GENERAL REPORT

ON THE

Topographical Surveys of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT, HEAD QUARTER ESTABLISHMENT

FOR SEASON

1869-70.

BY

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SURVEYOR GENERAL OF INDIA.

SUBMITTED TO THE GOVERNMENT OF INDIA, HOME DEPARTMENT.

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CONTENTS.

No. 87A.

SURVEYOR GENERAL'S OFFICE;
Calcutta, 18th January 1871.

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
HOME DEPARTMENT.

SIR,

I have the honor to submit my Annual General Report* on the operations of the Topographical Surveys of India, for the past season of 1869-70, together with a detailed account of the proceedings in my Head Quarter Offices, for the information of the Government of India.

* No. 87B, dated 18th January 1871.

I have the honor to be,
SIR,
Your most obedient Servant,
H. L. THUILLIER, *Colonel*,
Serveyor General of India.

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No. 87B, dated Calcutta, 18th January 1871.

INTRODUCTORY.—This report contains a general review of the results of the operations of the Topographical Surveys of India, for the season of 1869-70, from the 1st October 1869 to the 30th September 1870, and of the work performed in the several branches of my Head Quarters Office, for the year ending 31st December 1870, and is submitted in continuation of the report No. 62A, dated 15th January 1870, for season 1868-69.

2. NUMBER OF PARTIES EMPLOYED.—The same seven topographical survey parties designated, commanded, and distributed as follows, were at work :—

No. 1 PARTY.—Gwalior and Central India Survey, was employed under Lieutenant Charles Strahan, R. E., Deputy Superintendent, in portions of the Native States of Gwalior, Jeypore, Tonk, Kotah, Boondi and Jhalra-patan.

No. 2 PARTY.—Central Provinces Survey, was employed under F. B. Girdlestone, Esq., Officiating Deputy Superintendent, on portions of the Sathpoora range in the districts of Baitool and Chindwarra, and in triangulating in advance a portion of the Balaghât district.

This party was broken up and absorbed from the 31st October 1870, *vide* paras. 86 and 87.

No. 3 PARTY.—Central Provinces and Vizagapatam Agency Survey, was employed under Colonel Saxton, Deputy Superintendent, in the States of Kalahandy, Kasipur and Bustar of the Central Provinces—Jeypur and Panchpetta of the Vizagapatam Agency, and Peda-Kimidy and Purla-Kimidy of the Ganjam Agency.

No. 4 PARTY.—Chota-Nagpore Division Survey, was employed under Lieutenant M. T. Sale, R. E., in the States of Sirgoojah, Jushpoor and Gangpoor of the Lower Provinces, and the triangulation in advance was extended over portions of the contiguous Native State of Sohagpoor, of Rewah and of Raigur, and the district of Belaspoor in the Central Provinces.

Owing to the extension of the operations of this party into the Central Provinces, to occupy a portion of the ground formerly assigned to No. 2 Party, which has been broken up, it will be necessary to alter its designation during the ensuing season, when the Chota-Nagpore Division will be completed.

No. 5 PARTY.—Bundelcund Survey, was employed under Captain R. V. Riddell, R. E., Deputy Superintendent, in the Bundela States of Punnah, Chutterpoor, Bijawur, Adjigurh, Jusso and Chirkaree.

No. 6 PARTY.—Khasia and Garrow Hills Survey, was employed under Major Godwin-Austen, Deputy Superintendent in North Cachar, and in the Khasia and Garrow Hills, and ordered to be broken up, but subsequently retained on a reduced footing, on the special representations of the Government of Bengal.

No. 7 PARTY.—Rajpootana Survey, was employed under Captain George Strahan, R. E., Deputy Superintendent, in portions of the Native States of Jeypoor, Jodhpoor, Udeypoor, Sirrohi, Tonk, Kotah, Boondi and the British district of Ajmere.

3. All these parties are, without exception, employed in portions of India, of which either very old imperfect and unreliable rough sketch and the smallest scale maps exist, or in ground which is altogether unrepresented on existing maps. In most cases, the country through which the operations of the Topographical Branch of the Survey Department is now extending, is extremely unhealthy, the inhabitants, except in the British districts and some portions of Rajpootana, Bundelcund and Central India Agencies, are uncivilized and scanty, and cannot furnish the Native establishments employed, with the common necessaries of life. Labourers and carriage are procured with the utmost difficulty, and in some cases have to be imported from long distances, and to these difficulties are added the clearing of heavy forest, for points of observation on commanding hill peaks, and the fixing of suitable marks, such as poles with brushes, cairns or piles of stones, &c., at regular intervals throughout the country, to serve as objects for the observer, and land-marks to the plane tablers.

4. Under these circumstances, and variety of arrangements required for such diversified work (as well described in a former report for 1867-68 by Major Montgomerie, who held temporary charge of this branch of the Department), it may well be presumed that the Executive Officers and their subordinates have no easy task to perform, and that the administration and control of the several parties widely scattered over India, and working under conditions which necessitate special arrangements and directions for each, must prove a source of considerable anxiety, and need much watchful care, as well as judgment on the part of the executives, to meet promptly any emergency which may arise.

5. OBJECT AND SYSTEM OF SURVEY.—The objects of the Topographical Survey of India have been described in various preceding reports, and are generally well understood now. Based on secondary triangulation depending on the several principal series of the Great Triangulation of India, it furnishes on a moderate scale (one inch to the mile only), and at a most moderate cost, reliable geographical maps of portions of country in non-regulation British provinces and Native states, for purposes of Civil and Military administration. Its operations are rapidly conducted through unremunerative, unhealthy and hilly or rough ground, very sparsely inhabited, where any more expensive or elaborate detail system of survey would be undesirable, and in fact a waste of money. India, in fact, is far too large a country, and too diversified in its land tenures, to be dealt with by one description and scale of survey only. These imperial topographical operations furnish all details absolutely necessary for good military maps, as well as to assist engineers and local officers in selecting and laying out lines of road, canals, railways, &c. and for other administrative purposes, required in feudatory States.

6. The annually increasing demands for the maps of the topographical (as well as Revenue) surveys, and the projects for State Railways, prove how generally they are now appreciated, and the extent to which they are utilized by all branches of the public service, and for which purpose they are immediately re-produced and published, being now available to the extent shewn on the Index Maps, illustrating the progress of each survey attached to this report.

7. TOTAL AREA OF FINAL TOPOGRAPHY OBTAINED.—During the season under review, the aggregate area of final survey accomplished by the seven topographical parties, is 16,135 square miles, of which 14,996 square miles has been rendered on the scale of 1 mile to the inch, and 1,139 square miles in the Garrow and North Cachar Hills, on half inch to the mile.

8. In addition to this, the skeleton triangulation in advance of topography has been extended during the season over an area of about 13,218 square miles by theodolite observations at 349 stations, from which 1,760 points have been trigonometrically fixed, or about 1 point to every 7½ square miles of area, and 1,773 elevations have been determined, giving about one height to every 7¼ square miles of area.

9. The total area of triangulation now in advance of detail survey executed by the seven parties during this and preceding seasons amounts to about 30,100 square miles, and this for the most part represents ground fully prepared for and awaiting topographical delineation.

10. COST OF THE SEASON'S OPERATIONS.—The entire expenditure of the seven parties, inclusive of every charge for superintendence, establishments, and contingencies, is Rs. 3,54,107, of which Rs. 46,148 is due to contingencies alone, or to the cost of clearing jungle, cooly labor, feed and keep of elephants, carriage of Government property, camp equipment, &c. The average expenditure for each party is therefore Rs. 50,629 working under varied circumstances in

widely different parts of India, and under Executive Officers and Assistants of different grades and Military rank, which entail differences in the relative cost.

11. Statement of General Results and Cost of each Party.—The following tabular statement shows the amount of field-work accomplished by each party, and the actual cost of each during the season, and will be useful in comparing the relative out-turn and labors of each executive:—

Designation of Survey.	Final Topography completed in square miles.	Triangulation completed in square miles.	Stations observed at.	Number of points fixed.	Square miles to each point.	Heights trigonometrically determined.	Square miles to each height.	Amount of fair mapping rendered.	Total cost, Rupees.	Remarks.
No. 1 Party—Gwalior and Central India Survey	2,891	1,300	27	173	7·5	137	9·5	3,166	55,026	
No. 2 Party—Central Provinces Survey	1,188	890	20	139	6·0	68	10·5	5,753	40,850	
No. 3 Party.—Central Provinces and Vizagapatam Agency Survey	2,372	600	80	107	...	140	...	2,175	64,431	
No. 4 Party—Chota Nagpore Division Survey	3,374	3,440	60	266	13·0	72	47·7	2,030	43,703	
No. 5 Party—Bundelcund Survey	2,053	3,052	60	325	9·3	672*	3·5	2,707	55,207	* Of which 220 are minor obligatory heights.
No. 6 Party—Khasia and Garrow Hills Survey	1,291	450	44	120	...	53	...	5,760	45,043	
No. 7 Party—Rajpootana Survey	2,066	3,537	62	571	6·0	431	8·0	1,015	50,021	Rs. 42,563 for the regular 1-inch survey. Rs. 7,458 for the 6-inch survey of Mount Aboo.
Totals ...	16,135	13,218	340	1,760	...	1,773	...	...	3,64,407	Or an average rate for final survey (exclusive of the cost of the 6-inch survey of Mount Aboo) of Rs. 21-8 per square mile, and Rs. 21-15 inclusive of the cost of the Mount Aboo Survey.

12. Average Rate of Final Survey and Remarks thereon.—The general average cost per square mile of the topography delineated, including the cost of the triangulation in advance, is Rs. 21-8-0, or in English money 43 shillings per square mile; this gives the very small average rate of nearly 6¼ pie, or 1 penny per acre for the cost of the final survey, a cost trifling enough even for a first and cursory survey of non-revenue paying portions of India. These general results are highly satisfactory and encouraging.

13. Comparison of Results of 1868-69 with 1869-70.—A comparison of the results of season 1868-69 with those of 1869-70, is given in the margin, showing a small decrease (666 square miles) in the out-turn of area surveyed, which is entirely due to the diversion of the operations of No. 6 Party into new ground, and the sudden emergency which necessitated the stoppage of the operations of No. 2 Party, and the reduction of both establishments as explained in paras. 86 and 148. But for these causes a large additional area of final survey would have been obtained, and the average cost reduced in proportion.

	Area in square miles.	Total cost.	Mileage rate.	
			Rs.	A.
Season, 1868-69 ...	16,801	3,69,608	21	15
„ 1869-70 ...	16,135	3,43,949*	21	8
	—666	—21,659	...	...

* Excluding Rs. 7,458, the cost of the 6-inch survey of Mount Aboo just completed.

14. The decrease of triangulation in advance is due to the same causes, and in the case of No. 6 Party, Khasia and Garrow Hills Survey, must, it is feared, affect the out-turn, both of topography and triangulation for the next two seasons.

	1868-69.	1869-70.	Difference.
Triangulation in advance in square miles	15,592	13,218	—2,374
Points fixed trigonometrically ...	1,476	1,760	+284
Heights trigonometrically determined	1,224	1,773	+549

15. General Remarks, 1869-70.—In the number of points fixed and heights trigonometrically determined, there is an increase, showing that the several Deputy Superintendents of Survey have not relaxed in their efforts to maintain a proper maximum standard in these important elements, one of which, the points

trigonometrically fixed, is the basis of the work, and on which its general accuracy mainly depends, while the other, heights or elevations obtained by trigonometrical leveling at regular intervals, add greatly to the value of their labors, by showing at a glance, on maps, the relative difference in height of accessible obligatory points or objects, in the country brought under survey, as so important for all future researches of the Geologist and Engineer.

16. In 1868-69 the general average was for—

Points fixed by triangulation	...	...	1	to every $10\frac{1}{3}$ square miles
Elevations determined ...	...	...	1	„ $12\frac{3}{4}$ „

The general average for 1869-70 is for—

Points, fixed by triangulation	...	...	1	to every $7\frac{1}{2}$ square miles
Elevations determined ...	...	...	1	„ $7\frac{1}{4}$ „

or an increase of about 33 per cent. in fixed points, and of nearly 60 per cent. in heights from trigonometrical leveling, thus showing that the call so urgently made in para. 14 of my report for season 1866-67, has been well responded to by Executive Officers in charge of Surveys.

17. All the topography rendered is reported by the several Deputy Superintendents of Survey to have been tested in the field, generally with very satisfactory results; the details given are as complete as the scale of survey will admit, and every precaution has been adopted to render the maps faithful representations of the ground surveyed.

18. TRIANGULATION.—The following table exhibits the nature and value of the season's triangulation, and the number of plane table fixings per square mile in each party:—

SURVEY PARTIES.	NUMBER OF TRIANGLES.				TRIANGULAR ERROR IN SECONDS.		MEAN DIFFERENCES IN COMMON SIDES IN INCHES PER MILE.				Average plane table fixings in each square mile of survey.	REMARKS.
	1st Class.	2nd Class.	3rd Class.	4th Class.	1st Class.	2nd Class.	1st Class.	2nd Class.	3rd Class.	4th Class.		
No. 1 Party ...	...	54	14	359	...	3·4	...	1·50	1·32	7·20	8·3	173 points fixed trigonometrically.
„ 2 „ ...	...	...	43	189	...	...	...	...	6·6	16·3	...	139 ditto ditto.
„ 3 „ ...	...	309	...	...	3·6	...	...	2·0	8·0	12·0	5·4	167 ditto ditto.
„ 4 „ ...	13	33	...	150	2·4	13·5	·12	·5 / 7·8	...	20·0	5·8	266 ditto ditto.
„ 5 „ ...	2	137	673	...	·8	17·4	1·5	8·4	14·7	...	6·1	325 ditto ditto.
„ 6 „ ...	...	13	71	145	...	12·7	...	5·2	20·0*	33·5*	2·0†	* Observations to hill peaks without marks. † On ½ inch scale. 120 points fixed trigonometrically.
„ 7 „ ...	8	116	93·7	20	1·4	4·0	0·0	2·0	12·7	...	...	571 points fixed trigonometrically.

19. These results prove that the triangulation is good and can be relied on, and a comparison of the number of triangles with the number of points fixed, shows that care has been taken generally to obtain several intersections to points interpolated from stations, so as to leave no doubts regarding their identity.

20. FAIR MAPPING COMPLETED AND RENDERED.—The aggregate area represented by the standard inch scale and half inch scale maps, actually rendered at Head Quarters in sheets or sections of 15 minutes of Latitude by 30 minutes of Longitude, is about 22,606 square miles.* These uniform sheet maps, 53 in number, including certain arrears of former seasons received at the close of the recess, were, after due examination, treated for reproduction by the photozincographic process, and, with very few exceptions, have already been transferred to zinc, and 300 copies of each printed off, from which a large number have been issued to various Departments of the State, to meet the pressing demands made in very many instances, even prior to the receipt of the originals in this Office. The out-turn of maps published both in the photographic and lithographic presses, are advertized monthly in the Government Gazettes for general information.

