly by Messrs. Hamer and Wainright; one sheet was done by Lieutenant Badgley who also looked after the computations and the completion of charts, &c. The maps and charts completed are, in Rewah—

General maps, scale one inch=one mile.

Sheet Nos. 16, 18, 20, 21, 22, 23, and 24.

And in Bundelcund—

General maps.

Sheet Nos. 27, 28, and 34.

Exaggerated maps in Rewah:—

No. 14, partly done in recess quarters season 1867.

Nos. 16, 17, 18, 20, 21, 22, 23, and 24.

And in Bundelcund—

Nos. 27, 28, 34, and 36.

Charts Nos. IV & VII scale 4 miles=1 inch plan of Nagode and environs.

26. The computations this year were few, only a small portion of the field season having been devoted to triangulation.

First class Secondary Triangles in Bundelcund	...	...	10
Minor Secondary Triangles in Rewah	...	...	14
" " " Bundelcund	...	...	16
2nd class " " Rewah	...	...	30
" " " Bundelcund	...	...	66
Triangles by two sides and included angle	...	...	10

Heights:—

From Trigonometrical observations	...	...	43
" Barometrical	...	...	27
Lats. and Longs. of Secondary stations in Bundelcund...	...	...	10

The average angular error of the Secondary Triangles is 9.35 seconds.

The average linear error of—

1st class Secondary Triangles is 1.368 inches per mile.

Minor Secondary Triangles is 15.368 per mile.

2nd Class 18.0

These last two discrepancies are large, but in explanation I must place on record, that these are due to a hurried triangulation with small instruments, the object having been to furnish some points in the field to the detail surveyors, the original triangulation having been very deficient of such, in parts under survey. The signals were chiefly trees and peaks, and as the bases were small the large discrepancies between common sides is easily accounted for.

27. The alphabetical lists of poles, villages, &c., for the general report of the Rewah survey have been brought up to date. During next year, I hope that the survey of the Rewah territory will be completed, and the report submitted.

A general report of the operations in Bundelcund has been prepared, embracing the whole of the principal 1st class secondary, and minor triangulation, but only so much of the second class secondary triangulation in sheet IX as has been tested by detail survey, of which fair maps have been submitted previously, or are now ready for submission, which latter are only sheets Nos. 27 and 28. The remaining detail necessary to fill up a complete report of half degree sheets Nos. IX, X, and XI, will be forwarded with the fair maps as soon as each half degree sheet shall have been completed.

28. A large amount of arrears of mapping has been worked off; all that now remains to be mapped, of unfinished detail survey, are sheets No. 28 of Bundelcund and No. 25 of Rewah, both very small portions of a full sheet. This is in a great measure due to the employment of extra draftsmen supplied by the Calcutta Office, who, together with the Native Surveyors, have been continually employed in printing and outlining.

Nobbi Buksh, Native Surveyor, has been employed during the whole recess season in the shading of maps, he is, I think, improving in the style suited to Photozincography, he has done good work during this recess. Native Surveyor Prem Raj promises to become a good draftsman, and both Abdur Rahim and Abdul Rahman have worked very fairly. Messrs. Hamer and Wainright have done the exaggerated maps, with the exception of one sheet, and both have shown an improvement in their drawing since the beginning of the recess season.

29. The health of the party was as good as I expected: we only lost one kalassy. The Health of the party, efficiency, &c. sickness was in nearly every case fever, and excepting in the case of Mr. Kirk, whose services were lost for nearly two months, and of Mr. Chamarett who was ill for a fortnight, both at the beginning and end of the season, the efficiency of the party was not interfered with.

Area triangulated and cost. 30. The area triangulated was about 400 square miles at a cost of Rs. 4-13 per mile.

Area plane tabled and cost. 31. The area plane tabled was 2,272 square miles, at a cost of Rs. 23-14-2½ per square mile.

32. I have concluded my report for last year's work, with the exception of that on Bandogurh, for which a separate memorandum is attached, with a plan enlarged from my original plane table section.

33. I propose to finish the survey of Rewah by completing general maps Nos. 25, 38, 40, and 41 working in Bundelcund during the unhealthy parts of the season on general maps Nos. 29 and 30, and to extend the principal triangulation westwards from the Amua meridional series north of Latitude 24°30' in a series of polygons as far as the Rangir meridional series, also to complete the triangulation of sheets X and XI.

Field work will begin I hope on the 1st November.

The Fort called Bándogurh is situated in N. Latitude 23° 41', East Longitude 81° 5' in the south portion of Rewah and is very nearly in the centre of a pergunnah named after itself.

2. The Fort may be roughly described as an immense rock, nearly rectangular in shape, measuring at the top about 2,000 yards from east to west, by 1,300 yards from north to south, and rising to a height of about 1,000 feet above the valleys, at its base inaccessible from the south side, and very nearly so from the three others.

At the few places where the sides of the rock do not form a natural wall, walls have been built and there guns are in position and guards always stationed.

3. The ascent to the Fort lies in a gorge from the village of Gopálpore situated at the foot of the rock, on the east end of the north face. At about $\frac{2}{3}$ th of the height from the foot of the hill, a curtain wall or parapet of masonry stretches right across this gorge, and on this guns are mounted. I noticed three or four at one part and several piles of shot glistening in the sun; the commandant of the Fort informed me that 10 guns were mounted on this wall and there certainly is room for any number.

Farther up the gully I noticed a masonry edifice which looked like a large gateway forming another obstacle to the ascent on the western slope of the gully.

4. There used to be an entrance to the Fort on the east side, but it has been closed and not been in use for many years. In the wall at the top of the slope there are from 11 to 13 embrasures; these are at different elevations, extending along the side of the hill which led me to suppose that the ground behind the wall has not been reduced to a uniform level.

5. The road (a mere bridle path) chiefly used by the Rewah officials, and the inhabitants of the neighbouring villages on the north side for communication with the Fort is that from "Tála" (a village of about 500 inhabitants, at which there is a thannah) on the left bank of the Cherrangunga, distant about 4 miles from the Fort.

From Tála the road lies through about half a mile of open country, and then enters a gorge between the hills "Durwar" and "Chittarhai" through which the Cherrangunga, a beautifully clear mountain stream finds its exit. The next half mile of this gorge possesses every means of being made impassable, as the sides of the hills on both sides rise precipitously and the narrow level space between them is covered with a mass of very large trees. About a quarter of a mile beyond this gorge, the road from Tála is joined by another from a small village called "Bijeria," which crosses a neck of the Chittarhai hill, passable for cattle, mules or elephants.

At the junction of these two roads a guard was stationed to oppose my progress, and I was obliged to forego the pleasure of obtaining by minute personal inspection, information concerning the near approach to this place so mysteriously kept, but from more distant observation I did not think that this road presented any obstacles between this point and Gopálpore, which is used more as an out-post to the Fort than for any other purpose.

6. Another entrance through the outer belt of hills is from the village of Maháwan on the west side of the Fort, this path passes between the hills "Bandani" and "Durwar" and is, I should think, the easiest entrance to Gopálpore; guns bear on this entrance from the north-west corner of the rock. I did not notice any such precaution observed with regard to the other entrances, though guns could easily be brought to bear on any of them from more than one part of the Fort.

7. From the east there are two roads from the villages of "Gagour" and "Lakumar" respectively, the former follows for a time the left bank of the "Behi" Nuddy, at the foot

of the south side of the hills called "Boggara" and "Maibiarhouk", and then winds round the north side of a hill south-west of "Maibiarhouk" into Gopalpore. That from Lakumar passes north of the Boggara hill, and crosses the "Baruha" Nuddy below the east end of the Chittarhai hill, and thence winds into Gopalpore; both roads are easy bridle paths.

8. From the south there is a road from the village of Gohari, which after crossing some swampy ground, partly cultivated with rice, within a mile of the Fort or rock, passes between the Fort and the hill called Bandeni; this road seems considerably used. That from Mahavan is very little used, and lies through dense forest on ground so slightly undulating as to be nearly level, until it reaches the gorge north of Bandeni. There is another road from the villages of "Ghata" and "Marhoun" which passes over the ridge joining the Bando rock with the trigonometrical station of Rampore, but this is not passable for cattle, and is very little used.

9. A farther examination was impossible as I could not pass the guards which were stationed at every entrance to the valley on the north side of the Fort, but as I visited all the hills having any view, in the neighbourhood, except Bandeni which was not only prohibited to me by an arrangement between the Political authorities and the Rewah Chief, but was as far as I could see, not attainable except to a monkey or a sailor. I think I accomplished all that was possible.

10. The slopes of all these hills are very steep and in many places perfectly precipitous. The hill called Boggara and the two between it and the Fort are almost bare of forest; on the top of the former a patch of trees grows, but the slopes until near the foot are too precipitous, on all but the eastern spur, up which lies the best ascent. There are trees at the top of Bandeni, but a great deal of bare ground on the southern spur, I failed to discover where an ascent could be made to this hill, some of my guides said that men could ascend, but none would tell me by what route, and most of them declared they had never heard of a man having made the ascent. With the exception of those above specified, all these hills are covered with forest, but the undergrowth is small.

11. The highest point of the whole group of hills is near the south scarp of the Fort, where a dot marks the spot on the plan, the height being 2,662 feet. The surface of the rock slopes down towards the north, which edge is, I should think, from 100 to 150 feet lower than the southern. The top of Bandeni is 2,629 feet above the sea only 33 feet lower than the highest part of Bandogurh, and considerably higher than the greater portion of the surface of the rock.

The "Durwar" hill is 2,115 feet in elevation or about 550 feet lower than the Fort. The shortest distance between the two hills is about 1,500 yards.

The "Chitarhai" hill is about 250 feet lower than Durwar, and is at about the same distance from the Fort as Durwar; "Baggara" is nearly 3,000 yards from the nearest point of the Fort and its height is 2,233 feet; "Maibian Chouk" is about the same height as Durwar but the top is a mere pinnacle about 40 yards in width at the most, with perpendicular sides for about 30 feet from the top.

The hill on which the trigonometrical station of Rampore is built is 2,375 feet in height, and is about 2,400 yards distant from the eastern side of the Fort. The highest parts of the ridge joining this with the Fort are about 500 feet lower than the highest part of the Fort, the ascent to this from the south side is perfectly practicable for mules or elephants lightly laden, but the descent on the north side is much more precipitous.

12. The Cherrangunga springs from the north side of the rock on the west side of Gopalpore and is said to flow at all seasons. The "Baruha" was dry when I was in the neighbourhood in the month of January. The "Behi," rising from the north side of the Rampore hill, is said never to run dry.

The "Damnar" or "Douna" running eastwards along the south foot of the hills also has water in it at all seasons.

The supply of water on the Fort is chiefly procurable from tanks, some said there were as many as 12 of these, but the most straightforward of my informers said that there are only 4 which can always be depended upon, and that a large amount of the water used by the garrison is brought up from the Cherrangunga.

13. Report says that large quantities of grain and provisions are stored in the Fort. The accounts as to the strength of the garrison were the most variable, some said 300 sepoy, some 1,500; the space covered by huts and in the Fort is about equivalent to a village of 1,200 inhabitants, I should think that there might be 500 fighting men in the place.

I heard that for the past three or four years repairs have been in course of execution all round the walls, and also that from about the same date a steady supply of ammunition has been sent into the Fort.

14. So jealous are these people of any information connected with the Fort becoming known to Europeans that they were in the habit of changing my guides daily, and invariably sent me as stupid men as possible, while I was working in the neighbourhood of the Fort.

A year before Lieutenant Badgley failed to obtain mortar to repair the Great Trigonometrical Station of Rampore as they thought he wanted to build a post of observation or something equally absurd.

15. The plan of Bandogurh on the scale of 2 inches=1 mile, has been enlarged from my original plane table section, and though not more accurate or trustworthy than the work from which it was prepared, will, as a mere military sketch, on account of its larger size, and the proportionally smaller space occupied by the printing, be perhaps found more useful.

16. I have just heard from the Political Assistant of Nagode, that the plan of the Fort prepared by the Rewah Chief has been sent to me, but it has not yet arrived. If it should come before this is dispatched, and there should be anything in it worth embodying in my plan, it shall be done.

Extract from the Narrative Report of CAPTAIN H. H. GODWIN AUSTEN, in charge No. 6 Topographical party, Cossyah and Garrow Hills Survey, for Season 1867-68.

Strength of party.

1. The strength of the party on taking the field was as follows:—

Lieutenant M. T. Sale, R. E., Assistant Surveyor, 2nd grade.
 Mr. N. A. Belletty, Civil Assistant, 1st class.
 „ T. W. Babonau, Sub-Assistant, 2nd grade.
 „ A. G. Wyatt, Sub-Assistant, 2nd grade.
 „ M. J. Ogle, Sub-Assistant, 2nd grade.
 „ P. C. Gilhooly, Sub-Assistant, 3rd grade.
 „ W. A. Stratford, Sub-Assistant, 4th grade.
 „ P. J. Doran, Sub-Assistant, 4th grade.
 Nasirudin, Native Surveyor.
 Abdur Rahim, Native Surveyor.
 Daliludin, Native Surveyor.
 Gour Chundra, Native Surveyor.
 Ramloosan, Native Surveyor.

NATIVE ESTABLISHMENT.

1 Tindal,	1 Jemadar,
1 Duffadar,	1 Naik, and
55 Signallers and Khalashies.	15 Chaprassis.

The party was strong and the Assistants well trained and experienced, with the exception of Messrs. Stratford and Doran, new hands, and Gour Chundra and Ramloosan from the Pegu Survey, who were unaccustomed to plane tabling.

2. These were carried out in accordance with the plan sketched out in my narrative report of last year. Great delay was experienced in moving out of Cherra Poonjee, on account of the want of coolies and the apparent inability of the Civil Officers to do anything in the way of forwarding Government operations. No Khasia porters were entertained permanently as in former years; the wages then asked and given being far too high and exorbitant, no men would accept Rs. 10 a month, the demand being for 11 and 12 Rupees. The delay of nearly a month was after all of little consequence in the season's out-turn, and led eventually to some saving. The wages of permanent coolies (natives of the Jawai District) I was enabled afterwards to reduce to Rs. 10 a month, and the number of these were much curtailed; local labor being obtainable on most sides.*

3. The special object to be carried out was the completion of the degree sheet between Lat. 25°-26° and Long. 92°-93° and this was almost accomplished. I decided to sketch about 1,000 square miles between Lat. $\frac{25^{\circ} 46'}{25^{\circ} 15'}$ and Long. $\frac{92^{\circ} 30'}{92^{\circ}}$ on the inch scale. This portion is contiguous to Jawai and Shillong, and being by far the most populous and best cultivated, was better adapted for the instruction and capabilities of my young Sub-Assistants and the Native Surveyors. It was high and healthy, and gave employment at the end of the season, when the lower parts were no longer safe to remain in. As regards triangulation, it consisted of extension eastward and the giving of some extra points that were wanted within the above area.

4. Members of the party left Cherra Poonjee on the 20th October, and by the 4th November, all assembled at Jawai and started thence to the several sections assigned them. Mr. Wyatt was the only Assistant left at Cherra sick, recovering from a very dangerous attack of fever.

Date of taking the field.

The season extended over seven months.

* The cost of the operations, it is satisfactory to find, has been much reduced since 1866-67 and previous years, viz., from some 69,000 to 63,000 Rupees, or a reduction of Rs. 6,000, while the strength of the party was at the same time increased.

5. The principal triangulation of the Jaintia Series was taken up by Mr. Belletty at the stations of Sunrum, Saranthu, Tiniang, and Sonoriang with the 14-inch Theodolite, and the extension carried eastward to $93^{\circ} 30'$ beyond Asalu, many points being fixed near 94° and in Manipur. Mr. Belletty's work consisted of a polygon of seven sides with one triangle of the next polygon of six sides, the completion of which will entail entry into the Manipur State. It is exceedingly well selected for extension there along the line of the Borail range.

I took up in December a Secondary series of extension from Nongjinghi H. S. and Sunrum H. S., running north towards Lat. 26° to give points to the plane tablers there; this I afterwards deputed Mr. Ogle to extend further.