* 16,846 square miles on 1 inch scale.
5,760 do. do. ½ do.

21. Remarks on the Season's fair Maps.—The area actually mapped during the season under review will furnish excellent materials in non-regulation British and Native States for portion of sheets of the Indian Atlas as follows:—

	Contained in
No. 1 Party.—Portions of the Native States of Gwalior, Kotah, Boondi and Jeypoor ...	Atlas sheets 51 and 52.
No. 2 Party.—Sathpoora Hills in the northern portion of Districts Chindwarra and Baitool, Central Provinces	Atlas sheets 54 and 71.
No. 3 Party.—Portions of the Native States of Bustar and Jeypoor, &c., in the Central Provinces and Vizagapatam Agency ...	Atlas sheets 93 and 108.
No. 4 Party.—Portions of Korea, Sirgoojah, Odeypoor and Gangpoor in the Chota Nagpore Division, and Raigar in the Central Provinces	Atlas sheets 90 and 105.
No. 5 Party.—Portions of Punnah, Adjigurh, Chutterpoor, Bijawur and Chirkaree in Bundelcund	Atlas sheet 70.
No. 6 Party.—Portions of North Cachar, Khasia and Garrow Hills	Atlas sheets 131, 125 and 119.
No. 7 Party.—Portions of Boondi, Odeypoor and Jeypoor (Native States)	Sheets 51 and 34.

22. Exaggerated Maps for reduction.—The system heretofore employed for drawing and preparing the *exaggerated maps* for reduction to $\frac{1}{4}$th by photography, as referred to in para. 17 of last report, having been found to be attended with many difficulties by reason of the want of uniformity in drawing difficult ground in the several sections or standard sheets of the same square degree at different periods and by many draftsmen, a new plan has been inaugurated on a very admirable suggestion of Lieutenant Waterhouse, in charge of the Photographic Office. As soon as the eight standard sheets, composing an entire degree, are available, they are reduced to half scale and transferred to zinc, and impressions taken in faint blue ink, over which the exaggerated drawing is then made in black ink, in such a way as to be susceptible of fair reduction to one-half again, which gives the required scale of $\frac{1}{4}$ inch to the mile, or 4 miles to the inch.

23. By this process, the draftsman is guided by a true transcript of the original drawing, all traced for him in faint blue, and he has only to exaggerate for reduction to one-half instead of a quarter, a very material advantage in generalizing the hilly ground, and by these means superior accuracy is ensured as regards uniformity and the combination of eight sheets into one reduced degree. The experiments already tried have given excellent results, and I trust that the attainment of these reduced geographical materials, so much required for various objects, may be more successfully carried out in future.

24. Effects of Photography.—The introduction of photography, and the multiplication of maps by the carbon printing process, whilst it has doubtless been highly advantageous in many respects, has, it may be said, with equal truth, caused many complications and difficulties in a Geographical Office, and the results of such reduced degree sheets can only be looked upon as a preliminary step to serve temporary purposes prior to the absolute compilation and engraving of the sheets of the Atlas of India.

25. The standard sheets prepared one season are sent down to Head Quarters for the reduced blue prints, and these cannot be taken up before the ensuing recess, consequently there are no exaggerated maps to report, or account for, on the present occasion. This delay is the only drawback to the new method of treating these reductions.

26. Relative Value of Standard Sheets.—Relatively the following opinion has been formed of the general finish and style of the fair maps (standards) rendered by the several parties; on the whole, they are excellent productions, and worthy of the Department:—

Of *No.* 1 *Party* (Lieutenant Charles Strahan's), all the maps are very well executed, and the delineation of ground is excellent; as MSS. drawings they are very superior. On some sheets, the details are, however, still so finely drawn as not to be susceptible of proper reproduction by the photozincographic process, and there is great difficulty in touching up and remedying these defects on the zinc plates, and rendering the results quite satisfactory for the treatment in question.

Of *No.* 2 *Party* (Mr. F. B. Girdlestone's), the hill features are drawn in a bold masterly style, very characteristic of the ground, and are decidedly a great improvement on former season's work. Mr. Girdlestone has done much towards this, and Lieutenant Sale has likewise

contributed largely to re-drawing many of the former season's sheets, and putting the style on a better footing altogether. The horizontal shading of the lower features in some of the maps being in pale ink have not reproduced so satisfactorily as is desirable, and the writing is rather weak and imperfect.

Of *No.* 3 *Party* (Colonel Saxton's), the sheet maps describe the ground well, much care has evidently been bestowed on them, and there is a gradual improvement manifest. The details in some instances may be said to be rather too crowded for the scale, and there is a look of uniformity in the stiff and conventional manner in which the peaks and hill tops are described. The ground is extremely difficult to delineate and is forest-clad throughout. All the maps have reproduced well.

Of *No.* 4 *Party* (Lieutenant Sale's), the maps are all good representations of the ground, the relative differences of height are apparently well shewn with good relief, and all have reproduced very satisfactorily. Vast improvement has been introduced into the maps of this season by Lieutenant Sale, and the assistants have greatly benefitted by his tuition.

Of *No.* 5 *Party* (Captain Riddell's), all the maps describe the features of the country faithfully, and the hill drawing and outlining is remarkable for clearness and excellent finish. The writing is somewhat inferior and open to amendment. All the sheets have reproduced well.

The maps of *No.* 6 *Party* (Major Godwin-Austen's) are on the ½-inch scale. The very massive and peculiar features of the hills (North Cachar, Khasia and Garrow) are well delineated in the usual effective and bold style introduced by this Officer, and carried on after his departure under Mr. Bellety's supervision. The maps have generally reproduced well.

Of *No.* 7 *Party* (Captain George Strahan's), the maps are very well finished in every respect. The ground is open and easy, except where jungle is met with. All the sheets have reproduced well, and are excellent specimens in every respect. The large scale map of the northern half of Mount Aboo is a highly creditable and effective piece of drawing by this talented Officer.

27. General Report, Computation Volumes.—Very few volumes of General Reports or original sets of computations and angle books have been rendered this season owing to a change having been introduced on the mode of recording these numerical results separately for each square degree instead of by the accidental limits of each season's out-turn. It is a great object to be able to refer to particular observations at the close of a survey, and by making up the computations in degree volumes, the best facility is afforded.

28. Combined Results of Topographical and Revenue Surveys.—The combined results of the Topographical and Revenue Surveys for the season under review represent a total area of 37,074 square miles, obtained at an aggregate cost of Rs. 11,67,546 for the field work, including the mapping and computations, or an average rate of Rs. 32-3 equal to £3-3 for every square mile surveyed.

29. The operations of the Revenue Survey Branch being separately reported on in detail by the Deputies Surveyor General, only the general results are given in the margin, to show the extent of details mapped for publication and reduction.

Area brought under Revenue and Topographical Survey in season 1869-70, *with cost and average rate of Survey.*

	Square miles.	Cost.	Average rate of Survey per square mile.
			Rs. A. P.
Upper Circle, *viz.*, North-Western Provinces, Oudh, Central Provinces, Punjab and Sindh	14,464	5,11,020	35 4 0
Lower Circle, *viz.*, Bengal Proper, Assam and Arracan ...	6,590	3,32,736	50 12 0
Total ...	21,054	8,43,701	40 1 0
Add Topographical Surveys	16,135	3,23,807	21 15 0
			General average rate.
Total ...	37,189	11,98,169	32 3 0

30. The total out-turn of the two branches in one season is somewhat above one-half the area of England and Wales. In addition to this a small area is topographically surveyed under the Trigonometrical branch, which is reported on separately.

Area of England and Wales, 68,320.

31. Aggregate Results brought up from previous Reports to 1870.—In my last report (para. 35), the combined cost and out-turn of the Topographical and Revenue Surveys up to 1869 was given, and the following statement completes this information up to date, showing

a total area topographically accomplished of 6,34,379 square miles, of every variety and description of country, at the very moderate rate of £2-11*s.* per square mile :—

	Area accomplished in square miles.	Total cost in Rupees.	Average rate of survey per square mile.
			Rs. A.
Total of Topographical and Revenue Surveys up to 1869 ...	5,97,190	1,50,28,652	25 2
Ditto ditto ditto up to 1870 ...	37,189	11,98,168	32 3
GRAND TOTAL UP TO END OF 1870 ...	6,34,379	1,62,26,820	Rs. 25 9 or £2-11

32. INSPECTION OF PARTIES.—Four Topographical Parties (Nos. 1, 2, 5 and 7) were inspected by myself, and throughout the recess I was in constant personal communication with the Deputy Superintendents in charge of these surveys. Each office was frequently visited, and the records and state of the work in progress duly inspected. Professional details needing immediate orders, and the future operations of each party, after full discussion, were thus satisfactorily determined on and instructions issued. Being on the spot, I was able to arrange for the closing of the work of No. 2 Party by the end of the recess season, and the proper disposal of the records, instrumental equipment and camp-equipage of the party, as also for the transfer to other parties of the European assistants, whose services it was desirable to retain.

33. No. 6 Party likewise having been brought down to Head Quarters in Calcutta, during the recess, with a view to disbandment, derived all the advantages of instruction and example there. The Executive Officer of No. 4 Party being on leave, and subsequently employed on duty at Mussoorie, was enabled also to confer on all points of procedure and practice, and so to maintain uniformity with the results of his survey, as well as to derive advantage from the experience of others. No. 3 Party, therefore, was the only one which did not come under actual observation this season, and it was inspected by myself at Ootacamund in the previous season.

34. On the whole, I have great reason to report most favorably of the efficient state of the several parties inspected, of the successful exertions made by both officers and assistants, and of the general progress and improvement in the surveys, as well as of the well-directed and laudable efforts of the officers engaged to reduce expenditure, and at the same time to uphold the character of the work, and to maintain rigorous principles of procedure in every step and stage of their operations, both in Field and Office.

35 CARTOGRAPHY.—The work accomplished in the drawing and compiling branches is well described in detail in Statement B (appendix) by Mr. James, Assistant Surveyor General, in immediate charge of this portion of the work, and shows an immense amount of miscellaneous mapping of various descriptions. Unusual pressure has been put upon the compiling branch to meet the wants of the engravers employed on the sheets of the Atlas of India, for whom finished drawings or originals of each sheet are required, and no less than 17 quarter sheets have been completed for this purpose, as far as survey materials were available. The usual general compilations, miscellaneous maps on various scales, plans of Civil and Military stations and charts have also been pushed on with good effect by the Assistant Surveyor General (Mr. James), whose indefatigable exertions and successful results are always conspicuous not only in this, but in all the various branches of this Office.

36. The duties of the geographical examiners have been very heavy, and this part of the work has been carefully carried on, under Mr. James' able directions, by Mr. J. F. Baness, whose long service in the Department well qualify him for this task.

37. ENGRAVING BRANCH.—It affords me much satisfaction to state, that the first issue of two quarter sheets of the Indian Atlas has been made as detailed in the margin ; many other sheets have been advanced almost to completion, and only await small blanks of surveys to be rendered. The current year will, I trust, furnish a considerable addition to this very important publication. The style of the work is all that could be desired, and well bears a comparison with the engraved sheets produced in England. The special advantages of copper-plate engraving in this Office are too numerous to specify in this place, but the superior results arising are manifest in all the publishing branches of this Department.

No. 87 S. W., Lucknow, &c.
No. 125 S. E., Sylhet, &c.

38. The health of the European staff of engravers which was at first indifferent has improved greatly during the past year, and absences from slight attacks of indisposition have been less frequent. The Native engravers (two) and nine apprentices have been carefully super-

vised and instructed, and it is very encouraging to notice the rapid progress which some of the Native apprentice lads have made in writing, outline engraving, and even in the more difficult process of hill etching. There is every prospect of their services being turned to good account ere long, and most of them are at present usefully employed in assisting the European engravers in the easier portions of writing and outlines on the Indian Atlas sheets now in hand.

39. Mr C. W. Coard, Superintendent of this branch, has devoted a great portion of his time with much effect and zeal to the training of the Native apprentices, and under his special tuition, with occasional help from his assistants, fair progress has been made.

40. In Appendix C, a detailed statement of the engraving work performed, with an estimate of the probable time which some of the Atlas sheets now in hand will yet take to complete, is given.

41. In the copper-plate printing establishment, Native agency has been trained with very fair results, but only a few hands have been as yet entertained, owing to the engraving being still very slow, and but few plates in a state for issue. The out-turn of plate printing is as follows:—

Proofs of atlas sheets and other subjects	444	Impressions.
Atlas sheets (¼ plates) small maps of India, Cholera Report plates, Pendulum observation plates, Index to Great Trigonometrical Survey operations, Index to atlas sheets, &c., printed ...	26,177	do.
Transfer of tint plates and maps	760	do.
TOTAL ...	27,390	do. of various subjects.

42. The out-turn and progress of the engraving and plate printing branch is highly satisfactory in all respects, and reflects credit on Mr. Coard and his staff.

43. LITHOGRAPHIC BRANCH.—In Appendix D, a detailed statement of the work performed in lithographic drawing and printing is given. The demands on this useful branch are still increasing, and the amount of transfer-drawing, drawing on stone and printing, completed during the past year, is unusually large.

44. A competent Head Assistant has been found to succeed Mr. Lawrence, whose death was reported last year. Mr. E. Jevezy, a practical lithographer, trained in Europe, and with considerable experience in Australia, having furnished satisfactory proofs of his knowledge in all its details of the art of Lithography, has, after six months' trial, been appointed to the vacant post.

45. Great progress has been made in training natives in drawing on stone, and most of the younger hands are kept steadily at this description of work, which is specially valuable, in preference to transfer drawing, for the reproduction of the higher class of maps.

46. The amount of work performed and its estimated value is as follows. Many very useful and admirably executed maps have been published during the year, and the more important ones are distinguished in the Appendix:—

Original subjects, *viz.*, maps, plans, diagrams, &c., drawn and transferred ...	419	Subjects.
Ditto ditto printed from the above ...	2,06,471	Impressions.

From the 2,06,471 impressions taken, some of which are only sections of maps and plans, 1,01,610 complete copies are obtained, the value of which, at the ordinary selling price per copy, amounts to Rs. 89,409.

Of departmental professional forms, orders, circulars and memoranda slips, 1,18,604 copies have been printed, the estimated value of which is Rs. 2,900.

47. The following abstract shows the total amount and value of the work executed, and the total cost of the working of the Lithographic Establishment:—

		Copies printed.	Value.		
			Rs.	A.	P.
New drawings of maps, plans, &c., completed 419		1,01,610	89,409	0	0
Professional Forms, Departmental orders, &c.		1,18,604	2,900	0	0
			92,309	0	0
COST OF THE LITHOGRAPHIC BRANCH.					
For permanent establishment	29,511	8 0			
For contingent expenses	5,176	9 0			
Cost of extra work	3,658	8 0			
Cost of paper received from Stationery Office	6,306	0 0	44,652	9	0
Amount in favor of the Lithographic Branch			47,656	7	0
Or deducting the cost of the professional forms, &c.		Rs.	44,756	7	0

48. For these excellent results, and for the highly satisfactory working of this portion of my Office, I am greatly indebted to Captain Murray, Assistant Surveyor General in immediate charge, who has been indefatigable in his superintendence and has ably assisted me in various other duties.

49. PHOTOGRAPHIC AND PHOTOZINCOGRAPHIC BRANCH.—The speedy issue of the results of surveys in progress has been well maintained in this branch by the aid of photozincography, and has fully met the demands from all Departments of the State.

50. In the following statement, the nature and amount of the work which has passed through the Photozincographic Press Office is given:—

	Number of sections or sheets.	Number of negative plates.	Prints. Silver.	Prints. Carbon.	Transferred to zinc or stone.	Number of pulls or impressions.	Number of complete copies, &c.	Remarks.
Topographical and Revenue Survey maps, City and Cantonment plans, District and general maps, miscellaneous maps, plans and sketches, zincographs and nunstatic transfers.	704	2,290	3,965	2,265	647	96,366	*60,116	* Exclusive of silver prints.

51. The value of the 60,116 complete copies of maps, plans, &c., obtained, taken at the selling price, is ... ... Rs. 89,659 12 0

The total cost of the Photographic and Photozincographic branch, inclusive of all charges from 1st December 1869 to 31st December 1870, is ... ... Rs. 54,892 14 6

Leaving a balance in favor of the Office of ... ... Rs. 34,766 13 6

52. In Appendix E a detailed report is given by Lieutenant Waterhouse, Assistant Surveyor General in charge of the working of this branch, together with statements showing the description and the estimated value of each class of work performed, being in excess of the entire cost of the establishment, contingencies and paper, by Rs. 34,766 as profit to Government.

53. The combined out-turn from the two Printing Offices, Lithographic and Photozincographic, and the value of the maps, plans, charts and subjects reproduced at the lowest selling rates, with the surplus or profit to Government, is as follows:—

	Number of Maps.	Value. Rs.	Value. A.	Value. P.	Profit. Rs.	Profit. A.	Profit. P.
Lithographs	1,01,610	89,409	0	0	44,756	0	0
Photographs and Photozincographs	60,116	89,659	0	0	34,766	0	0
TOTAL FOR 1869-70 ...	1,61,726	1,79,068	0	0	79,522	0	0
Ditto for season, 1868-69	1,41,739	1,00,575	0	0	35,796	0	0
Excess in favor of season, 1869-70—difference ...	19,987	78,493	0	0	43,726	0	0

54. This is considerably in excess of the results of the previous year and shows the growing increase of the work performed in the Head Quarter Offices, and the special utility and remunerative character of the speedy reproduction and publication of the maps of the survey of India.

55. The services of Lieutenant Waterhouse have been very valuable, and I had great satisfaction in recommending him for promotion from 2nd to 1st Grade Assistant Superintendent, which was sanctioned from the 17th June 1870. He continues to conduct the duties of his Office with good effect and energy.

Home Department Notification No. 474, dated 24th December 1870.

56. The yearly increasing out-turn of maps, as reproduced by the different processes now in use, will be understood from the statement in the margin. The copper-plate printing will now materially add to this account. The question of storing such enormous additions to the records has become very serious, and additional Office accommodation has formed the subject of a special enquiry by a committee which sat last year, and which has rendered a report to Government.

	Photozincographed and Lithographed Maps Printed.
In 1867	67,482
„ 1868	1,06,805
„ 1869	1,35,741
„ 1870	1,61,726
TOTAL ...	4,61,754

57. PRINTED MAPS SENT TO ENGLAND.—Large despatches of printed maps, plans and charts from the results of surveys completed and in progress have been forwarded to the Geographical Department of the India Office, with the object of keeping up the supply there, for sale and issue, of all materials representing the labors of this Department in all its branches, very nearly up to date. The Geographer at the India Office has also been well supplied with materials for the completion of several portions of some of the Atlas sheets of India, which are to be completed in England, and the engraving of which are in progress.

58. ISSUE OF MAPS TO GOVERNMENT OFFICIALS AND SALES TO THE PUBLIC.—During the year ending 31st December 1870, the issue of maps on indents and requisitions on service to Government officials amounts to 18,006 copies, for which no payments have been made, and 6,552 copies have been furnished to the local Agents at Allahabad, Lahore and Nagpore for sale and for issue on service. The value of these maps is given in the margin.

	Copies.	Value.
		Rs. A.
Maps issued on service ...	18,006	36,800 8
Maps issued to Local Agents ...	6,552	12,663 4
TOTAL ...	24,558	49,460 12

59. PROCEEDS OF SALES OF MAPS.—The cash account connected with map sales up to 31st December 1870, since the last account was rendered, *viz.*, 31st December 1869, is as follows:—

Dr. *Abstract Cash Accounts from 1st January to 31st December* 1870. *Cr.*

ITEMS.	AMOUNT.	TOTAL AMOUNT.	ITEMS.	AMOUNT.	TOTAL AMOUNT.
TO CASH ACCOUNT—			BY TRANSFER ACCOUNT—		
Balance in the Bank of Bengal, as per printed Report for 1868-69	3,450 10 9		Amount paid to Government by Cheque No. 348, dated 7th March 1870, as per Accountant General's receipt No. 6231, dated the 10th March 1870	... ...	4,000 0 0
Balance on account of outstandings ...	1,285 0 0		BY CASH ACCOUNT—		
Ditto Cash in hand	269 10 6		Balance in Bank of Bengal on 1st January 1871	1,262 11 0	
Ditto on account of sale of Maps since realized	128 4 11		Ditto on account of outstandings ...	901 0 0	
		5,133 10 2	Ditto Cash in hand	269 10 6	
TO MAP SALE ACCOUNT—			Ditto on account of sale of Maps with Agents, not rendered... ...	2,025 11 0	
Amount received from Sundries	586 14 0				3,459 0 6
Ditto Messrs. Thacker, Spink and Co.	2,022 11 0				
Ditto „ P. S. D'Rozario and Co.	44 6 3				
Ditto „ W. Newman and Co. ...	100 10 0				
Ditto Curator, Government Books, Central Provinces	95 0 7				
Ditto Manager, Punjab Printing Company, Limited	463 3 6				
Ditto Messrs. Barham, Hill and Co....	12 0 0				
		3,325 0 4			
TOTAL Rs. ...	...	8,459 0 6	TOTAL Rs. ...	... ...	8,459 0 0

60. The proceeds from the actual sale of maps is not so large as might be expected, but the account sales from the agents and cash payments for the same have only been rendered up to the month of September last. Until all officials are made to pay for maps demanded to such large extent on account of the public service, the financial results to this Department can scarcely prove what they ought to be. Not only have good maps to be issued gratis, but this Department is called on to expend large sums in mounting, binding, coloring, for which its Budget can no longer provide.

61. EUROPEAN WAR MAPS.—On the declaration of war between France and Prussia, this Office took immediate steps to produce various maps of Europe and of the countries immediately concerned, and in an extraordinarily short time some of the best maps extant were issued largely and met with a ready sale. These maps being for a particular and popular purpose were sent to all Military stations through Brigade Majors and Station Staff, and a considerable profit will be realized when the accounts under this head can be made up.

62. CASH PAID INTO TREASURY.—Since the account current was closed on 31st December last, a further sum of Rs. 3,000* has been paid into the Government Treasury on account of the proceeds of the sales of maps. This is in addition to the Rs. 4,000 paid in on the 7th March 1870.

* Accountant General's receipt No. 5765, dated 20th Jan. 1871.

63. The year under review has been one of great anxiety and importance to the well-being and efficiency of the Department. The Financial reductions carried out have materially affected every question of internal economy and administration. The prospect of the future may, however, it is hoped, be said to be improving.

64. The detailed accounts of the proceedings of the several executive establishments are as follows:—

EXECUTIVE ESTABLISHMENTS.

No. 1.—TOPOGRAPHICAL PARTY.

Gwalior and Central India Survey.

65. On the 1st December 1869, the entire party, of the strength shown in the margin, commenced field work. The detail operations or delineation of topography extended through the Native State of Gwalior and portions of Jeypore, Kota, Boondi and Jhalra-Patan in the Central India and Rajpootana Agencies, and with the exception of three small detached portions to the east lay within the degree square formed by the meridians of 76° and 77°, and the parallels of 25° and 26°, and embraced an area of 2,891 square miles. A large scale plan (12 inches = 1 mile) of the cantonment of Goonah was also completed.

Native States.

Gwalior, with portions of Jeypore, Tonk, Kota, Boondi and Jhalra-Patan.

Strength of the Party.

Lieut. Chas. Strahan, R E., Dy. Supdt., in charge.	3rd Grade,		Sq. Miles.
Lieut. T. Holdich, R. E., Asst. Supdt.,	1st Grade		203
Surveyor.			
Mr. H. J. Bolst,	2nd grade	...	335
Assistant Surveyors.			
Mr. G. K. Allnutt,	3rd grade	...	60 (and plan of Goonah Cantonments.)
„ G. L. Esteve,	3rd „	...	202
„ W. J. Cornelius,	3rd „	...	397
„ T. D. Ryan,	4th „	...	276
„ G. T. Murphy,	4th „	...	70
„ W. A. Stratford,	4th „	...	211
Sub-Surveyors.			
Joala Persad	...	...	243
Abdool Samad Khan	...	...	279
Abdool Sobhan	...	...	327
Churamun Lall	...	...	288
	Total	...	2,891

66. The Deputy Superintendent in charge reports favorably of the accuracy with which the field work has been executed, a considerable portion of which was duly examined and tested by himself in the field, and which my own inspection enables me to confirm.

Area of triangulation completed.

67. The triangulation in advance of details was extended over an area of about 1,300 square miles in the Gwalior and Tonk States by Lieutenant C. Strahan, Deputy Superintendent. Observations were made at 27 stations, by which 173 positions were determined, giving 1 point to every 7½ square miles of ground, and the heights of 137 points were obtained, giving one height to every 9½ square miles of ground.

68. The ground over which the detail work as well as the triangulation has extended during the season under review was very unhealthy, difficult, and covered either with heavy grass and bush jungle or forest; the health of the party consequently suffered considerably owing to a scarcity of wholesome drinking water.

Recess duties.

69. Recess duties, *viz.*, the fair mapping and computations, were not commenced at Mussooree before the 1st June 1870, owing to the detention of the Surveyors in finishing up their sections under many difficulties in the month of May; the out-turn of work by the end of October was as follows:—

8 Standard maps, scale 1 mile = 1 inch.
2 Charts of triangulation for Degree Sheet VIII.
1 General report (volume completed) of all the computations connected with Degree Sheet VIII.
Portions of the General Report volumes, for Degree Sheets II and IV.
1 Horizontal Angle Book in duplicate.
1 Vertical ditto ditto.

Cost of the season's operations.

70. The total cost of the season's operations from 1st October 1869 to 30th September 1870 amounts to Rs. 55,026-8-0 for the area of 2,891 square miles of final topography completed, inclusive of the cost of triangulation in advance. This contrasts favorably with the cost of previous seasons.

71. During the recess, the party was on several occasions visited and inspected by myself, and I was glad to find that the objects and requirements mentioned in my previous report regarding this survey had been well attended to by the officer in charge, and that every endeavour had been made by him to render the topography in compact blocks, as so essentially required for the publication of the sheets.

Inspection of the party.

72. During my visits to the Office of this party, its past and future operations and proceedings were well considered and discussed, and I have directed various alterations in the disposal for field duties of the Assistant Superintendent and Senior Surveyors, with the view of working more together and under the immediate control of the officer in charge, so as to prevent complaints such as were prevalent during the season under review, and in order that the out-turn of work might be secured with proper supervision and control over the younger and less experienced assistants working in the Native States, where much tact and circumspection is necessary.

73. Lieutenant T. Holdich, R. E., Assistant Surveyor, has taken a good share in laying down the topographical details, which he performs with great skill. His exertions are favorably mentioned by the officer in charge. He will be employed in triangulating as well as in other duties of supervision over the subordinates during the current season.

74. The Assistant Surveyors marginally named were permitted to resign their situations from the dates specified opposite their names, and to supply their places, two* assistants from the Central Provinces Party No. 2 have been transferred on the breaking up of that survey, to meet the financial reduction made in the departmental budget. A new Probationary 4th grade Assistant, Mr. Templeton has likewise been posted to fill the remaining vacancy, and I trust superior efficiency and power has thus been afforded for carrying on the Gwalior Survey.

Mr. G. L. Esteve, 1st July 1870.
„ G. T. Murphy, 10th March 1870.
„ W. A. Stratford, 31st August 1870.
* Mr. Farrell, Assistant Surveyor, 1st grade.
„ Scanlan, Assistant Surveyor, 2nd grade.

75. During the ensuing season, the topography of a portion of Degree Sheet IX, Latitude 24° to 25°, Longitude 77° to 78°, in Gwalior and Tonk will be taken up, and the triangulation extended into portions of Degree Sheets VIII and X, situated to the east and west of Degree Sheet IX.

Extension of future operations.

No. 2.—TOPOGRAPHICAL PARTY.

Central Provinces Survey.

76. The party, of the strength given in the margin, marching from Jubbulpore commenced field work during the first week in December.

Sauthpoora Range in Baitool and Chindwara, with part of Balaghat District.

Strength of the Party.

F. B. Girdlestone, Esq., Officiating Deputy Supdt., 3rd grade, in charge.

	Sq. Miles.
Surveyor.	
Mr. C. Neale, 1st grade (employed also on triangulation)	30
Assistant Surveyors.	
Mr. R. D. Farrell, 1st grade	201
„ C. Scanlan, 2nd „	281
„ A. Chennell, 2nd „	0
„ B. Maine, 3rd „	122
„ J. Chennell, 4th „	132
Sub-Surveyors.	
Ramchander	201
Janardanrao	118
Sheikh Oomer	79
Gholam Muhomed	24
Total ...	1,188

77. The final topography to be executed was situated in the districts of Baitool and Chindwara; in the former a long strip of hilly country facing the southern flank of the Sauthpoora Range was taken up, with the object of establishing a good junction between the work of previous seasons in the hills and the Revenue Survey of the plains and cultivated portions of the Baitool plateau, and in Chindwara a block of difficult hilly and broken ground immediately north of the civil station and extending eastwards to the north and north-eastern frontier of the district abutting on Seonee which has been completed by the Revenue Survey.

78. The area of final work executed, which is all that remained to be taken up in that direction, covers 1,188 square miles as contributed by each member of the party detailed in the previous paragraph. Mr. F. B. Girdlestone, Officiating Deputy Superintendent in charge, having visited each

Final topography completed.

assistant on his ground, inspected and checked their work, reports favorably of the accuracy and style of final topography accomplished.