In January, having selected and cleared Marangksi H. S., to form one of the stations of Mr. Belletty's principal work, I connected this (using a 12-inch Theodolite) with the G. T. Stations of Sonaraja and Tharaoyang, secondary stations, and Kalangtam by a quadrilateral figure; these were again connected with the principal G. T. S. Stations of Merpa Tila and Dupi Tila. Secondary and tertiary stations were afterwards observed from Hajuma and Nemotha, G. T. S. principal stations, in order to sketch up the south ridges of the North Cachar Hills.

Lieutenant Sale's triangulation consisted of Secondary extension from Tiniang H. S. and Sunrum H. S. to cover with points the area near Long. 93° .

6. During the month of November and part of December, I was employed at Jawai, starting the Assistants into the field and in the instruction of Messrs. Stratford and Doran and the Native Surveyors who were to be employed independently on the ground in the immediate vicinity. I marched then to the north to instruct Messrs. Ogle and Gilhooly in the $\frac{1}{2}$ -inch work they were about to take up; at the same time observed at Nongtung, Nongjinghi and Sunrum to give more points and extend the triangulation north towards 26° ; supervised the work of Mr. Gilhooly on the 1-inch scale and a portion of Mr. Ogle's, and after seeing these two Assistants fairly at work and understanding the $\frac{1}{2}$ -inch sketching, I returned to Jawai, leaving again, on the 3rd January, with Mr. Stratford and Native Surveyor Gour Chundra for Nongba, where, after giving them some further instruction with the plane table, I left them to work independently and marched on for Sunrum, returning *via* Barato, Tiniang, and Raliang to Jawai, in order to judge of the ground in general and the triangulation of previous year by Mr. Belletty: current duties at Jawai occupied nine days. On the 25th January I marched for the south-east, and on the 29th selected, ascended, and cleared Marangksi Peak, a culminating point of the North Cachar range of hills, to form a principal station of the Jaintia Series in lieu of one selected by Mr. Belletty; connected this with the G. T. Series at Merpa and Dupi Tila Stations, and commenced sketching the country west of Long. $92^{\circ} 30'$ and south of Lat. 25° down to the plains of Sylhet and Cachar; visited the G. T. S. principal stations of Hajuma and Nemotha and extended Secondary triangulation from them to give points for detail work; inspected the work of Mr. Babonau near Sonaraja in February; occupied in triangulating and sketching the North Cachar Hills up to the 15th of April, visiting lastly the principal station of Sherfaisip and observing the angles of the principal triangulation. After this I returned to Jawai to superintend the return of the party to recess quarters.

Completed—

Of Topography on $\frac{1}{2}$ -inch scale	...	...	412 square miles.
Of Triangulation	...	...	about 600 " "

Nearly the whole of the above area was covered with dense forest, and *machans* had constantly to be erected on trees.

7 Left for his ground on the 20th November. This included the country east of Long. $92^{\circ} 30'$, and between the parallels of $25^{\circ} 15'$ and $25^{\circ} 45'$. Lieutenant M. T. Sale, R. E., Assistant Surveyor, 2nd grade. He carried on triangulation and plane tabling simultaneously within this area, the former a secondary series from Base, Tiniang H. S. and Saranthu H. S., east towards 93° , which at the same time gave him extra points for his

topography. This triangulation is fair, but wanting somewhat in carefulness of observation and record. His topographical work is very good, as well as the delineation of ground by pen work. The country near the Kopili River was densely overgrown with forest, and what is a still greater impediment to a Surveyor on foot, *viz.*, towering grass, ground only fit for an elephant. This portion is low, and its flat monotonous aspect does not permit of the selection of many natural objects for intersection. Lieutenant Sale completed 700 square miles by the end of March; he then took up the examination of the work of Messrs. Stratford and Doran, and Native Surveyors Daliludin and Gour Chundra, and the topography of a piece of ground that had been deserted by Mr. Babonau near Tharaoyang, Great Trigonometrical Station, and which it was important should be done for many reasons affecting both the progress and credit of the party. Lieutenant Sale's work during the season was very satisfactory. His talent as a draftsman is considerable, and will be of great value to whatever topographical party he may be in. He has since been transferred to No. 3 Topographical party, Central Provinces and Vizagapatam Survey.

8. Mr. Belletty carried on the extension of the principal triangulation from the stations of Sonoriang, Tiniang, and Saranthu. He selected stations in advance to form a polygon of seven sides, taking the triangulation up to Asalu; thence by another figure of six sides, extending it up to $93^{\circ} 50'$; the last station (Angaoluo) observed as lying in Long. $93^{\circ} 40'$. The two south-east stations of the last figure will fall in the Manipur territory. The topography of sheets Nos. 32, 33, 37, with parts of 36-38, are ready to be taken up next field season. The last stations form excellent points for a further advance into Manipur and along the Borail range. Altogether Mr. Belletty's work of the past season is very good, and much credit is due to him for the same, considering the nature of the ground which is so densely covered with forest and high elephant grass. During the recess Mr. Belletty has taken the leading part in all the computation work. I am glad to be able this year to report favorably of this Officer's work, both in the improved arrangement and in the reduction of the cost of his field work.

9. Mr. T. W. Babonau joined the party a few days before taking the field, and from previous reports I expected a valuable addition to our strength. The work assigned to him lay on the boundary of the Sylhet District, and the southern slopes of the Jaintia Hills. That portion of his work examined was correct, but the amount altogether completed was very small. The last portion on the south-east was very carelessly done. The ground was not by any means traversed to the extent it should have been, as shown by his plane table stations, and no excuse existed for this imperfect mode of getting over the not insurmountable difficulties of high grass, &c., that it presented. A portion near Tharaoyang in Native Surveyor Daliludin's board was given him to superintend and see finished up. Shortly after commencing this, a Khalashie was killed by a tiger, when Mr. Babonau deserted his ground and retired to Jawai, where nothing could induce him to return to his post again. This would have caused a gap and delayed the publication of a whole fair sheet of topographical detail for another year. Eventually Lieutenant Sale was able to march to the ground and finished it. Considering the very short time Mr. Babonau was with this party, and the numerous instances that his conduct met with my disapproval and censure, I cannot, I am sorry to say, mention him favorably. He has since been transferred to No. 5 Topographical party, Rewah and Bundelcund Survey.

10. This Sub-Assistant, at the end of the recess, was quite prostrated by a bad attack of fever, and for some days was in a dangerous state. As the weather became more bracing he quickly recovered, and joined the headquarters at Jawai early in December, but not being sufficiently strong for field work, he remained there employed at various Office duties until the 29th December, when he left for the south-west portion of the Jaintia District, working up to Long. 92° ; later on he completed the unfinished portions of the work originally given to Mr. Doran and Native Surveyor Daliludin. His plane table section is neatly done, and shows a decided improvement as regards the care bestowed on it. He has taken a share in

Mr. N. A. Belletty, Civil Assistant, 1st grade.

Mr. T. W. Babonau, Sub-Assistant, 2nd grade.

Mr. A. G. Wyatt, Sub-Assistant, 2nd grade.

the computations, but considering his standing, does not show that amount of knowledge, accuracy and care he should now have attained. He has good abilities as a draftsman.

10a. Mr. M. T. Ogle left Jawai for his ground on the 13th November, taking up the slopes north and west of Nartiang on the inch scale up to Lat. $25^{\circ} 45'$. On the 16th December I joined him at Umwang, meeting at the same time Mr. Gilhooly. The $\frac{1}{2}$ -inch scale being quite new to them, they accompanied me for a few days sketching the hills in the vicinity, and soon picked up the more general style of sketching. At the same time extension of the triangulation commenced at Laru or Nongtung; this I afterwards handed over to Mr. Ogle to carry down to the plains of Assam. This was done very well, and the results show good observations. He completed very faithfully and rapidly a large area on the $\frac{1}{2}$ -inch scale in very difficult ground. During the recess Mr. Ogle has been engaged principally in the preparation of maps, and is a useful Assistant to me in this way, being accurate and reliable in the compilation, details, &c. I have every reason to be satisfied with and to report favorably of this Assistant.