Triangulation in advance.

79. Owing to the completion of the Sauthpooras and the intervening district of Seonee, a new field had to be formed for the employment of this party in the Central Provinces, so as to keep its operations clear of the progress making by No. 4 Party, working up from the western limits of the Chota-Nagpore Division through Belaspoor and Mandla; consequently a new division was formed for employment southwards in Balaghat, and the zemindarees of Ryepore, Chanda, &c., with the object of taking up all the wild, broken, and hilly tract left between the several Revenue Surveys of Ryepore, Chanda and Nagpore Districts; a part of the country so little known or traversed, and which it is very important to connect by minor triangulation with the surveyed portions of the Central Provinces.

80. The season's triangulation therefore lay detached in the Balaghat District, between the meridians of 80° and 81°, and parallels of 21°-15′ and 22°-20′. This district which is situated to the east of Seonee and due south of Mandla is densely covered with forest, and is notoriously unhealthy. The district of Seonee which is richly cultivated had been taken up and completed in the regular course of the operations of the Revenue Survey in previous season, and the plateaus or revenue-paying portions of Baitool and Chindwara were also necessarily left to be dealt with by the Revenue Survey.

81. A considerable distance, therefore, intervened between the ground in which the plane tablers were to be occupied in completing the detail survey and the country to be triangulated. Mr. Girdlestone, therefore, detached the Senior Surveyor, Mr. Neale, with one Assistant (Mr. A. Chennell) and a Sub-Surveyor into Balaghat to select and clear stations, to commence observations in the southern portion of the district as soon as a sufficient number of stations had been cleared, and to lay out the triangulation over the northern portion, for which, the observations would in due course be taken up by the Officiating Deputy Superintendent himself.

82. While proceeding to Balaghat, Mr. Neale and his entire party were completely prostrated by jungle fever, and they never were free from it for the remainder of the season. The triangulation was commenced from a fresh base of the Jubbulpore meridional series of the Great Trigonometrical Survey in the valley of the River Wynganga, immediately in the vicinity of *Boorha*, the new and temporary civil or sudder station of this district, which has only been recently formed, but owing to unusual heavy rains during December and January, and the constant relapses of fever from which the party suffered, the selection of suitable points, or stations of observation and clearing of rays in such difficult ground, was considerably retarded.

83. Final observations were, however, commenced by the third week in January, by which time Mr. Girdlestone had also entered the district, and were continued on until nearly the end of February, when, in consequence of the necessity for reduction of Survey establishments for financial reasons, I was compelled to discontinue these operations which were of an expensive character and greatly retarded by various obstacles; the project of carrying on and completing the triangulation and the topography, therefore, of all the extreme southern portion of the Central Provinces, has for the present been unfortunately abandoned.

Area of triangulation completed.

84. Observations were taken at 20 stations, from which the positions of 138 points were obtained and 68 heights determined, over an area of 839 square miles, giving on an average one point to every six square miles of ground and one height to every 10½ square miles. In addition to this, approximate triangulation was laid out, stations selected and cleared, and poles fixed over an area of about 2,600 square miles, all of which will be lost.

Cost of the season's operations.

85. The total cost of the season's operations amounts to Rs. 40,856.

These results, considering the very short field season and the extremely difficult and unhealthy nature of the ground surveyed, are satisfactory, and reflect great credit on the zeal and energy of Officiating Deputy Superintendent and his Assistants.

Reduction of the strength of the party.

86. Consequent on the orders of Government for the reduction of the expenditure in this Department, the Assistant Surveyors and Sub-Surveyors marginally named were from the 22nd April 1870 transferred to the Indore State Railway for employment on survey duty, and struck off the rolls of this Department. The Native Doctor attached to the party was at the same time transferred back to the Medical Department, and with the exception of ten of the

Mr. B. Maine, Assistant Surveyor, 3rd grade.
„ J. Chennell, ditto, 4th „

Sub-Surveyors.

Janardanrao.
Ramchander.
Gholam Mahomed.

native establishment, whose services were absolutely necessary in the recess, all the remainder were discharged.

87. As it was essential that all the work of this survey should be completed and rendered by October, prior to the final disbandment of the party and transfer of the remaining Assistants to other surveys, and as the professional computations and mapping remaining to be finished at the time of the sudden decease of Mr. Mulheran were unusually heavy, I directed Lieutenant M. T. Sale, R. E., Officiating Superintendent in charge No. 4 Topographical Survey, who was at Mussoorie on leave, to assist me in my office with the mapping of this party for the remainder of the recess.

Recess duties.

88. Frequent inspections of the party were made by myself at Mussoorie during the recess with great satisfaction. The results achieved appeared to me very creditable, and the state of the party, all that could be wished for. All the usual computations have been rendered in duplicate, together with—

1 Volume (Fair) General Report for Degree Sheets 1 and 2.
4 Horizontal Angle Books, original and duplicate.
4 Vertical Angle Books, original and duplicate.
22 Pages, lists of villages.
2 Charts of Triangulation for Degree Sheets 1 and 2, (2 miles = 1 inch).
13 Field sections (original plane table sheets) of 1869-70.
26 Standard maps, scale 1 mile = 1 inch, seasons 1866 to 1870.
1 Fair copy plan of Pachmari Hill, scale 4 inches = 1 mile.

89. All these records have been safely lodged in my office. The final report of the Hydrabad Survey, a most voluminous record referred to in the 109th para. of my last report, has been got out of hand at head quarters by Captain Murray, Assistant Surveyor General, to whom much credit is due for the able manner in which he completed so heavy a task.

90. The fair copies, standard maps of previous seasons, having proved to be unsuited for photozincographic reproduction, and defective in the delineation of this peculiarly difficult ground in question, Mr. Girdlestone with his reduced establishment undertook the additional task of redrawing the whole series of maps, so as to secure uniformity of execution as well as the size and fulness of the sheets. For this purpose, a master-hand was necessary, and with the aid of Lieutenant M. T. Sale, R. E., whose talents as a Topographical Draftsman are of a high order, no less than thirteen large and full sheets were redrawn in addition to those of season 1869-70. The services of Lieutenant Sale during his leave and for the remainder of the recess were thus utilised in a most beneficial manner, and the result of his labors have elicited my cordial approval and acknowledgments.

91. Mr. Atkinson temporarily lent from the Rajpootana Topographical Survey, and Messrs. Farrell, Scanlan, A. Chennell and J. H. Wilson, also rendered good aid in contributing to the redrawing of some of these sheets. These Assistants are reported on in very commendatory terms.

92. The whole of the Fair Standard Sheets of this Survey for the entire Sauthpoora Range have thus been admirably executed, and are fair specimens of good topographical delineation.

93. By the close of October, No. 2 Topographical Party was altogether broken up and disposed of. The accounts were closed, the Ordnance stores and camp equipage transferred to No. 4 Topographical Party, which required such additions and found them conveniently placed at Jubbulpore. Messrs. Farrell and Scanlan were posted to No. 1 Party, Gwalior and Central India Topographical Survey, Mr. J. Chennell to No. 5 Bundelcund Party, Mr. Wilson, Junior, and Sub-Surveyor Sheik Omer to No. 4 Party, Chota-Nagpore Division Survey, and the remainder of the Native establishment was discharged.

94. The Government of Bombay having asked for the services of an experienced officer for the survey of the Bahrein and Khatiff Straits in the Persian Gulf, I recommended the employment of Mr. Girdlestone on this duty, and the Government of India has been pleased to sanction* his transfer temporarily on the condition that he may revert, if necessary, to his place in the Department again.

Transfer of Mr. Girdlestone to the Bombay Marine Department.

* *Vide* Home Department Notification No. 415, dated 31st October 1870.

95. I cannot permit Mr. Girdlestone to leave this Department even for a time without recording the high sense I entertain of his professional abilities and valuable services. I greatly

regret the loss of this officer's services in the Department, where he had gained ripe experience and used it with the utmost zeal and good effect. A constant spectator in his office during the recess at Mussoorie, I had the best opportunities for observing the excellent mode in which he carried on all his duties, and I have every hope that he may again be permitted to conduct topographical surveys under my command.

96. Extracts from Mr. Girdlestone's report descriptive of the country surveyed and its resources, some notes on the Balaghat District, as well as notes by Mr. Assistant Surveyor Scanlan on the "Bharias" inhabiting a portion of the Sauthpoora Range, are given in the Appendix.

No. 3.—TOPOGRAPHICAL PARTY.

Central Provinces and Vizagapatam Agency Survey.

97. The very wild and unhealthy nature of the country through which the operations of this survey party has extended for many years past, has always rendered it desirable to adopt every precautionary measure to protect the establishment from undue exposure in the jungles, while miasmatic influences are most active, hence the actual working or field season has never exceeded four months, or from January to May. It has likewise been absolutely necessary to recruit the health and vigor of the subordinates by sending them to a hill climate for the recess, where the ill effects of their life in the jungles can be counteracted. During the season under review, the party after recessing at Ootacamund assembled under Colonel G. H. Saxton, Deputy Superintendent, 1st grade, at Vizianagram, and started for the field by the middle of December.

Native States.

Kalahandy, Kasipur and Bustar of Central Provinces; Jeypoor and Panchpeta of the Vizagapatam Agency, and Pedda-Kimidy and Purla-Kimidy of the Ganjam Agency.

Strength of the Party.

Colonel G. H. Saxton, Deputy Supdt., 1st Grade, in charge.

	Sq. Miles.	
Surveyors.		
Mr. R. W. Chew, 4th grade ...	230	Assisted also in triangulating and interpolating points.
Mr. J. Harper, 4th grade ...	172	
Assistant Surveyors.		
Mr. J. A. May, 1st grade ...	192	
Mr. F. Adams, 1st grade ...	224	
Mr. T. Claudius, 2nd grade ...	242	
Mr. W. F. Pettigrew, 3rd grade	250	
Mr. W. S. Barnet, 3rd grade ...	170	
Mr. A. Cooper, 4th grade ...	186	
Sub-Surveyors.		
Mr. R. Trewman ...	261	
Mr. E. Atkins ...	281	
Mr. J. McCay ...	164	
Total ...	2,372	

Triangulation.

98. The attention of the Deputy Superintendent was first directed to the completion of the triangulation for the small unsurveyed portion of the Saora Hills, situated immediately north of Purla-Kimidy within the Ganjam Agency, inhabited by wild Saora tribes, a small tract which has remained so long a blank in the map owing to the political and other difficulties attending its proper survey. This small area of about 600 square miles was successfully triangulated by Colonel Saxton himself, and a very interesting description of these hills and of the reception he met with from the inhabitants, by Colonel G. H. Saxton, is given in the Appendix of this report. In addition to this triangulation, points were fixed by interpolation from stations within the work of previous season, in which duty, the Deputy Superintendent was aided by Messrs. Chew, Harper and May.

99. Observations were made at 80 stations, from which the positions of 167 points and the heights of 140 points were trigonometrically determined.

Season's out-turn of topography.

100. The area of which the topography has been delineated lay in two detached blocks, but in continuation of the detail survey of the previous season. The eastern portion situated between Latitude 18°-45′ and 19°-25′, Longitude 82°-25′ and 83°-15′, embraced a considerable part of the dependency of Jeypoor in the Vizagapatam Agency, the western block included chiefly portions of Bustar and estates appertaining to it, in the Central Provinces, between Latitude 18°-30′ and 19°, Longitude 81°-30′ and 82°-15′. The total area accomplished is 2,372 square miles, as detailed on the 1st para., which Colonel Saxton states has been well delineated. Various tests were applied to check the accuracy of the details with fairly satisfactory results.

101. In para. 122 of my last Administration Report (season 1868-69), I remarked on the desirability of connecting the old triangulation and survey of the Neilgherry Mountains by the late Lieutenant Colonel Ouchterlony, as well as the new survey of Ootacamund now in an advance state under the Madras Revenue Survey Officers with the Great Triangulation of India now in actual progress, and I mentioned that Colonel Saxton had been directed to devote the months of April and May before the setting in of the monsoon in order to effect this. This question formed the subject of a reference from the Madras Government, and was fully reported on in my letter marginally noted.

Home Department, No. $\frac{F}{289}$, dated 2nd Aug. 1870.

102. By the end of May, the party had marched back to Vizagapatam, the nearest sea port, returned by steamer to Madras and commenced recess duties at Ootacamund. The following maps and professional computations were completed :—

Recess duties.

Computations of triangles in triplicate.
Ditto of latitudes and longitudes in duplicate.
Ditto of heights in duplicate.
Synopsis sheets and alphabetical lists of latitudes and longitudes in triplicate.
Angle books (Horizontal and Vertical) 317 pages (duplicate).

Mapping.

Standard sheets (1 inch) completed	...	...	...	3
Ditto completed in part as far as survey has progressed			...	6
Charts of triangulation (fair) 2 miles = 1 inch	...	...	...	2
Ditto ditto for Office record	...	...	...	2

103. The Deputy Superintendent reports that no arrears of work exist in his office.

104. The total cost of the season's operations, inclusive of all charges, amounts to Rs. 64,431, which is larger than that of other parties, owing chiefly to the higher cost of superintendence.

Cost of the season's operations.

105. The results of the season's survey, *viz.*, 600 square miles of triangulation and 2,372 square miles of topographical delineation, though not large, is fair for the country in question, as much as is to be expected during so short a field season and such difficult and unhealthy ground. The triangulation of previous seasons in advance of topography is large, nearly 8,200 square miles, and with future additions by interpolating points from stations visited in the course of the Deputy Superintendent's progress, season by season, while inspecting his plane table surveyors, will furnish an ample basis for the topography of the next three seasons, so that, no further triangulation is immediately necessary.

General Remarks and programme for the ensuing season.

106. The detail surveyors will, during the ensuing season, be divided into two parties; one, consisting of four Assistant Surveyors, will complete the topography of the Saora Hills, and the second party will occupy ground in Jeypoor and its dependencies, between the meridians of 82° and 83° and the parallels of 18°-15′ and 18°-45′.

107. Colonel Saxton reports favorably of all the Surveyors and Assistants under his orders, and specially mentions Mr. Chew, who has rendered him good aid both in field and recess duties. Mr. Cooper, Assistant Surveyor, 4th Grade, has been promoted to 3rd Grade from the 1st January 1871.

108. Mr. W. S. Barnet, 3rd Grade Assistant Surveyor, transferred to this party from the late Pegu Survey, being from age and ill health unfit for active duty, was, on the return of the party to recess quarters, recommended for a superannuation pension, and awaits the orders of Government. Messrs. R. Trewman and E. Atkins, Sub-Surveyors, resigned from the dates specfied opposite their names in the margin.

Mr. R. Trewman, 16th September 1870.
Mr. E. Atkins, 1st September 1870.

109. Mr. J. McCay, Sub-Surveyor, has been promoted to 4th Grade Probationary Assistant Surveyor, and transferred to No. 6 Topographical Party, Khasia and Garrow Hills Survey, from the 1st December.