10b. This Sub-Assistant marched with Mr. Ogle to commence on the 1-inch work of the Jaintia District, north-west of Nartiang; thence after instruction at Umwang, &c., he took up the northern slopes, on the reduced scale towards Assam, in a very difficult country; his out-turn was very large and well done in every way, showing great advance in both drawing and accuracy of detail, constituting him an able and practised Surveyor. Before leaving the field Mr. Gilhooly completed some minor triangulation with 6-inch Theodolite at Jawai and fixed the heights of some points in the vicinity. During the recess Mr. Gilhooly has been employed at the computations; at this he is very competent, hard-working, and accurate, and renders most efficient assistance. These last two Assistants will be employed on Secondary extension of the triangulation during the approaching cold weather, besides other topographical work.

10c. The work given to this Sub-Assistant was north-east of Jawai along the course of the Mantang; the ground proved rather too intricate for so young a hand, and two-thirds of it on inspection proved to be wanting in the definition and accuracy of its features, and was taken up again by Mr. Gilhooly. This nevertheless cannot fail to bring about with his other practice, experience in hilly ground, and, I trust, early competency in the difficult ground which he must learn to sketch accurately. Mr. Stratford during the recess has been employed at the computations; at this work he is steady and accurate, and is reported on favorably by Mr. Belletty with whom he was working.

10d. The portion of country given to this Sub-Assistant lies north-west of Jawai; it is open and in some parts large featured, and this, no doubt, led to the better and more successful completion of what he took up, as compared with that of his cotemporary Mr. Stratford; though he has also the advantage of more activity and better physique for hilly ground. His work was accurate, but wanting greatly in neatness of finish and legibility; this, it is to be hoped, greater care in future will obviate. During the recess Mr. Doran has taken an active part in the computations, and is becoming familiar with them and useful in the Office, and promises well in the Department.

10e. Nasirudin, Native Surveyor, was deputed to finish the gaps on the western side of the Cossyah Hills. Owing partly to his want of tact, he embroiled himself with some villagers near Nongstein, and marched back to Jawai; after wasting much time unnecessarily and wantonly at Shillong, he never returned to this ground, and afterwards did some scattered bits of work on the Assam border. Employed there at too great a distance from immediate supervision, he took advantage of it, and by so doing he has forfeited my good opinion. He is a draftsman, and for a native, a clever hill shader, but even in this there is a perceptible falling off, as well as in his printing.

10f. Daliludin combines great neatness and accuracy of detail in his sketching of the country on the 1-inch scale with very decided idleness and want of energy, so that his progress was very slow. On Mr. Babonau deserting his ground, this Native Surveyor did the same, and thus lost much time, so that to

complete the work given to him it was found necessary to send Mr. Wyatt (at the close of the season) to the ground so as to avoid a gap. This Native Surveyor tendered his resignation soon after returning from the field. This I accepted, but I believe it is his intention to rejoin.

10*g*. This Native Surveyor, it has been found necessary to employ on duties connected with the office and in the field, at the superintendence of clearing hill sites, building platforms, &c., from time to time, recording, making duplicate copies of Angle-Books, deduction of means, and the large amount of copying connected with the general report. He is a very useful and willing man, and at the same time could be made useful at plane tabling, in which he has received instruction and promises well.

10*h*. Gour Chundra joined this party from the Pegu Survey and was only acquainted with traverse work; this previous schooling and experience of ground has been of much use to him, and he speedily learnt the use of the plane table; some portions of the work he did near Jawai are for accuracy and the amount of detail really good specimens of such kind of sketching, and I am well satisfied with his endeavours to succeed. During the recess he has been employed at reduction of various plans and traces, and has made himself a fair printer, though with no knowledge whatever of English.

10*i*. Ramloosan was also from the Pegu Survey, but much too old for any service in so hilly a country; he could not take the field, and has retired from service with a gratuity.

10*k*. Ismail, draftsman, joined during the recess from the Surveyor General's Office, Calcutta; he has done a large amount of printing, and has much improved in neatness.

11. The total area completed by each individual of the party and grand total of the Success of Detail Parties. season's operations is given in the following table:—

Out-turn of Topographical Work.

NAMES.	1-INCH SCALE.			½-INCH SCALE.			GRAND TOTAL.	AVERAGE PLANE TABLE STATIONS PER SQUARE MILE.	
	Internal Area.	Marginal Area.	TOTAL.	Internal Area.	Marginal Area.	TOTAL.		1 Inch.	½ Inch.
Captain Godwin Austen ...	...	...	...	411·6	...	411·6	411·6	...	0·69
Lieutenant M. T. Sale, B. E.	...	...	...	669·5	30·0	699·5	699·5	...	0·41
Mr. T. W. Babonau ...	...	...	...	346·0	30·0	376·0	376·0	...	0·53
„ A. G. Wyatt ...	227·5	50·3	277·8	...	...	...	277·8	2·7	...
„ M. T. Ogle ...	178·2	34·7	212·9	402·0	80·0	572·0	784·9	2·7	0·49
„ P. C. Gilhooly ...	237·6	31·7	269·3	453·1	85·0	538·1	807·4	1·8	0·36
„ W. A. Stratford ...	*104·0	24·0	128·0	...	...	...	128·0	7·7	...
„ P. J. Doran ...	143·3	21·0	164·3	...	...	...	164·3	3·1	...
Nasirudin ...	72·8	9·5	82·3	195·3	4·0	199·3	281·6	2·3	0·79
Daliludin ...	117·8	18·7	136·5	...	...	...	136·5	4·9	...
Gour Chundra ...	89·1	17·0	106·1	...	...	...	106·1	7·8	...
	1170·3	206·9	1377·2	2567·5	229·0	2796·5	4173·7		...
Deduct Mr. Stratford's, rejected on examination ...	*61·4	19·0	83·4	...	...	...	...		...
TOTALS ...	1105·9	187·9	1293·8	2567·5	229·0	2796·5	4090·3		
	General average of plane table stations ...							4·1	0·55

Area, internal, 1-inch	1105·9	square miles.
Ditto $\frac{1}{2}$ "	2567·5	" "
Total area, internal, 1 inch and $\frac{1}{2}$ inch	<u>3673·4</u>	square miles.
General average plane table stations	1 mile = 1 inch	... 4·1.
Ditto ditto	2 miles = 1 inch	... 0·55.

The area completed is large, and when compared with former season's work most satisfactory; the average of stations per square mile on the $\frac{1}{2}$ -inch appears low, but I do not think so when the nature of the country is considered. In a great part of it a greater number of settings could hardly have been effected without entailing loss of time and expense by frequent clearing of heavy jungle; this when carried out only exposes a country so hidden by the jungle that minor features cannot be distinguished or followed out with real accuracy.

12. Attendance has been most regular the whole summer, and all have applied diligently to the different work assigned them, leaving very little now in an unfinished state. My best thanks are due to the Assistants for the manner in which, both in the field and quarters, they have seconded my plans, and thus led to the success of the party's operations.

COMPUTATIONS.

		No.
TRIANGLES	{ Principal	11
	{ Secondary	81
	{ Minor Secondary	207
HEIGHTS	{ Principal, sing. deductions	13
	{ Secondary, " "	72
	{ Minor Secondary, " "	77
LAT. AND LONGS...	{ Principal, sing. deductions	21
	{ Secondary, " "	74
	{ Minor Secondary, " "	34
ANGLE BOOKS	{ Horizontal openings	128
	{ Vertical " "	28
Abstract of observed horizontal angles, pages		55

Alphabetical list of Latitudes, Longitudes, and Heights.

Alphabetical list of villages in Cossyah and Jaintia Hills, season 1865-66, 1866-67, and 1867-68, written out, but partially compared.

General report	1866-67	} Final and complete, ready for submission to Calcutta.
Ditto	1867-68	

Boiling point, computations of No. 51.

Duplicate angle Books, horizontal and vertical, for season 1867-68, copied and compared.

A large portion of the above work, it may be noted, is arrears, many of the heights having been observed in 1863-64.

The share taken by the several members has been noticed in my separate report of each. Mr. Belletty has relieved me of much work in this section of the recess duties, thereby leaving me unfettered to attend to the more particular work of the mapping and hill shading so necessary now that our maps are reproduced in this country from the originals.

MAPPING.