No. 4.—TOPOGRAPHICAL PARTY.

Chota Nagpore Division Survey.

110. The abolition of No. 2 Topographical Party, Central Provinces Survey, having been decided on (as detailed in the Report of No. 2 Party, paras. 86 and 87), it was very necessary that the operations of this party, which were fast drawing to a close in the Chota-Nagpore Division, should continue systematically westwards, so as to embrace the country between Bhokar and Korea of Chota-Nagpore and the Nerbudda River, comprising the Talook of Sohagpoor (transferred by British Government to the Maharaja of Rewah) and the northern and hilly portions of the district of Belaspoor and the Zemindarees and Native Estates attached to it, together with the districts of Mandla in the Central Provinces; for all of which a first survey is imperatively called for, as the country is scarcely, if at all, represented on our maps owing to its insalubrious, wild and difficult nature.

Native States.

Sirgoojah, Jushpoor and Gangpoor of Chota-Nagpore Division, Lower Provinces; Talook Sohagpoor of Rewah, with the Native State of Raighur and northern portion of District Belaspoor in the Central Provinces.

Strength of the Party.	Square Triangulation.	Miles. Topography.
Lieut. M. T. Sale, R. E., Offg. Depy. Supdt., 3rd grade, in charge	2,800	None.
Surveyors.		
Mr. G. A. McGill, 3rd grade	640	289
„ J. Vanderputt, 4th grade, assisted Lieut. Sale in triangulating		141
Assistant Surveyors.		
Mr. A. G. Wyatt, 2nd grade		453
„ A. James, 2nd „		528
„ J. A. Barker, 3rd „		399
„ G. Rae, 4th „		291
„ L. R. L. Owen, 4th „		192
Sub-Surveyors.		
Baboo M. S. Dutt		424
„ H. Dutt		256
Eusuff Sheriff		400
Total ...	3,440	3,373

111. The officer in charge of this party was therefore instructed to continue the triangulation, which during previous seasons had been completed up to the western limits of Korea, Bhokar, Sirgoojah, &c., of the Chota-Nagpore Division, and in due connection with the triangulation of the Ganjam and Orissa Party in the Native States of Korba, Raighur, &c., into the country above described. A series of triangles extending longitudinally from about the meridian of 82°=40′ to that of 81°=15′, and between the parallels of 22°=30′ and 23°=15′ was completed, covering an area of 3,440 square miles across Sohagpoor and the Ummurkuntuck Range or plateau. From this range which is formed of a series of perfectly flat topped, broad (in some places several miles broad) forest-clad hills running in several parallel ranges so near together, that the series of triangles could not be carried from range to range, and of so uniform a height, that it was impossible to see over the intervening range. Towards the northwards, however, the Ummurkuntuck Range, or rather plateau country, is more broken, and by diverting the series a little to the north, the difficulty was overcome, and finally by a few large and well conditioned triangles the series was carried well into the Mandla District.

Triangulation completed.

112. This triangulation will hereafter be continued until it closes on the Jubbulpore series of the Great Trigonometrical Survey on about the meridian of 80°, which brings it into contact with the Revenue Survey of the districts of Jubbulpore and Seonee already completed.

113. Observations were taken at 60 stations, from which 266 points were laid down and 72 heights of useful obligatory points were trigonometrically determined.

114. The topography completed was situated chiefly within the Chota-Nagpore division in the Native States of Sirgoojah, Jushpore, Oodeypore and Gangpore, with a small portion of the Gurjat State of Raigar adjoining the Belaspoor District of the Central Provinces. A description of the nature of the country passed over will be found in the Appendix extracted from the Officiating Deputy Superintendent's report. Atlas Sheets Nos. 90 and 105 are materially benefitted, and the latter almost entirely filled up, leaving but a very small area to complete the south-west corner of the Chota-Nagpore Division, and to form a proper junction with the old Ganjam and Orissa Division Survey. The total area of final survey completed amounts to 3,373 square miles, as detailed in para. 110.

Amount of final topography executed.

115. Lieutenant Sale reports that the quality of the detail topographical survey executed is good, and has been very carefully tested in the field.

116. The total cost of the season's operations amounts to Rs. 43,763, inclusive of the cost of triangulation in advance of topography.

Cost of the season's operations.

117. After a long march through the extreme length of the Division, the entire party reached recess quarters at Dorundah late in the month of May. This survey having now extended so far westwards, and occupied the Central Provinces jurisdiction, the head quarters for recess will

Recess duties.

be removed for the future; Jubbulpore forming the rendezvous and most convenient depôt to march from. The recess duties will be removed to Mussoorie, where it is most desirable not only to recruit the health of the party, for so many years isolated in unhealthy tracts, but for the purposes of departmental supervision and amalgamation with other executives, whereby alone excellence of style and uniformity of rendering the results for publication can be attained.

118. The usual professional computations and fair mapping have been completed, *viz.*:—

2 Horizontal Angle Books in duplicate.
2 Vertical ditto ditto.
Computations of principal and secondary triangles, latitudes, longitudes and heights, with synopsis of results, (duplicate).
Computations of principal and secondary triangles, latitudes, longitudes and heights, with synopsis of results, fair for General Report volume copied in part.

Mapping.

Standard Sheets (1 inch)	...	...	...	...	9
Exaggerated for reduction (1 inch)	...	...	...	...	1
Chart of Triangulation, scale 4 miles = 1 inch	...	...	...	...	2

119. During the field season, the health of the party was not so good as usual, partly caused by the lateness of the rainy season of 1869 and partly by the unusual amount of rain which fell in the cold weather, but principally by the very unhealthy nature of the country under survey. The jungles of Mahtin and Northern Belaspoor have an evil reputation, and although there were no cases of a very malignant type of fever, yet there was scarcely a single individual in the Deputy Superintendent's camp who escaped without being more or less attacked, and in most cases by a fever over which quinine seemed to have no effect. The healthy plateau of the Chota-Nagpore Division having been left behind, greater difficulties have to be expected, Lieutenant Sale states, both in the nature of the ground to be surveyed, the health of the Surveyors and the supply of labor, than hitherto experienced.

120. Lieutenant M. T. Sale, the Officer in charge, suffered severely from the effects of malarious fever contracted in the jungles above described, and was consequently compelled to seek complete change of air, for which purpose he obtained two months' privilege leave to visit Mussoorie; I therefore availed myself of his presence with the other Topographical Parties recessing in the hills, to procure his assistance in the completion of the fair mapping and redrawing of several sheets of the late Mr. Mulheran's Survey for the reasons already explained in para. 90 of this report, and the aid thus rendered by Lieutenant Sale has proved most advantageous in every way, and will enable me to publish new editions of the whole of the Sauthpoora range sheets in a greatly improved form and in one uniform style.

121. During the employment of Lieutenant Sale on the above duty from June to October, the routine recess work at Dorundah was conducted under the immediate superintendence of Mr. G. A. McGill, the Senior Surveyor attached to the party, with great judgment and discretion. Lieutenant Sale remarks in high terms of praise of Mr. McGill, and the efficient assistance he renders both in field and recess duties at all times. Mr. McGill having also qualified by length of service, was promoted to fill an existing vacancy from 3rd to 2nd Grade Surveyor from the 1st January. Mr. A. James has also been reported very favorably on, and was promoted from 3rd Grade to 2nd Grade Assistant from the 1st of September 1870, having served three years and eight months in his old grade.

General remarks on the season's out-turn.

122. The results obtained, *viz.*, 3,440 square miles of triangulation in advance and 3,373 square miles of topographical delineation, is exceedingly good; in such a country, a larger out-turn could not have been expected even under more favorable circumstances, which is highly creditable to Lieutenant Sale's exertions. The expenditure of the party has also been well controlled, and contrasts favorably with that of previous seasons.

Programme for the current field season.

123. The triangulation during the ensuing season will be extended northwards from the parallel of 23°-15′ through the Talook of Sohagpoor belonging to the Native State of Rewah, and will connect with the triangulation of No. 5 Topographical Party, Rewah Survey, about the parallel of 23°-45′. The detail parties will be employed in the northern portion of the Belaspoor District between the meridians of 82° and 83° and north of Korba and Tartuma.

Home Department Notification No. 483, dated 30th December 1870.

124. Major G. C. Depree, Deputy Superintendent, 1st grade, who had for many years conducted the operations of this party, returned from furlough on the 9th December 1870, was re-posted to this party, relieved Lieutenant Sale on the 9th December 1870, and is now conducting the operations.

125. Owing to the reduction of the Department for financial reasons, Lieutenant Sale's transfer to the Public Works Department has been sanctioned by Government from the month of March next, and he is, pending his transfer, employed at my head quarters in redrawing the hilly ground of a few of the remaining fair maps of No. 2 Topographical Party, Central Provinces Survey, a duty for which his artistic talents as a delineator of ground specially qualify him. I avail myself of this opportunity to bring to the favorable notice of Government the good services rendered by Lieutenant Sale during the 4½ years he has been attached to the Topographical Survey Department. He possesses superior professional qualifications, and has always proved himself a valuable executive officer. His well known talents as a topographer have been turned to excellent account in training subordinates and improving the style of mapping of both No. 4 and No. 2 Parties, and I regret exceedingly the loss of his services to this Department.

Home Department, No. 323, dated 31st August 1870.

126. Captain W. F. Badgley, Assistant Superintendent, having returned from furlough* on the 20th January, has been posted to this party, which required a Military Assistant.

*G. O. No. 1230, dated 23rd December 1868.

No. 5.—TOPOGRAPHICAL PARTY.

Bundelcund Survey.

127. The operations of this party for the season under review lay within the Native States of Bundelcund marginally named; the topographical details taken up extended westwards from Longitude 80°=30′, between the parallels of 23°=50′ and 25°, and the triangulation in advance was extended westwards from Longitude 80° to 79° between the parallels of 24° and 25°=15′.

Bundela States.

Punnah, Chutterpoor, Dijawar, Adjegurh, Jusso and Chirkaree.

Strength of the Party.	Sq. Miles.
Capt. R. V. Riddell, R. E., Dy. Supdt., 3rd grade, in charge.	
Lieut. J. R. Wilmer, Probationary Asst. Supdt. ...	116
Surveyor.	
Mr. A. Chamarett, 2nd grade	334
Asst. Surveyors.	
Mr. A. J. Wilson, 1st grade	338
„ C. F. Hamer, 2nd grade	104
„ C. Kirk, 3rd grade	259
„ E. A. Wainright, 3rd grade	271
„ H. Kitchen, 4th grade	271
„ W. H. Lilley, 4th grade	240
Sub-Surveyors.	
Nubee Bux	333
Prem Raj	204
Abdool Ruhim	347
Abdool Ruhman	136
Total ...	2,953

128. The petty states through which the survey was carried had been suffering during the past year from famine, and a good deal of sickness prevailed in some portions of the country. The ground was difficult for detail survey, being a succession of long, parallel, forest-clad ridges and valleys, running from north-east to south-west, formed by the Bundair and Bindaichal Hills, through which the Cane or Kian, Patna, Sonar and Biarmi Rivers run, a tract which required careful survey on getting at the details.

129. The area of topography completed covers 2,953 square miles, in addition to which two large scale surveys (12 inches to the mile) of the forts and towns of Punnah and Adjegurh have been completed. The topography was carefully tested and examined in the field by check routes, and the Deputy Superintendent in charge reports very favorably of the accuracy of the work.

Area topographically delineated.

130. The triangulation was completed over an area of 3,052* square miles, of which 700 square miles had been partially fixed and laid out during the previous season. The points in advance are therefore ample.

Triangulation in advance.

	Sq. Miles.
*By Captain Riddell ...	... 1,067
By Lieutenant Wilmer ...	„ 715
Mr. Chamarett ...	... 500
„ Hamer ...	... 770
Total	... 3,052

131. Observations were taken at 56 stations, from which 325 positions were determined, or one point to every 9¼ square miles of ground; 872 heights were trigonometrically determined, of which 220 were of obligatory points, the general average being one elevation for every 3½ square miles.

132. The usual professional computations in duplicate, with the exception of the angle books, which still remain for transcript, were completed during the recess, *viz.* :—

Recess work.

2 Sets computations of triangles, latitudes and longitudes of 1st and 2nd class secondary points, computations of heights.
1 Fair copy General Report, volume II, for half Degree Sheets X and XI.

Maps and Charts.

8 Fair standard maps (scale 1 mile = 1 inch).
2 Plans of Adjegurh and Punnah (scale 12 inches = 1 mile).
2 Charts of triangulation (scale 2 miles = 1 inch).
81 Published sheets (1 inch) of Rewah and Bundelcund, colored.

133. The total cost of the season's operations amounts to Rs. 55,267-5 on the out-turn of final survey and triangulation in advance.

Cost of the season's operations.

134. This party has executed a very full season's work at a very moderate cost. Captain Riddell has carefully supervised the work of his subordinates, and taken an active share in both field and recess duties, and the very moderate cost attained is entirely due to his exertions in keeping down the expenditure of the party in the field.

Opinion on the season's work.

135. The progress of the recess duties was carefully watched by myself, and frequent inspections made of the office of this party with great satisfaction, and I have full reliance on the general results which have been very admirably brought up, displaying great care and judgment on the part of the officer in command, as well as laudable zeal and assiduity on the part of the subordinates. The amount of work rendered, proving a very arduous season's labors.

Inspection of the party.

136. The Deputy Superintendent reports in favorable terms of the services rendered by Lieutenant J. R. Wilmer, Probationary Assistant Superintendent, who was posted to the Department under the orders of Government marginally noted. This was Lieutenant Wilmer's first season in the field, and during it, he has ably assisted Captain Riddell in every duty connected with the working of a survey party in difficult ground, and has taken a full share during the recess in the season's fair mapping and professional computations. This promising officer having passed a most successful examination on the completion of his year's probation, was confirmed in his appointment from the 28th August 1870 by the orders of the Government of India noted in the margin.

Home Department, No. 276, dated the 24th August 1869.

Financial Department, No. 3289, dated the 21st November 1870.

137. Mr. A. Chamarett, 2nd Grade Surveyor, has rendered very efficient service, and the Deputy Superintendent reports in high terms of praise of the satisfactory and able manner in which this Surveyor has assisted him.

138. Mr. Chamarett, after 18 years' arduous field service, has been transferred to do duty in my Head Quarters Office, to assist in the drawing, compiling and geographical examining branch, where the services of properly qualified and experienced Surveyors are much needed.

139. During the current season, this party will complete the topography of the unsurveyed portion of the Native States in Bundelcund, between the meridians of 79° and 80°, connecting on the north with the Humeerpoor and Banda Districts of the North-West Provinces, on the west with the portions of Jhansee, together with Jeithpoor and Mahoba Pergunnahs, and interlaced portions of Oorcha and Churkaree, Bundela States, executed by the Revenue Survey Branch, under the late Lieutenant Burgess in 1857, and on the south with the districts of Saugor and Dumoh of the Central Provinces, the revenue survey of which is also completed. The whole of Rewah and Bundelcund of the Central India Agency will thus be provided for, filling up gaps in the Atlas of India, which have so long remained blank in Sheets Nos. 69, 70, 89.

Future operations of the party.

140. The extension of the operations of this party to the Bhopal State, under the Central India Agency, having been approved by Government orders marginally cited, and the Deputy Superintendent having made arrangements for the accomplishment of the topographical details of the entire unsurveyed area in Bundelcund by the bulk of his establishment, under his Military Assistant, has broken ground himself in Bhopal, and commenced

Vide Home Department Order, No. 413, dated 28th October 1870.

triangulating in advance in this Native State from the east, emanating from the Great Longitudinal and Great Arc Series of triangulation of the Great Trigonometrical Survey, near the Saugor boundary, from which limit, a new division has been formed for the party, bounded by the parallel of 23½° North Latitude, joining on the 1st division, Gwalior Survey, as well as with the 7th division, Rajpootana Survey, and extending southwards to the parallel of 21°-30′ to the northern limits of Khandeish, embracing westwards portions of Holkar's territory, Indore, Mhow, Dhar, Amjhera, &c., to the meridian of 74° Longitude, so as to complete all that remains of the Rajpootana Agency in that direction.

141. This forms a compact and convenient division of territory for survey by this party, comprising sheets 53 and 36 of the Atlas, and is only separated from the old ground in Bundelcund by the Saugor District, whilst it leaves ample area for both the 1st and 7th division parties for many years to come.

No. 6.—TOPOGRAPHICAL PARTY.

Khasia and Garrow Hills Survey.

142. In paragraphs 172 to 176 of my last report on the administration of the topographical surveys of India, I remarked in detail on the circumstances which had led to an entire alteration, under the orders of the Bengal Government, in the plan of operations laid down for this party, as detailed in the margin, and which necessitated its diversion from the Naga Hills on the extreme east to the Garrow Hills on the west. This change caused the loss of much valuable time at the season most favorable for survey operations, and threw the main strength of the party at a late date into ground which had not been either reconnoitred or triangulated in advance, and in which the delineation of topography could not consequently be at once taken up.

Garrow and Naga Hills, North-East Frontier.
Strength of the Party.

Major Godwin-Austen, Deputy Supdt., 2nd grade, in charge.	Observed at 10 stations and selected and cleared others; completed also 515 square miles of reconnoissance on 4 inch scale.
Lieutenant R. Beavan, Assistant Superintendent.	Employed on triangulation, observed at two stations.

Surveyor.

Mr. N. A. Belletty, 1st grade.	Observed at 12 principal stations and selected and cleared others.

Assistant Surveyors.

	Sq. Mls.	
Mr. M. J. Ogle, 2nd grade	335	Also 650 square miles of rough reconnoissance and some triangulation.
„ P. J. W. Doran, 4th grade	341	Also 190 square miles of rough reconnoissance.
„ J. H. Wilson, 4th grade	384	
„ W. Robert, 4th grade	30	

Sub-Surveyors.

	Sq. Mls.
Nasiruddin	77
Gour Chandra	124
Total	1,291

Triangulation executed.

143. Under these circumstances, Major Godwin-Austen, Deputy Superintendent in charge, with the Assistant Superintendent (Lieutenant Beavan), and Senior Surveyor (Mr. Belletty), entered the Garrow Hills very late in the season, and commenced under the personal co-operation and valuable assistance of Lieutenant Williamson, Deputy Commissioner, triangulating from the meridian of 91° proceeding westwards, keeping between the parallels of 25°-10′ and 25°-30′ to fill up the southern portion of this long untrodden and totally unknown hilly tract. Unfortunately, Lieutenant Beavan's health failed completely while on this duty, and being unable to render any real assistance in the field, was sent down to head quarters by the officer in charge, preparatory to a general reduction of the establishment and to the entire stoppage of the operations to meet the financial diminution of the department estimate. The Deputy Superintendent and Mr. Belletty accomplished an area of 450 square miles, clearing and observing at 22 hill stations, which was effected with great ease and advantage as far as the political aspect of the duty was concerned, under the admirable arrangements and indefatigable exertions of Lieutenant Williamson who accompanied the party throughout, and gave great promise for the satisfactory completion of the whole tract occupied by the Garrows, which, for political reasons, has so long defied all attempts to penetrate and describe it.

144. In addition to the above, Mr. M. J. Ogle, Assistant Surveyor, who was detached in North Cachar, executed some trifling triangulation in connection with that of previous seasons towards the Eastern or Munneepoor Frontier, by which a few peaks in Munneepoor and South Cachar were fixed. The entire results of the season's triangulation obtained from observations made at 44 stations determined the positions of 120 points and 53 heights.

145. The altered conditions under which the party had to work necessarily affected the employment of the detail surveyors, and pending the completion of some triangulation in the Garrow Hills, they were sent out in various directions to square up the topography of previous seasons to the boundaries of adjoining States and Districts, so as to utilize the triangulation as far as possible, which had been completed in North Cachar and along the northern and southern face of the Khasia Hills, after which, they retraced their steps westwards, entered the Garrow Hills, and helped in laying down the southern boundary on Mymensing.

Area reconnoitred, and final topography completed.

146. The total area of topographical delineation completed amounts to 1,291 square miles, of which 350 square miles on the ¼ inch scale includes portions of the Naga Hill District and North Cachar, 152 square miles on the inch scale in the Khasia Hills, 77 square miles on the ½ inch scale in the Kamroop District, and 712 square miles on the ½ inch scale along the southern face of the Garrow Hills, including a survey of the boundary between Pergunnah Shooshung of District Mymensing and the Garrow Hills, on a scale of 2 inches to the mile.

147. A reconnoissance was then executed on the reduced or ¼ inch scale of the most difficult part of the so-called Independent Garrow Hills, occupied by the most unfriendly natives of about 705 square miles, and a very fair sketch of the country produced with far greater facilities afforded by the inhabitants than could have been expected, also in North Cachar and on the Munneepoor Frontier, an area of 650 square miles was finished in detail.

148. Major Godwin-Austen having for some time been an applicant for furlough to Europe, was delayed for a considerable period, and at length obtained it for two years, in the month of April 1870, but was then obliged to defer availing himself of it, as it was essentially necessary for him to complete the field work undertaken in the Garrow Hills, and which no one else could well take up at that time. Being, however, compelled to avail himself of the furlough allotted to him within a fixed period of the date of the General Order appearing, this officer, on the 26th March, delivered over temporary charge of the party to the senior Surveyor on the spot, Mr. N. A. Belletty, who, after bringing the operations to a close, was instructed to break up the Native establishment in conformity with the Financial Orders for the abolition of the party, and having disposed of all superfluous hands, brought down the European portion of the party to head quarters at the Presidency on the 10th July 1870, where the recess duties were conducted under the personal supervision of Captain Murray, Assistant Surveyor General attached to my office, at a much less cost than they could have been at Cherra-Poonjee. In this office also, great facilities were afforded in bringing up the mapping and computations by the reduced establishment, and under the circumstances of the loss of the officer in charge and the Military Assistant. At the close of the recess, it was contemplated to abolish the party altogether under the special orders of the Government of India to that effect.

Recess duties.

149. During the recess the following computations and maps were completed:—

Computations in duplicate.

Triangles	... 228
Latitudes, longitudes and azimuths ...	... 45
Heights	... 45
Angle books (fair) horizontal and vertical...	... 364 pages.
Abstract of angles	... 50 pages in duplicate.

Mapping.

Standard maps (½ inch scale)	5 sheets, completed. 2 do., partly do.
Exaggerated maps for reduction to ¼ inch scale ...	13 sheets completed.
Boundary survey (2 inches=1 mile)... ...	1 *fair trace in 2 sections.*
Charts of triangulation (¼ inch)	1 fair copy and 4 for office use.

150. The total cost of the party for season amounts to Rs. 45,033, of which Rs. 8,973 is due to contingencies, always excessive in these hills owing to the unreasonable cost of local labor and the trifling amount of work performed for the highest possible rate of monthly wages, daily rate of labor not being procurable at all. The expenses were confined to the lowest limits by the discharge of every hand at the earliest possible moment.

Cost of the season's operations.

151. In order to meet the necessity of the period for reduction of establishment owing to the financial difficulties of the Government, Lieutenant Beavan, Assistant Superintendent, was transferred* for employment in the Revenue Survey Branch of the Department from the 1st March 1870, and no officer was appointed to fill his place, so that, the salaries of a Deputy Superintendent and Assistant Superintendent were saved for seven months of the year.

* Home Department, No. 163, dated 11th May 1870.

152. The loss of Major Godwin-Austen's services at this critical juncture was exceedingly inconvenient and detrimental to the work in hand, as no officer was so well suited for conducting difficult explorations and making rapid reconnoissances of a country both physically and politically opposed to such operations. The Deputy Superintendent has done excellent service in these eastern hills, and I much regret his departure even for a time.

153. I am much indebted to Captain Murray for his supervision over the recess duties in connection with this party whilst in Calcutta, which he performed to my entire satisfaction.

154. Mr. N. A. Belletty merits my commendation, and has rendered good service as a triangulator in the field as well as a computer and excellent office assistant in the recess; and although but little effective work has been accomplished during the season under review, he has had a most anxious time and considerable difficulties to overcome. The small out-turn is in no way attributable to the establishment or to this department, but to unfortunate circumstances and counter orders, over which he had no control.

155. The Government of Bengal having very strongly urged the continuance of these operations for the completion of the Garrows and the remaining unfinished portions of the Naga Hills, as so obviously desirable, induced the Government of India to consent to the same, with an establishment on a reduced footing, for which purpose an extra grant of Rs. 25,000* has been made for the ensuing financial year, and the European nucleus of the party has therefore been retained and sent back to prosecute the work, after recruiting its native establishment, the whole of which had been previously discharged in the best way practicable. The extra expenditure entailed by these expensive operations are to be met out of the general savings from the department, and I trust, with rigid economy that the object in view may be carried out.

Future operations of the party.

*Financial Resolution, No. 1976, dated 18th July 1870.

156. The survey of the portion of the Munneepoor boundary conterminous with the Naga Hill District, which, owing to various difficulties and misconception of orders on the part of the Assistant Surveyor deputed to perform this duty, could not be executed last year, a party as per margin has again been detached specially to undertake the boundary survey, to co-operate with the Deputy Commissioner of the Naga Hills and the Commissioner deputed by the Government of Bengal to adjust the Munneepoor and Naga Hill District boundary. After completing this special duty, the Assistants have been directed to prosecute the usual scale survey or to make a reconnoissance of the Naga Hill District left undelineated last year, or of as much of the country between the meridians of 93° and 94°, and parallels of 25°-30′ and 26°-30′, as can be accomplished.

Mr. M. J. Ogle, 2nd grade Assistant Surveyor.
„ W. Robert, 4th „ „ „

157. Mr. Belletty with the head quarters camp started from Calcutta on the 23rd November and proceeded *viâ* Mymensing to the southern face of the Garrow Hills, entering the hills near Dalloo due south of Tura, the head quarters of the Deputy Commissioner. No triangulation in advance as a groundwork or basis for topographical delineation being ready, his first attention will be directed to the selection and clearing of stations. After the triangulation has been laid out, a reconnoissance will be made of the south-western and western portions of the Garrow Hills, or of all the country in the vicinity of Tura and south of it to the plains of Mymensing, and westwards to the boundary of Pergunnah Khurribarree of District Goalparah, which, I trust, will bring nearly the whole remaining tract under some sort of delineation or triangulation.

158. By the return† of Captain Melville, Deputy Superintendent, 2nd grade, from furlough to Europe on the 5th January 1871, I have been enabled to place a competent officer in charge of this party; he has proceeded *viâ* Mymensing to join the head quarters camp now in the vicinity of Tura, and will, it is hoped, be able to carry out the programme so well laid out and partially executed by Major Godwin-Austen.

†Home Department, No. 17, dated 20th January 1871.

159. The strength of the party for the current season will be as per margin; but the work is difficult and many things arise to prevent even fair progress for the money expended; except for the cordial co-operation and assistance rendered by both the Commissioner, Colonel Haughton, and the Deputy Commissioner, Lieutenant Williamson, nothing could be done. The best acknowledgments of this department are due to the above officers.

Captain A. B. Melville, Deputy Superintendent in charge.

Surveyor.

Mr. N. A. Belletty.

Assistant Surveyors.

Mr. M. J. Ogle.
„ P. J. W. Doran.
„ W. Robert.
Mr. J. McCay, Probationer.
„ R. A. Gibson, Probationer.

Sub-Surveyors.

Nasirudeen and Daliludeen.

No. 7.—TOPOGRAPHICAL PARTY.

RAJPOOTANA SURVEY.

NATIVE STATES.

Portions of Jeypore, Jodhpore, Udeypore, Serrohi, Tonk, Kotah, Boondi, and Ajmere.

160. The field operations of this party were resumed towards the end of November.

161. The ground for detail survey previously triangulated as described in paragraph 183 of last report was situated in the Native States of Kotah, Boondi, Jeypore, and Udeypore, within the degree square formed by the meridians of 75° and 76°, and the parallels of 25° and 26° comprised in Atlas Sheet 34. The topographical delineation of 2,066 square miles was completed, of which 52 square miles overlaps into the work of the Gwalior and Central India Survey, along the meridian of 76° East Longitude, which was necessarily taken up to establish a good junction between the work of the two parties. In addition to this, the survey of the city of Kotah, 387 acres, and city of Boondi, 628 acres, on the large scale of 12 inches to the mile, was completed. A detached survey of the sanitarium and adjoining plateau of Mount Aboo was likewise commenced on the large scale of 6 inches to the mile, on the special requisition of the Governor General's Agent, which has been under progress during the greater part of the recess, the triangulation having been laid down by Captain Strahan himself, connected with the Great Western Longitudinal Series of the Great Trigonometrical Survey, and this officer having likewise started the topography, and carefully instructed two well qualified assistants in the style of delineating the difficult ground on this scale, left them to reside at Aboo until the whole survey was completed, which, I am happy to state, has just been accomplished during the current season. The map of the northern portion admirably drawn by Captain Strahan has been rendered to this office and has been reproduced. The other portion will now be fair drawn, and the entire map published without loss of time.

STRENGTH OF THE PARTY.

Captain George Strahan, R. E., Deputy Superintendent, 3rd grade, in charge.

H. Horst, Esq., Assistant Superintendent, 1st grade.

Assistant Surveyors.			Square Miles.	
Mr. E. S. P. Atkinson,	1st grade	...	270	Also employed on triangulation.
„ R. Todd,	2nd „	...	313	
„ C. Tapsell,	2nd „	...	287	
„ F. Kitchen,	3rd „	...	193	Also employed on the survey of the cities of Kotah and Boondi and plan of Mount Aboo.
„ W. Stotesbury,	3rd „	...	167	
„ W. McNair,	3rd „	...	461	
Sub-Surveyors.				
Kalka Persaud		...	105	
Hurloll Singh		...	270	
	TOTAL	...	2,066	

Triangulation in advance of topography.