I must allude to fair copy map, sheet No. XXII, the hill shading of which was executed by Lieutenant M. T. Sale, n. e., in a very able way; he has represented that portion of the Jaintia Hills successfully. Mr. Ogle in the detail and compilation is very assiduous and has brought all this work up to date, with the Charts of Triangulation, &c. Mr. Wyatt also turned out a good fair copy map, No. XXIII, of the south of the Jaintia Hills; more practice will render his hill shading freer. Native Surveyor Nasirudin has taken a large share in the mapping; his drawing is superior to that of most Surveyors in the junior grades, but some parts of his work show a want of care.

The list of maps and drawings done will show the work of each individual. All my endeavours have been directed to ensure accuracy and a faithful delineation of the physical features:—

	No.	No. of sheet.	Country between Long. and Lat.	Scale.	Hill shading by	REMARKS.
FAIR COPY MAPS.	1	XX	$\frac{92^{\circ} 0' 92^{\circ} 30'}{25^{\circ} 45' 26^{\circ} 0'}$	$\frac{1}{2}$ Inch.	N. Surveyor Nasirudin ...	Completed.
	2	XXI	$\frac{92^{\circ} 0' 92^{\circ} 30'}{25^{\circ} 30' 25^{\circ} 45'}$	1 "	Captain Godwin Austen ...	
	3	XXII	$\frac{92^{\circ} 0' 92^{\circ} 30'}{25^{\circ} 15' 25^{\circ} 30'}$	1 "	Lieutenant Sale ...	
	4	XXIII	$\frac{92^{\circ} 0' 92^{\circ} 30'}{25^{\circ} 0' 25^{\circ} 15'}$	$\frac{1}{2}$ "	Mr. Wyatt ...	
	5	XIII	$\frac{91^{\circ} 0' 91^{\circ} 30'}{25^{\circ} 0' 25^{\circ} 15'}$	$\frac{1}{2}$ "	Nasirudin ...	
EXAGGERATED MAPS.	1	XII	$\frac{91^{\circ} 0' 91^{\circ} 30'}{25^{\circ} 15' 25^{\circ} 30'}$	$\frac{1}{2}$ "	Nasirudin ...	Wanting further detail—unsurveyed.
	2	XI	$\frac{91^{\circ} 0' 91^{\circ} 30'}{25^{\circ} 30' 25^{\circ} 45'}$	1 "	Nasirudin ...	
		XXVII	$\frac{92^{\circ} 30' 93^{\circ} 0'}{25^{\circ} 0' 25^{\circ} 15'}$	$\frac{1}{2}$ "	Not commenced ...	Compilation and printing finished.
		XX		$\frac{1}{2}$ "	Captain Godwin Austen.	
		XXI		1 "	Nasirudin.	
	XXIII		$\frac{1}{2}$ "	Nasirudin.		

CHERRA.	Trace of all the country N. of Shillong, surveyed up to date, for Supdg. Engineer, Assam, by Gour Chundra.
	Trace of Pemberton's Map of N. E. Frontier and Upper Irrawady, by Gour Chundra.
	△ On 8 Miles=1 Inch, of season 1866-67, for General Report, Lieutenant Beavan.
	" On 8 " =1 " " " 1867-68, ditto ditto.
	" On 4 " =1 " " " 1866-67, for Surveyor General, Mr. Belletty.
" On 4 " =1 " " " 1867-68, for Office use, Mr. Ogle.	
" On 4 " =1 " " " 1867-68, for Surveyor General, Lieutenant Beavan.	

Sheet No. XI still remains unfinished, wanting only 80 square miles of topography, a gap due to the conduct of Nasirudin, Native Surveyor, last field season already referred to.

Every advantage was taken of fair weather at close of recess to give instruction and practice in the use of the Theodolite and plane table.

13. This may be pronounced really good, and it is surprizing, considering the unhealthy nature of some portions, that our losses have not been severe. With Health of the Party. the first heavy showers in the spring (April) fever attacks all parties working in the jungle clad tracts, yet the climate of Cherra Poonjee appears to be exceedingly good, for all who are attacked soon shake it off, and regain their health and strength during the recess. The amount of sickness among the men of the Establishment is very small, a single death only having occurred during the year under report. Two Kbalashies were killed by tigers; the first was sleeping with four other men in a hut, when the brute broke in the side and carried him off. The second was taken off during the day when on the march. Removing the detail parties out of the low ground early in the season has tended no doubt to preserve the health of the party.

14. Our Native Establishment is still mainly composed of Hindustanis, and I find good recruits come with the men who return from leave. A large proportion of Goorkhas and a few Kukis have been brought on the Establishment and efficiency. strength of the Establishment, and as we work eastward and these last named people get to know us better, I trust to be able to get more of them; they are excellent men for our particular work.

15. The survey of the Garrow Hills is necessarily postponed until the greater part of that very small area can be traversed by an organized topographical party in safety. To attempt the survey of a ribbon-like line skirting the dependent tribes is only running into great expense and wasting energy, with little to show, and that little of a very unsatisfactory nature.

The triangulation during 1868-69 will be pushed along the Borail into Manipur on the south-east and the Naga Hills on the north-east, while a secondary line will be carried down into Nowgong.

In topography the portion near Gowhatty will be finished, and the Khasia Hills proper may then be said to be completed. I hope to get all sketched up to the Kopili, which will also complete Jaintia. The rest of the detail parties will be in the North Cachar Hills in the neighbourhood of Asalu. I shall myself visit Manipur and select stations for the principal extension there, and if all work with the same zeal and health and strength, the results should again be large.

Memorandum as to Geology of Jaintia Hills and as to the distribution of Tribes.

16. The western boundary of the district of the Jaintia Hills is the River Mangat, crossed on the direct road from Lailangkote to Jawai; the valley is deep and extremely picturesque, the hills rising from the narrow strip of rice land at the bottom, in steep slopes of grass and wooded ravines, close under the crest, into precipitous cliffs. Nongjirong Hill is very conspicuous. The formation here is metamorphic, a well stratified gneiss, and in the bed of the river the boulders are almost entirely of that rock with quartzitic sandstone, and a few of dark green trap. Ascending from the river to the top of the slopes of the left bank and passing the village of Simanting, on the right, a short distance, the first patches of a stratified rock are seen; this is a coarse gritty sandstone of light color, forming the tops of the little eminences, and never exceeding here perhaps 20 feet in thickness. They are lost sight of as soon as the descent into the Mantadu commences, where the metamorphic rocks at a high angle are seen again; the sandstone series reappearing when the opposite ascent is crowned. A strong interbedded conglomerate is very noticeable here, and always lying at the base of this formation. Its chief peculiarity now consists in the beds of dark purple hue, in others of so fine a white that they might almost be mistaken for chalk,—broken up and mixed with water, it is used largely as a whitewash for the sides of the native huts in the place. These sandstones (of considerable thickness) now form the mass of all the elevated points in Jawai, and are conspicuous near the Dák Bungalow, resting horizontally on the highly tilted older rocks. On the hill mass of Chermang south of Jawai and the Mantadu, its thickness has greatly increased, bringing in above the conglomerates, thinner and finer beds less sandy in composition, and here we find traces of the carboniferous shales, and in places a dark, hard earthy coal, often wanting, invariably thin bedded and altogether very local in its distribution. To the east of Latuber, the same features may be seen all the way to Satunga, the metamorphics appearing on the higher parts of the plateaus, where the sandstone occurs in isolated thin patches. But at Satunga with a fall in the hills, we are introduced to a new series altogether, viz., the limestone (nummulitic), of which an outlier forms a mass with low perpendicular and jagged sides to the right of road, and on the very edge of the southern depression of the level of the country. To the south-west one or two wooded isolated knolls show the limits of the northern extension. It rests on the sandstones in this locality (also with their associated coal beds), and there is no doubt that these last are of secondary age, prototypes of rocks better developed under Cherra Poonjee, fining out at Maobelarkar, on the road to Shillong. There is also an appearance of unconformability of succession between these secondary strata and the nummulitic pointing to a long lapse of time and very different conditions of surface before the deposition of the limestone began. Here we are also near the confines of the tertiary sea, in which they were formed as shown by the thinning out of the limestone beds. Proceeding south to the low range of hills of which War H. S. forms the highest point, the limestone has greatly increased in thickness,