162. The triangulation of the general operations in advance was extended westward from the meridian of 76° from the Arumlia Meridional Series of the Great Trigonometrical Survey, between the parallels of 25°-5′ and 26°-5′ through portions of Udeypore, Mairwarra and Ajmere, and a series of 1st class triangles along the meridian of 74° emanating from the side, Kamragor Hill Station, to Raonak Hill Station of the Karrachi Longitudinal Series, Great Trigonometrical Survey, forming a quadrilateral and hexagon, was laid out and observed, covering a total area of about 3,537 square miles. Observations were taken at 62 stations fixing the position of 571 points, or 1 point to every 6 square miles of ground, and 431 heights were determined trigonometrically, giving on an average 1 height to every 8 square miles of ground.

Field work examined.

163. All the topographical delineation was duly examined and tested in the field by check routes, and the Deputy Superintendent reports well of the general style and accuracy of the work completed by every member of the party. The ground was for the most part easy and open, and it has been very carefully and well shown on the maps.

164. Recess duties commenced at Mussoorie on the 1st May 1870, when the usual computations, fair maps and charts as follows were completed, *viz.*:—

IN DUPLICATE.

- 9 Principal triangles.
- 116 Secondary do.
- 937 Second class do.
- 168 Deductions of latitudes, longitudes and azimuths.
- 227 Pages of horizontal angles.
- 132 Do. of vertical do.
- 2 Figures reduced by least squares.
- 11 Miles of traverses.

Standard maps, plans and charts.

- 2 Standard maps (1 inch) completed.
- 3 Standard maps (1 inch) half finished.
- 2 Plans of the cities of Kotah and Boondi on 12 inches to the mile, drawn for reduction to half scale.
- 1 Sheet plan of part of Mount Aboo (6 inch scale).
- 90 Copies of published sheet maps, colored.

165. In addition to the above, the general report volume of Degree Sheet 5 and chart of triangulation have been partly completed, and a very complete volume of the report on the triangulation of Mount Aboo prepared and furnished.

Cost of the season's operations.

166. The total cost of the season's operations from 1st October 1869 to 30th September 1870 amounts to Rs. 42,563, of which Rs. 7,458 is due to the large scale survey of Mount Aboo. The average rate per square mile struck on the above outlay, including charges for the triangulation in advance, and as well as the separate survey of Mount Aboo, is Rs. 24-3, or setting aside the cost of the latter, the average rate for the 1 inch scale survey would be Rs. 20-10 per square mile.

Opinion on the season's out-turn and expenditure.

167. The out-turn of the season, *viz.*, 2,066 square miles of topography and 3,537 square miles of triangulation, together with the large scale important survey of Mount Aboo, is exceedingly good, while the expenditure, Rs. 50,020-14, for the whole year is very moderate. These results reflect great credit on the management of Captain George Strahan, Deputy Superintendent in charge of the Survey, and prove, that by vigilant personal supervision and rigid economy, he has secured a maximum amount of excellent work at a moderate cost.

Inspection of the party.

168. During the recess, this party was repeatedly visited and inspected by myself, and it affords me the greatest satisfaction to bear testimony to the ability, zeal and systematic regularity with which Captain George Strahan conducts all the duties entrusted to him. I have repeatedly had occasion, in my annual reports to Government, to draw special attention to the excellent services of this able officer, and my opinion of his valuable services are strengthened by his continued employment. Captain George Strahan was promoted to 2nd Grade Deputy Superintendent by the orders cited in the margin.

Home Department Notification, No. 462, dated 19th December 1870.

169. Mr. H. Horst, Assistant Superintendent, has ably assisted Captain Strahan in every duty both in the field and recess. He is a most efficient, painstaking and zealous officer, and merits my best commendations.

170. I was much pleased to observe the steady application of the several members of this party to recess duties during my visits to Captain George Strahan's office. Messrs. Kitchen and Stotesbury are specially selected as deserving of praise for their successful exertions with the Aboo Survey, and Mr. McNair is likewise highly commended. Mr. Kitchen has received promotion from the 1st January, the date of his completing the usual qualifying period of service in his former grade.

171. The entire establishment is in a high state of efficiency. All the records are in perfect order, and the Deputy Superintendent has thoroughly succeeded in imbuing all his assistants with the zeal and energy which form so conspicuous a characteristic of his administration of this party.

Future operations.

172. During the current field season, the principal triangles will be extended from the meridian of 74° and connected with the Goorhagurh Series, Great Trigonometrical Survey, near the town of Ajmere, and to the north of that place for Degree Sheet 12.

173. The large scale survey of Mount Aboo has already been prosecuted to completion, and the topographical delineation of the country southwards of the regular survey of the Rajpootana States to the parallel of 25°, and from Longitude 76° westwards to Longitude 74°-30′ through portions of Boondi, Kotah and Udeypore, will be taken up.

* *Vide* Home Department Notification, No. 478, dated 29th December 1870.

174. Captain A. E. Downing, Assistant Superintendent of Survey, who obtained furlough to Europe on the 12th December 1868, returned to India on the 10th December 1870,* and owing to the Financial reductions in this Department, his services were placed at the disposal of the Department Public Works from the 16th December 1870.

175. Extracts from the Deputy Superintendent's report are given in the Appendix.

SURVEYOR GENERAL'S OFFICE,
The 18th January 1871.

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

APPENDIX.

APPENDIX A.

REMARKS PROFESSIONAL, GEOGRAPHICAL, & STATISTICAL,

BY

EXECUTIVE OFFICERS.

Extract from the Narrative Report of LIEUTENANT CHARLES STRAHAN, *in charge No. 1, Topographical Party, Gwalior and Central India Survey.*

NATIVE STATES.
Gwalior, Tonk, Kota, Boudi, &c.

The portion triangulated this year was in the southern half of Degree Sheet IX, the greater part of which is now ready for plane tabling, as well as northern part of Degree Sheet VIII. There has been no principal triangulation this season, as my work was all round the Sironj base line, and consequently, included stations belonging to four Trigonometrical series, so that it was only necessary to break up the large triangles, and to fix intersected points. I found some difficulty amongst the stations of the Karachi longitudinal series, from the trees having grown up to such an extent that several of the rays were no longer visible. At Losalli Great Trigonometrical Survey, from which there should have been five principal stations visible, I could only see one, even with heliotropes, all the other rays being now obscured by trees. Rampú Great Trigonometrical Survey and Tinsia Great Trigonometrical Survey had both been dug up, but some of the masonry of the platform was found sufficient to enable me to judge of, where the mark-stone was, within I should say, one or two feet at the outside. On most, I found the masonry pillar built over the mark-stone according to the orders received from the Superintendent, Great Trigonometrical Survey. I have sent to the Great Trigonometrical Office a memorandum showing the state in which I found the different Great Trigonometrical Stations I visited. The country in which Tinsia Great Trigonometrical Station and Agar Great Trigonometrical Station are situated, is by no means suitable for triangulation, and it was only by means of very close reconnoitring that I could fix on stations. I had not time this year to observe from these 2, but I anticipate considerable difficulty in picking up poles or trees in their neighbourhood. The whole place is one mass of jungle, with small hills all about the same height, and undulating ground, with a few large khos or valleys intersecting it. The village of Tinsia is now quite deserted, a ruined fort being the only remnant left of it. There are no other villages near, and it was only after some hours' search that I found the station; my guide never having heard of it. There was also rather troublesome work about Jajon, Hatni, and Ramnager Stations, but I was enabled to get more commanding situations for observing from. About Sironj, the country was of quite a different character, being highly cultivated and open; but as it was very flat, it necessitated making more 1st class secondary stations, than would have been the case otherwise.

* * * * * * * * *

Another thing was the unhealthiness and great want of good drinking water in parts of the country, more especially in Lieutenant Holdich's 2nd table, No. 126, the western border of the Shahabad jungles. This and the section on the east, No. 128, are very flat, and, except in the neighbourhood of the few villages, where there is a little cultivation, are covered with jungle. In the early part of the season, high grass added much to the difficulty of survey operations. Through the western one, ran several streams of water lined with beautiful green trees and under-growth, forming a striking contrast to the burnt-up arid appearance of the jungles around them. The water is beautifully clear and apparently good for drinking purposes, but if constantly used, fever was sure to ensue. I attribute my attack of fever in great measure to having to depend on one of these streams, where it left the jungle. The natives suffered much more severely than we did, as they drink so much more water and take no precautions, such as boiling or filtering. One klassee died in Agra from fever, and many took leave and went to their homes utterly broken down.

Lieutenant Holdich's plane tables, Nos. 50 and 126, were both very difficult; the first near the Jhansi boundary had a good deal of detail, and on the top of the range of hills, and also in many other parts there was a great deal of forest land necessitating traversing. His second table No. 126, I have spoken of before; it was surveyed throughout with the chain. His outturn appears small on paper, but considering the nature of the ground and the great amount of sickness in the latter part of the time, I think it is a good season's work. The ground is well shown, and the maps are neatly drawn. To show how hard it is to judge of a man's outturn without knowing the nature of the ground, I may mention that when he was in the Rajpootana Survey Party in 1866-67, he plane-tabled over 500 square miles, besides some check traverses, and he states that he had harder work to survey 203 square miles this season, than he

had during the whole of that season. On one day before he closed work, he was unable to go out, as all his klassies were ill with fever. In recess, Lieutenant Holdich has computed with me all the first class triangles, their latitudes and longitudes and heights, incorporating them with last year's work, a great deal of which we have re-computed, in consequence of a change in many of the basis. He has also computed all the interseeted points and their heights, and drawn the hill shading of 2 standard maps, besides other small jobs, such as coloring photo-zincographed standards sheets.

Extract from the Narrative Report of F. B. GRIDLESTONE, Esq., *in charge No.* 2, *Topographical Party, Central Provinces Survey, for season* 1869-70.

Sathpoora Range, Baitool, Chindwarra, Balaghat, &c.

Remarks on the country triangulated in Balaghat

The nature of the country triangulated will be best gained from the notes compiled and attached. The triangulation executed by the officer in charge was chiefly along the valley of the Wyngunga, on the western slopes of what are called the high lands of the district, while that done by Mr. Neale was extended also over the Lanji plains, south of Boorah, the civil station of Balaghat. All the above tract is very malarious up to the end of February, and entrance into it much dreaded by the Natives. Even those of the district (notwithstanding the exertions made with them by the Deputy Commissioner, Captain Bloomfield, in our behalf) could hardly be induced to enter the hilly tracts or to assist us in any way in clearing hills or carrying loads, although offers of very liberal payment were made to them. The hills in the latter tract are isolated, but lie in flat very jungly country; the dense bamboo forest all over this district, added enormously to the expense and time taken in clearing stations for purposes of triangulation. The coolies we did manage to get hold of, were constantly running away, and the kalassies employed in superintending them continually prostrated with fever. The wildest portion of the district is at its north-east corner, where it adjoins Mandla and Belaspore. The triangulation of all this portion was arranged with much difficulty by Mr. Chennell, Senior. A cleared high tree, (which in such forest-clad country makes a magnificent signal and is about the most economical,) has been left on every prominent hill in the country. Tiger and bison are plentiful in these parts, and create great ravages both upon the inhabitants and crops. Many of the small villages above the ghats have been deserted in consequence.

Remarks on the country plane tabled in Chindwarra.

After constant marches through the lovely undulating and well wooded plains in Baitool and the western portions of Chindwarra, it was quite a contrast to enter the wild and almost unknown tract which came under detail survey during this last field season. The remainder of what are styled the hill jagheerdarees, originally thirteen, but now twelve in number, was the block comprising the season's operations. Peopled as they are chiefly by Gonds and other aboriginal tribes, and nestling among the wildest and most lofty parts of the great Sauthpoora range, many of which had never been hitherto penetrated by Europeans, the work among them, though arduous and very trying to health, could not help but prove most interesting and exciting. The three jageerdarees remaining for topographical survey were those of Hurrye, Pagara and Sonpur or Khapa, comprising an area of under 1,000 square miles. The former was one of those originally held by a family of Mowassees or Koorkoos, the heriditary guardians of the cave of Mahadeo in the Pachmari Hills. The chief duty of these guardians appears to have been that of levying a tax on all pilgrims attending the annual fair at Mahadeo, and afterwards worshipping at that ancient shrine. Owing, though to continual outbreaks of cholera among the crowds, who then congregated, and the disease being thus spread on their return to their homes, over the rest of the country, this fair has since been abolished, and the jagheerdars have in consequence lost a large slice of their former revenue.

The Hurrye Jageerdaree is now held by Thakoor Chuttersah, and consists of about 240 villages given to his ancestors 200 years ago by Bakhut Biland, Rajah of Deogarh, for assistance given in the wars of those times. Much information could not be learned about this jagheer, owing to the sanad and other important papers having been lost from the family during the reign of Appa Sahib, when constant raids on his palace were made by freebooters. Much of the wealth of this ancient Thakoor disappeared during those dark times. The country then was even wilder and covered with more dense jungle than it is now, though even yet the hard exertions of the six Thakoors who have since sat on the guddee, have succeeded but little in reclaiming portions of this great wilderness.

The character of such parts of the Jagheerdarees of Pagara, Hurrye and Khapa as came under topographical survey during the last season were, as usual, wild, hilly and very unhealthy. Little can be added to the description given of them by a settlement officer, who visited them several years ago. Nearly half of the villages are still uninhabited, and their lands waste, and the country generally may be described as a barren wilderness. Here

and there are oasis of cultivation, but much labor would be requisite to develope their fertility. It is doubtless, owing to the wild and impracticable character of the country, and the great unhealthiness of its climate, that it was so long ago given over as an asylum for wild Gond chiefs and their retainers, who alone could flourish under conditions incompatible with the existence of more civilised races of men. The general nature of the country is hills of varying altitude, with intermediate valleys, a scanty population, little skilled in agriculture, more inclined to drink than to work, and the fewest possible means of intercommunication in the way of roads.

It is in the area comprising this last season's work that the great Sauthpoora range begins to break up into lower ridges, and on these their eastern slopes, the ground becomes very confused and broken up, more especially so in the Hard and the Shakar River valleys in plane tables 37,38, and 40, surveyed by Messrs. Scanlan and Maine. In the only open country to be found in this tract, and situated in latitude 22°-36'-53" and longitude 79°-15'-57", lies Hurrye, the ancient and well known capital of the district, and at a height of 2,013 feet above sea level. Here it is that the Thakoor and his chief officers and attendants live. This village lies on a rough track running from Chindwarra to Nursingpore, 48 miles from the former, and 27 miles from the latter, civil station. Beyond a few banias, kumars and coarse workers in silver, there is but little trade or manufacture in the town, which is simply a cluster of 53 mud huts, two or three pucca and tiled houses, and a large pucca square building in which the Thakoor lives and transacts all his kutchery work. Great hospitality and attention is however paid to all Europeans entering his district, and whatever he could do, was done by the Thakoor towards smoothing the many difficulties which necessarily arise in the survey of his wild dominions.