and is superimposed at the same time by beds of quite a different mineralogical character, being nodular, ferruginous, and highly fossiliferous; above this well marked horizon no limestone with nummulites were seen, local unconformability of these last is noticeable, due either to a falling in of the limestone, but what I am more inclined to think a prior denudation of surface; the fossils are minute with an occasional gastropod of larger size. This ridge, on the north of which lies Nongkhli, well known as one of the last strongholds of the Jaintias during the rebellion of 1861-62, is succeeded on the south by the main ridge and watershed of the hills, the stream at Nongkhli being a feeder of the Kopili. Crossing a low pass at the head of the last mentioned stream, the view that suddenly opens out is almost Himalayan: below lies the deep valley of the Umsnat, backed on the east by the high mass of Marangksi; its precipitous cliffs showing out grandly against the noble forest that covers all else. In this great section, everything above the nummulitic is exposed, this last forming the bottom beds in the valley, succeeded by the fossiliferous, ferruginous strata, and again above by an enormous thickness of soft, thick-bedded sandstones of light ochre-tint, and this higher mass is the universal rock of all the higher forest-clad hills running thence due east to Asalu. In the bed of the Umsnat the limestone is almost horizontal, but lower down has a very slight dip southward. It also thickens in this direction very rapidly with interstratified beds of sandstone. The whole mass preserves its horizontality, and there is nothing very noticeable over a large and broad band, save that with the deepening valley, lower beds of the limestone are exposed; but in no spot did I see sandstone of cretaceous age, or that which could be mistaken for it. The Umsnat joins the Simleng, and the united streams form the Lubah, which forms a junction with the Barak near Molagul. The Semling and Lubah form a deep valley with an east and west strike, and the mass of the upper nummulitic or tertiary sandstone rises precipitously on the south, forming a ridge parallel with it: upon this line the first bending over to the south commences; the best section to observe this is near Katom, where the Lubah turns south in a gorge cutting diagonally right across the whole mountain mass; the solid limestone of great thickness and the higher sandstones all dip over together, becoming perpendicular, and are succeeded at this point by a thin bedded series of newer rocks, clays, and sandstones of various colors and hardness; the angles of dip varying slightly north and south of the perpendicular show a great crushing, *perhaps* a folding of the beds. As we leave the higher hills for the low eminences (Tilas), the sandstones are coarser, and have strings of small pebbles scattered through them, also large lumps of lignite. In one place the whole of the roots and part of the trunk of a large tree were seen in the perpendicular strata of the river bank. These last mentioned rocks are evidently of lower Sewalik age, and are capped unconformably further into the plains by masses of irregularly bedded clays and conglomerate which pass under the present alluvial surface.

Before closing my remarks on the geology of the Jaintia Hills, the nummulitic coal should be alluded to. This has long been known to exist at Lakadong, and was there, I believe once worked; the same formation occurs at many points further east, particularly near Narpo, at no great distance from the Lubah River, navigable for small boats: its value has yet to be made known and perhaps established: there is no reason why beds of considerable extent should not with proper search be discovered. Its position high in the nummulitic limestone is precisely the same as that at Cherra Poonjee. This coal is nowhere met with east of the Lubah and Umsnat Rivers.

17. The most striking feature of part of the Khasia range of hills is the extremely even height of the central mass; nowhere is this so well seen as from the peaks of the north Cachar range. Marangksi, &c., the dead level line of the whole mass as far east as Tiniang H. S., is from here most noticeable, even the distant Shillong peaks make hardly any show in the distance. This central mass or high table-land is all of gneiss, generally at a high angle, and the denudation it has been subjected to must have been enormous prior to the secondary epoch. It falls very gradually to the south for a long distance, with a last sudden dip over Jaintiapur. On the north the lower levels are successively reached by a series of steps that can be followed for many miles. The last descent being the greatest, corresponding to the like sudden depression at Nunklow, &c.

Physical configuration of Jaintia Hills in connection with geology.

Tiniang and Saranthu mark the limits of this table-land on the east, and overlook the much lower country of the valley of the Kopili. In the Jaintia District the trap rock comes in with the northern fall in the country, and the high isolated peaks to the south of the Mangkhen are found to be a continuation of the quartzitic sandstones of the Shillong peak, &c., almost perpendicular, but lying up against an amygdaloid trap associated with a true granite, which comes in with an east and west run on the north, and forms the remarkable rounded bosses, such as Billu, Kongor, &c. Granite also occurs contiguous to the gneiss north of Nartiang and thence in an easterly direction immediately north of Nongjinghi, which is almost the highest point of the Jaintia Hills, 4,563 feet above sea level. The Nongjinghi ridge is gneiss resting against the granite. As at Lailangkote in the Khasia Hills, the trap is closely associated with the granite, and in such situations, the titaniferous iron sand is found in great quantity, and smelting furnaces are seen in all the adjacent villages. This dark green dyallagic trap appears to have been injected between the granite and gneiss, or quartzitic sandstones, at or about the period of the great disturbance and change in the metamorphic series. The parallelism of the drainage lines south-east of Jawai is very remarkable, and with the cross drainage at right angles, breaks the country up into irregular parallelograms, which probably display a monster jointing of these metamorphic rocks: the most remarkable lines taken up in succession by different great valleys and ravines are—

Ist, a main line rather irregular, but to which all lines to the south conform; commencing from the west at Carpenter Village on the Mangat, that river carries it to Jarain E.N.E. and up to the junction of the Kawa-Manvi with the Mantadu, north-westerly by the Keremontha ravine past Wapang into the Umpai, and by the Mureen into the Kopili near Khangasi, this last river continuing for many miles with a north-easterly course altogether constituting a great physical feature extending from west to east for fifty-five miles.

The 2nd line at an average distance of six miles to south of the first can be traced from Pomtdong, past Thangbuli to the Mantadu River, at junction of the Raliang on the left bank, following this last-named river over the watershed into the Lonngang River and in succession by the Umkorpong to the north of Satunga, where this river turns sharp at right angles to the south, yet the same direction can be carried on to Umthnong, and is lost in the sudden W.S.W. bend of the Kopili.

The 3rd line can be taken up at the base of the hills near Jaintiapur by the River Rangpani into the Umchaliang S.W.-N.E., crossing the Mantadu again to the Lamu River-past Thampianai G. T. S. into the Pamesken by a succession of ravines to the N. W. of Khleriat, where the last stream, the Shashem, turns to the S.S.E.

The same run, but with a more east and west course, is taken up in succession on the north by the Muntang and Manriang Rivers, tributaries of the Kopili, and lastly by the Mangkhen.

These great lines of continuous depression are again displayed on the south and east, and show there a decided curvature. I may note the Lubah, Simleng, and Arten into the head waters of the Kopili north of Sherfaisip, and again further south the deep depression marked by the valleys of the Koomra, Jarangkayeng into the Jatinga, and taken up on the north of the main watershed at Asalu by the valley of the Dhansiri. To the southward of this trough, the strata are found tilted high in that direction, giving the more pointed shape to the peaks of the south-west Borail range. The line is intimately connected with the original elevation of the whole mountain mass, and the ³/₄ parallel continuous lines already noticed are doubtless due to the same parallel forces of elevation. As might be expected the geological formations all coincide with these great natural flexures, carrying the nummulitic series with its limestone and cretaceous rocks far north on the Kopili and thus into the valley of Assam.

18. On the east of the Jaintia Hills, the Sintengs are succeeded by races differing from them much in language and customs. The principal of these are the Mikirs, Kùkies, and Cacharies. On the north some petty sub-tribes are met with, differing, more or less, from the Sintengs or hill people of the table-land; these are known as Lalùs and Bhois; the former are a small

Distribution of different races and tribes.

community inhabiting the area of the last slopes between the Rivers Mantriang and Umiam. Their burial rites appear peculiar, and differ from any people I have met with. They do not intermarry with either of their neighbours, the Bhois and Mikirs.

The Bhois are the people of the jungles in contradistinction to those of the high open lands, yet even when they move up into this latter portion of the country, they still retain their individuality and name of Bhoi.

Colonies of Mikirs are found in Kharwang, Jingthong, and on the Umiam, in Nongflüt, on the north-east, and down again in the south-east corner of the Jaintia District on the Simling; some of these last have even crossed the Kalangtam ridge into the Koomrah valley; they are a good looking, fair race, quiet, civil, and industrious; the women are excellent weavers, and a large proportion of the strong, close woven, red and white striped "chudders" are made by these people and fetch high prices.

On the south-east, and extending along the high line of hills, Kùki tribes replace the Mikir; there are many sub-divisions of these, but the Purana (Rangkhör and Kùchùng) appear the most numerous. The Beteh, a sub-division of the Purana Kùkies, are few in number, only two or three villages. These last bury their dead in a spot adjacent to the village, setting up boughs, with inverted gourds, skulls of animals, &c., stuck on them. The head-dress of the women is also peculiar. The Changsels are another Kùki tribe, emigrants from the south-eastern hills bounding Tipperah; they are found in the hills east of the Jatinga. The Purana Kùkies have apparently adopted Hindoo notions and customs, and burn their dead, make offerings to Hindoo deities, &c. With all these last mentioned tribes, the love of song and the dance is universal, and establishes an individuality and a marked difference between them and the Khasia and Sinteng.

The Cachari is only found in the low lands close to and along the very base of the hills; they are divided into (1), Birmons, (2), Dhaos. Some of them have again emigrated, following the Kopili River, and some are, I believe, to be seen near Gowhatty.

Extract from the Narrative Report of LIEUT. A. E. DOWNING, in charge No. 1 Topographical party, Rajpootana Survey, for Season 1867-68.

The party had already started for the field, when the order to take charge of it reached me at Ootacamund, the recess quarters of No. 3 party to which I was then attached. I found the camp at Delhi, where I received charge personally from Lieutenant G. Strahan, and no time was lost in getting to work. Our strength was as follows:—

Lieut. A. E. Downing in charge.	Mr. W. Stotesbury, Sub-Assistant.
Mr. J. F. Baness, Civil Assistant.	„ F. Kitchen ditto.
„ E. Atkinson Sub-Assistant.	„ W. W. McNair ditto.
„ R. Todd ditto.	
„ C. E. Tapsell ditto.	

NATIVE SURVEYORS.

Kalka Pershad	Mr. W. Manly
Hurlall Singh	Mahomed Ali
Mr. J. Noah	Hurbana.

The programme, as arranged by Lieutenant Strahan, and to which I was directed to adhere as closely as possible, was as follows:—“Mr. Baness with six plane tablers will proceed *via* Hissar to survey in detail the ground in the north of Bikaner and Shekawatti, completing all that lies between the meridians of 75° and 76° up to the British frontier on the north, and joining on to last year's work on the south. This being completed, he and his six plane tablers will move down south of Jeypore, where there is more ground ready triangulated. Mr. Baness himself will pass the remainder of the season in triangulating, and the Officer in charge will spend such part of the season as is not taken up in superintending, in triangulating new ground, and in giving new points in and about the city of Tonk for the large scale plan of it.”

This programme was followed as closely as possible. It appeared that the present work of this party was confined to the survey of the country lying between the meridians of 75° and 76°, a large tract was already completed extending from Lat. 26° 45' to Lat. 28° 15' (this is shewn in the accompanying index map in red), and it was desirable that all the ground to the north (colored blue) as far as the British frontier should be finished. Mr. Baness with Messrs. Atkinson, Todd, Tapsell, Stotesbury, and McNair, also Native Surveyor Hurlall Singh, were detached for this purpose. They left Delhi on the 27th October and reached their ground on or about the 15th November.

The triangulation had been completed as far south as Lat. 26° 15' and was to be carried southwards, still keeping between the parallels of 75° and 76°. I started on this duty on the 3rd of November. I estimate the aggregate amount of survey completed during the season as 3,900 square miles of plane tabling, and 3,500 square miles of triangulation, and 244 miles of check traverse. In addition to this, the city of Tonk and cantonment of Deoli were triangulated for the survey of them on the large scale, and the map of the latter has been made.

The triangulation is entirely of a Secondary nature, that part of the country in which it lies is traversed by two meridional series of the Great Trigonometrical Survey, *viz.*, the Gooragurh and Rahoon, whose stations approaching to within sixty miles keep at about the same distance apart, until they join on to the western longitudinal series of the Great Trigonometrical Survey in Lat. 24°25'.

My work consisted of a net work of Secondary triangles extending from one of these principal series to the other, while that executed by Mr. Baness was entirely within the Gooragurh series.

The instrument used throughout was a 12-inch Theodolite; the triangular errors are 4"·6 for my set of triangles, and 3"·6 for Mr. Baness. In the connecting series all three angles were well measured. Such triangles as have only two of the angles measured, and are introduced only to lay down points for the plane tables, are designated minor Secondary. The observations for heights were made at the time of minimum refraction, and the mean difference amounts to 2·7 feet, a large number of heights of natural objects have been fixed, giving an average of 1 in 30 square miles. The order on this subject did not reach me, until a great deal of the triangulation had been completed, and there was not time enough to add to the number, as it was advisable to push on as fast as possible, there being so little triangulation ready in advance of the detail survey.

Had the heights of all the Secondary points of the Great Trigonometrical Survey been available, I should have been able to give a far higher average, as with them the number of plane tables, points, is as much as 1 in every 17 square miles. It is intended this field season to re-observe on several of last year's stations to obtain the heights of all these Secondary points of the Great Trigonometrical Survey, and they will appear in the maps.

The detail work lies almost entirely in the States of Jeypore, Shekawatti, and Bikaner, the average number of plane table fixings is 3·1 per square mile; this appears low, but is quite satisfactory when the nature of the ground is taken into consideration, for, besides the villages and roads, there is little else but sand to be shown.

Checking. The checking was done by myself, Mr. Baness, and Mr. Todd, and in no case shows any thing but very accurate working.

On leaving Delhi, my intention was to march direct *viâ* Jeypore to begin with the triangulation of the city of Tonk, which lies at the base of the hill on which is Rasia G. T. H. S. of the Raboon series. Owing, however, to the political difficulties with the State of Tonk, which resulted in the deposition of the Nawab, I was advised to avoid that part of the country for a while, so turning my attention to the Gooragurh series to the west, I began by observing on Kantola G. T. H. S. on December 10th, I was occupied here till the end of the month, when hearing that Colonel Keatinge, Agent to the Governor General for the Rajpootana States, was proceeding to Tonk with a military force, I took advantage of his presence there to carry out my original plans. Besides triangulating the city, I took a sketch plan of the fort, as being a place of some strength and importance. From this I worked down south as far as Boondi, and then turning westward completed my series by joining on to my former work. All this occupied me till the middle of February, when I heard from Mr. Baness, who was superintending the plane tabling in the north, that the work there had proved to be more and heavier than had been anticipated, and that there was no chance of its being finished before the middle of April. He was on his way to take up triangulation as had been arranged.

Having observed and computed the points for the large survey of Deoli and put the plane tabling in hand, I now turned my attention to the examination and inspection of the work of the several detail surveyors. I was so far from them when I brought my triangulation to a close, that I was quite unable to undertake the whole of this duty myself, so in the absence of any Military Assistant, I deputed one of the senior Sub-Assistants, Mr. Todd, to aid in running check routes through the work. I began by running a purl through Mr. Kitchen's table, the only one south of the old work that had been taken up, and found it very correct. A march of nearly 100 miles brought me to the next nearest Surveyor, Mr. McNair, on the 25th March. As this was his first plane table, I went out with him to personally observe his style of working, and was quite satisfied with what I saw; leaving him to finish his table. I visited Mr. Tapsell in an adjoining board, and also met Mr. At-

kinson and Mr. Todd, and inspected their work. I then returned to Mr. McNair and ran a check traverse through his table, and was well pleased with its accuracy. I also tested Mr. Tapsell's and Mr. Todd's work in the same way, with the same satisfactory result. This occupied me till the 12th April, on which date I joined the rendezvous for all the camps at Soorajghur. We reached Delhi on the 21st, and began office work at Mussoori on the 11th May.

Mr. J. F. Baness began by taking up one of the plane tables in Bikaneer, No. 14, which he completed as well as a portion of table No. 15, altogether about 350 square miles; he also ran a check traverse through Mr. Atkinson's work, and then moved down to his triangulation in the south; this extended over some 800 square miles in a difficult country. He excels as a draftsman, and during the recess has been employed almost entirely on the mapping. Mr. Baness' merits and energy are already known to you; I have only to add that he has always given me most effective assistance, and I am sure he will afford satisfaction in every thing he undertakes.

Mr. E. S. P. Atkinson was employed entirely on plane tabling in the field, and completed 660 square miles in a very satisfactory manner. He came to this party, as you are aware, with loss of grade for misconduct, and a special report was called for of his behaviour during the field season; this was furnished, and Mr. Atkinson was restored to his former position from the 1st April last. He has proved most useful during the recess in the mapping part of the duties, and I have much pleasure in recommending him to your favorable notice.

Mr. R. Todd, besides completing 436 square miles of plane tabling in the field, assisted me in running traverses through the detail survey, and in this way tested the work of Mr. Stotesbury and of Native Surveyor Hurlall Singh; he also undertook the instruction of Mr. McNair in the use of the plane table. I was glad to see his promotion in a late Department Order to take effect from the 1st October, as he is in every way deserving of it.

Mr. C. Tapsell's plane tabling amounts to 540 square miles, and is executed both well and correctly; it was tested by myself.

Mr. F. Kitchen in the field completed one table of 270 square miles, and also the large scale plan of Deoli cantonment. He was on sick leave, and did not rejoin until the middle of December. I examined his work and found it good in every way.

Both these Surveyors are thoroughly efficient in every branch of a topographer's duties; they both sketch well, and are quick and accurate computers.

Mr. W. Stotesbury shows as much as 764 square miles of plane tabling; it is very fairly executed and apparently correct.

Mr. W. W. McNair is a very promising Surveyor; he completed rather more than one table in the field neatly and accurately, in all 277 square miles, and has done good service during the recess in computing, compiling, &c.

All the Native Surveyors, except one Mahomed Ali, who has been dismissed, have given every satisfaction.

The following maps and plans have been prepared and finished during the recess:—
 general maps, Nos. 45, 46, 47, 3, 4, 5, 7, 8, 9, 10, 15, 16, and 2A, exaggerated maps, Nos. 2A, 3, 4, 5, 7, 8, 9, 10, 15, 16, 45, 46, and 47, besides these, six others, Nos. 6, 12, 17, 18, 19, and 23 partly prepared previously, have been completed,—three triangulation charts in degree sheets Nos. 2, 3, and 8; a large scale plan of the cantonment of Deoli, and two sketch plans of the fort of Tonk, one of which has been sent to the Political Agent there.

The detail survey of the past season lies almost entirely in and on the border of the Bikaner desert. Although the country is very easy to delineate, it is a very troublesome and uninteresting one to survey; it may be described as a sea of sand. It is on the border of the desert. The peculiar wave-like form of the sand ridges is most striking; as you journey into the interior, they assume the more rounded form of hillocks, the vegetation becomes more and more scanty, until you find nothing but small stunted shrubs; yet this arid and unpromising tract of country is, as far as I have seen, well inhabited. The season's maps show not only a large number of villages, but many well built and thriving towns, such as Jhoonjhoon, Seekar, Renee, Bissao, Churu, Lachmangurh. Cultivation is carried on to a small extent in their immediate vicinity, for the soil is by no means unproductive. I was informed that after the rains the whole country is green and looks like a vast meadow, but when I visited it in the months of March and April there was very little of this verdure to be seen, and I found my work of check traversing most trying; the nights were still cool, but as the day advanced, and the sun got up, the heat and glare became most unpleasant, the hot winds began to blow too, which added to the general discomfort. The water is by no means good, and is only found at a considerable distance below the surface; one well I measured was 200 feet deep. Generally each village has only its one well, but at the towns they are many and large, and are all carefully built with arrangements for pulleys and with reservoirs all round. There is little doubt but that the sand is gradually but steadily encroaching on the fertile country to the north-east of the desert.

The character of the country to the south, where I was triangulating, is very different. The sand is almost entirely lost sight of, and in its place are ranges of low hills covered with jungle; broad rivers and well cultivated plains. The maps of next year will contrast very favorably in an artistic point of view with those of this, which are little more than a mass of dotting to show the sand hills, interspersed with towns and villages and intersected by roads.

The arrangements for the coming field season are as follows:—Both the triangulation and the detail survey will be continued southwards from the old work, still keeping between the meridians of 75° and 76°. The Programme for coming field season. The plane tabling will begin at Lat. 26° 45' and the triangulation at about Lat. 25° 30'. Both the Officer in charge and the Civil Assistant, Mr. Baness, will proceed at once on this duty, which will be carried out on the same plan as that pursued last field season, that is, the former will run Secondary series from the Rahoon Great Trigonometrical series on the east to the Gooragurh Great Trigonometrical series on the west. Mr. Baness will continue his work within the limits of the latter. About the middle or end of February they will both proceed to the inspection and testing of the plane tables. At this time I propose that one of the Sub-Assistants, after being instructed in the use of the Theodolite, be detached to re-observe on old stations, to lay down the heights of a large number of points, whose altitudes have not yet been determined, and which can be shown in the maps of next year. In all probability the minor triangulation of the cities of Boondi and Kotah will come within the season's work, and should, I think, be done by the Officer in charge himself. The large plan of the city of Tonk will be put in hand this cold weather.

I would here bring to your notice that owing to the scanty fall of rain during the last three months, great scarcity of food is anticipated in Rajpootana, as well as in other parts of India. Captain Bruce, Political Agent, Haraootee, writes:—"We are suffering much for want of rain, and great distress will prevail." This will seriously affect the operations of this party, however by the time the ground is reached, where work will begin, the actual state of affairs will be known, and to what extent it may be necessary to make provision to meet, what really may be great distress. The autumn crops are said to have entirely failed, and unless there are good winter rains, there is every reason to fear a like fate for the spring crops.

Report on the Pegu Survey for 1867-68.

1. In my No. 848, dated 23rd November 1867, I reported as follows on the work then remaining :—

“ This consists in the compilation of 19 Gazetteers of villages, &c., and the publication of the entire series appertaining to the 66 townships of the Pegu Division of the Province of British Burmah. Two township maps yet remain for compilation in the Office, and 33 have yet to be lithographed. Besides this, and the final arrangement of the Office records, and the winding up of the accounts, nothing remains to be done unless a very comprehensive and exhaustive report on the Pegu Survey from its commencement should be required from me.”

2. I have now the satisfaction to report that the 19 Gazetteers above mentioned have been compiled ; that the entire series appertaining to the Bassein District, together with the township maps belonging to them, have been printed and bound up in the form of an Atlas of the Bassein District, as suggested in paragraph 17 of my Narrative Report for 1866-67 forwarded with my No. 828, dated 4th October 1867.

3. The Rangoon District Atlas, too, is almost complete, and the manuscript material for the remaining districts is also ready for publication.

4. All the township maps have been, or are being, lithographed. None remain in this Office.

5. The instruments and stores belonging to the Survey have been disposed of in accordance with the instructions conveyed in Surveyor General's letter No. 527, dated 21st March 1868, and the Office records are now being sorted and labelled in the manner therein suggested.

6. What remains to be done therefore is simply the passing of the township Gazetteers through the Press, and this, I hope, I may be allowed to proceed with leisurely, as it is work that requires the utmost attention.

7. During the year under review, the establishment has been gradually reduced, and at the close of 1867-68 there only remained Sub-Assistant Barnett and myself, and he was transferred to No. III Party on 1st August last under orders conveyed in your No. 141, dated 31st July 1868.

My Assistant, Mr. Montgomerie, was discharged on 30th June 1867 on the completion of his work, and has been granted a pension of Rs. 133-4 per mensem, as conveyed in your No. 1255, dated 21st September 1868.

Surveyors Gour Chunder and Ramloosain were transferred to the Cossyah Hill Topographical party in June 1867, as stated in my last report.

Sub-Assistant Cooper was transferred to No. III Topographical party on 26th December 1867, and Surveyor Moug Hpo Myah and Writer Samuel Peter were discharged on 1st May 1867 and 31st December 1867 respectively, and recommended for a gratuity.

8. The establishment accordingly now consists of myself only, and with my very heavy duties as Principal of the Civil Engineering College, I find it impossible to make great dispatch with the work of the Survey ; and, as I said before, I trust I may not be hurried in the work of revising the Gazetteer proofs of the Prome, Myan-oung, and Toung-ungoo