The highest range met with during the season, enters Mr. Farrell's board No. 39, in about latitude 22°-22', from whence one fork of an average height of 3,300 feet stretches away to the north as far as the north-western corner of plane table 38, picking itself up on the eastern side of the Shakar river, and running at an average height of 2,200 feet in an eastward direction for 10 to 15 miles; and another fork having run for a few miles due east on the parallel of 22°-22', turns up due north on the meridian of 79°-7', breaking again into two ranges, one of which culminates in the well known peak of Tuyapani in latitude 22°-43'-32" north, and longitude 79°-17'-9", and 2,328 feet above the sea level; and the other breaks off eastwards in the Ghungsa range, from which debouch the lower ranges of the Sauthpooras in the Seonee, Mandla and Balaghat districts.

The general appearance of the country contained in these three plane tables is arid, barren and very unprepossessing. It is broken up by multitudinous small streams and scarped ravines, whose tortuous and erratic courses took up much time to delineate accurately.

To survey these was one constant ascent and descent, up and down hills and ravines, covered with very dense jungle and grass from 4 to 10 feet high. In such ground it is difficult to pick out properly such features as scarps and precipices and abrupt slopes, which add so much to the character and beauty of a map, from the simple reason, that they were all quite hidden by the dense grass and jungle. The Hard and Shakar Rivers, both tributaries of the Nerbudda, are the chief drainers of this intricate tract.

These rivers often flow in very deep, narrow, rocky gorges. In many places, they contract from fine broad streams of 50 to 100 yards in width, to what look like narrow canals of about 25 feet only confined between sandstone walls several hundred feet in height. Every few miles there is a sudden drop of 10 to 20 feet in their bed, causing most picturesque water-falls.

These remarks especially apply to the gorges in which these two rivers burst through the last chain of the Sauthpooras, 20 miles north of Nursingpore, towards the Nerbudda valley. Here, in many places they run through clefts of only a few feet wide, which could be bridged by a man standing over them. These clefts though are hundreds of feet deep, and it is giddy work looking down them at the stream impetuously rushing through below. The scenery round these gorges is singularly wild and beautiful, but difficult to delineate on a small scale map, from its confusion and intricacy. The hills are broken up into endless small ranges and plateaus, and traversed by numerous small streams and dry water courses.

To the south, in plane tables 39, 35, 36 and 42, executed by Messrs. Farrell, Chennell junior, Ram Chunder and Shaik Omer, the hills become much bolder. The country rises by two successive steps to the high plateaus, on which are situated the large villages of Sonpur and Khappa, nearly 3,000 feet above sea level, or nearly 1,000 feet higher than Hurrye, and 2,000 feet higher than the Nursingpore Valley. To their westward, in about the same latitude, in plane tables 35 and 34, are the still higher plateaus, on which lie the villages of Chindi, Sidoli and Gonawani, all belonging to the Pagara Jagheerdar. These average 3,800 feet in height or nearly 3,000 feet above Kamptee and 1,500 feet above the civil station of Chindwarra, for which stations the two former would, it is believed, with proper buildings erected, make excellent sanitaria. They are level, open, cultivated plateaus, free from jungle of considerable area, easily accessible from the south, and many degrees cooler even than

the civil station of Chindwarra. From these plateaus, which are the watershed of the country, the drainage falls on the north into the Nerbudda, and on the south into the Pench and Kanhan, tributaries of the Wyngunga River. A few miles to their south, the country again falls to the level of the regular Chindwarra plateau by a ghât of about 300 feet, running for many miles along the parallel of 22°-15′ north.

Inhabitants.

Various tribes of the Gonds are the chief inhabitants of these tracts. Their peculiarities have often been described by more competent observers than myself; I have, however, appended to this report an interesting account drawn up by Mr. C. Scanlan, of one of their tribes called Bharias, of whom but little notice seems to have been taken by former writers, on the manner and customs of aboriginal tribes.

As may be imagined from their habit of dhya cultivation, which requires a new patch of land to be taken up every year, all these various tribes are wretchedly poor, and of a very migratory description. Their little villages are constantly abandoned and again colonized in a sort of recurring cycle.

Though the poverty of the population is so great, yet there is no actual want or distress. The wants of the people are very few and are easily satisfied, but the need of more nourishing food is apparent in the small stature of the men, and their apparent deficiency in muscular power. As is well known, however, the Gonds possess great physical endurance, and can undergo any amount of toil after their own fashion, such as in felling timber, or clearing land for dhya cultivation, while at the same time they are very averse to industry of a more steady character.

The amount of grain raised does not nearly suffice for the maintenance of the population, many of whom have to eke out a livelihood from the wild fruits of the jungles; during the harvest months, many of them resort to the valley of the Nerbudda, where there is a large demand for labor, and from the wages so earned, they are enabled to buy a few clothes and bring back a small stock of wheat to add a relish to their usual poor and monotonous fare.

Roads.

The only track, worthy of such a name as a road, is that leading *viâ* Omerwara and Hurrye, from Chindwarra and the south to Nursingpore. There are however no less than four difficult ghâts to ascend and descend in this short distance of 80 miles. A large Bunjari traffic in salt and grain carried on pack bullocks was noticed winding its way along this track all through the cold weather. It is difficult to imagine how any but very lightly laden animals can get along such a rough and toilsome route. Another track, *viâ* Gonawani, goes from Chindwarra to Delakhari over the Mohtoor plateau, and thence on to Bunkheri, a station on the Great Indian Peninsula Railway, 100 miles west of Jubbulpore. Then there is another well known track from Pagara, a large village in plane table 36 *viâ* Sonpur to Khapa and from Khapa eastward to Hurrye, and another from Khapa westward over dreadful hilly country to Delakhari. All these routes, as may be imagined from a look at the maps of the tracts which they cross, are totally unavailable for wheeled traffic, but are the only means of intercommunication this wild country possesses; nor could they be improved much without great labor and at considerable expense.

Minerals.

The debris of iron-smelting places were noticed all over the detail block of work, and the rough hatchets and spears of the villagers are all manufactured on the spot.

At the confluence of the Hard and Shakar rivers, 2 miles south of Delheri village, in plane table 37 an outcrop of coal was found by Mr. Scanlan, running in a north-easterly and south-westerly direction. It is at first visible in the scarp which lines the right bank of the former river and lies in various thicknesses between layers of sandstone. Locally it is known by the name of Sammanjnij, and it was while hunting for other treasures that this stratum was come upon. The place is probably known to the Geological Survey Department, as it is not many miles south of Mohpani, where collieries have actually been established by the "Nerbudda Coal Company."

Another substance called by the natives salajit, but whose European name is unknown to me, was also found near the village of Delheri. This article appeared to be a kind of salt, and is much valued by the natives. It is only found by the Barias, who keep its whereabouts very quiet. It was generally noticed oozing from the sandstone rocks forming eventually into incrustment by the action of the sun and air. It is of a dirty white color when so dried, and to the taste a biting acid. It is greatly esteemed by the natives as a successful lotion for ulcers, and also a valuable assistant in the healing of broken bones.

Products.

Catechu is extensively manufactured by a low caste of men all over the Hurrye District. It is got from the kair tree, and appears to be a very profitable article of trade. There is also a

considerable traffic in gum, honey and hulda and saj and sagon timber. Of the latter, which is a small kind of what we call teak, there are many large and valuable trees all over this jagheerdaree. By judicious thinning and pruning, the Raja might add greatly to his revenue from these forests. Tigers are very plentiful on the borders of Adagaon and Hurrye, and also near Tinapani, north of the latter village, where, as usual, the unfortunate inhabitants suffer terribly from the ravages they make on their cattle. Few indeed but surveyors know the misery and distress caused by wild animals in this country Many of the old inhabitants told me quite pitiful tales of the repeated losses they had sustained; how, after years of hard toil and self-denial, they had saved sufficient to buy a pair of bullocks, and then, how only a few months after their purchase, a tiger walked away with first the one, and then the other of them. Farming under such circumstances must be a hopeless kind of work. Moreover, as Gonds are always unwilling to point out the haunts of tigers to sportsmen for fear of offending their deities, there would appear to be but little prospect of relief for these unfortunate sufferers. Many herds of nilgai were seen to westward of Khapa, and also near Omerwara, and lots of pigs all along the banks of the Shakar River, as a rule, though I do not think that in this district wild animals, especially of the deer class, are as plentiful as in other parts of the Central Provinces. Of small game and the feathered tribe there is really next to none, as the Gonds spread nets for them in every direction. There is plenty of work, though in the fishing line, to compensate a sportsman for entering this district; all along the Shakar, good bags of maseer may be made, and again in the Pench River, south of Omerwara, one is always sure of sport.

Wild animals.

In concluding the above report, I would desire to place on record my great regret at having to give up, on its abolition, the charge of No. 2, Topographical Party, and also the regret I feel in the separation from the subordinates who have worked so well under my orders. For the last 15 months I have done my utmost, while laboring under many difficulties, to bring the party into a more efficient state, and trust, you may consider, that I have at least partially succeeded in doing so. I am greatly indebted for my success to the willing and hearty way in which all under my charge have carried out my instructions and wishes. A more zealous and honorable body of assistants it would be hard to find. For sixteen years, this topographical party has been employed in the survey of the most notoriously unhealthy and malarious tracts of Southern and Central India, completing during that time maps representing the enormous area of 26,580 square miles of country. Every member of the party has had to risk health and life while working in those malarious jungles, and I trust, that their long continued zeal and exertions, while performing their duty under circumstances of so much hardship and privation, may be prominently brought forward to the notice of the Government in your Annual Report.

Concluding remarks.

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*NOTES ON BALAGHAT.

Balaghat was only formed into a separate commission in 1867, by pergunnahs and talooks taken from the Districts of Seonee, Bhandara and Mandla.

Remarks on the country triangulated.

The civil station is situated at the ancient village of Boorha, lying in latitude 21°-48'-58", longitude 80°-13'-31", and situated about 1¼ mile east of the western bank of the Wyngunga River. No pucka civil buildings have as yet been built; there are, however, very flourishing schools and hospital, dispensaries and a kutchery established in kutcha houses. The native town (for it is rapidly developing from a village into a town) has been well laid out, and the whole station bears evidence of the great care and interest which the present Deputy Commissioner Captain Bloomfield takes in its welfare.

Many fine mangoe topes and old tombs and ruins about the place would lead one to suppose that Boorha was once a very large town. It has been well selected as the capital of the new district, for it lies on high open ground, capable of perfect drainage near the bank of the Wyngunga, which is navigable to Bhundara in the rainy season, and in the centre of a very fertile and highly cultivated tract of rice and wheat land.

Owing to the total absence of roads, and distance from other stations, the District of Balaghât was but little known till lately. The plains of Hattah, one of its now most fertile tracts, have indeed only been brought under cultivation within the present century, and the Ramgarh Bichwa tract and Mhow talook were, it is said, first taken in hand by one Lutchman Naik 40 years ago. The working up of these more distant parts of the district to the level of those nearer head quarters was the first object ordered to be taken in hand by Sir Richard Temple, and great progress has been made apparently in this work.

* Compiled from notes taken on the spot by Messrs. Girdlestone, Neale and A. Chennell, and also from notes supplied by the Deputy Commissioner, Balaghât.

Boundaries of Balaghât.

Balaghât is bounded on the west by the Wyngunga River, on the south by the Bagh Nuddee, on the south-east by the feudatory States of Kawarda, Khyragaon and Nandgaon, on the north by the Jubbulpore and Chuttesgurh road, and an imaginary line leaving that road between Bichwa and the Chulpee Ghât, joining the Wyngunga River about 60 miles north of the junction of the Bagh Nuddee.

Limits of Balaghât District.

The district lies between the parallels of 21°-8′ and 22°-15′ north latitude, and the meridian of 80°-3′ and 80°-55′ east longitude. It is thus about 76 miles long from north to south, and 45 miles in breadth from east to west. Its area roughly estimated is about 2,682 square miles, of which a large portion consists of forest-clad hills and broken undulating unculturable country.

Name, area and physical description of tracts.

The main mountain range which traverses the district, is a south-east projection of the Sauthpooras, and forms the greatest part of the Parswara tehsil. The highest point Dhakri H. S. rises to a height of about 2,736 feet above sea level, and its south-east extremity is just above Lanjee, from whence it dips towards the north and north-west or towards the valley of the Nerbudda. To the north-west the dip is conterminous and unbroken to the Parswara plateau and the Mandla border; but to the north, there is a sudden depression of about 200 feet, and in this are scattered the plains of Bhumlat and Sureyla.

In the south-west corner of Sureyla tehsil is situated the Teepagarh Hill, rising to a height of about 2,700 feet above sea level. This locality is the great strong-hold of the Bygahs, who have lived on and around it for many generations.

To the north of the plains of Bhimlat and Sureyla, rises the Bhaimsa Ghât range, an elevation of about 500 feet above the plains last mentioned. This range on its eastern flank turns northwards to Chiplee and attains a height of about 2,600 feet above sea level, culminating at Umerkantak in an elevation of about 3,300 feet above sea level.

To the west, the hills terminate within a few miles of the Wyngunga.

An irregular belt of hills and jungle-covered plains of about 20 miles in width, forms the southern border to the main range, which in the west terminates in stony ravines and sloping hills about five miles in breadth.

The geological structure is chiefly granite, with intermixture of quartz and mica. Trap is found on the tops of many of the hills in the Ramgarh tract.

Division of Balaghât into three parts.

Balaghât may be said to consist of three distinct parts—

1*st*.—Southern low lands, comprising Pergunnahs of Huttah, Dhumsoah, and Lanjee.

2*nd*.—The long narrow valley, known as the Mhow Talook, lying to the north of Sumapore, between the hills and the Wyngunga River.

3*rd*.—And the lofty plateau, on which is situated the Ramgarh Bichwa tract.

First part.

The first part is a slightly undulating plain comparatively well cultivated and drained by the Bagh, Sone, Deo and Wyngunga Rivers. On its northern and north-eastern edge, it is fringed with a belt of forest extending from about 1 to 5 miles from the base of the hills, and in various places along the banks of rivers which forms its southern and western borders. Here the country is so open that a clear view can be obtained from nearly every spot along the edge of the boundary streams. The soil is bad on banks of Wyngunga, but rich and alluvial in the valleys nearer the hills.

The second portion.

The second part is a long, narrow irregular shaped low-land country, composed of a series of small valleys interseeted with light granite hills covered with dense jungle, and having generally a run from north to south. From the main range to the Wyngunga, its breadth varies from 5 to 20 miles. The soil here is inferior, requires much water to produce decent crops. Irrigation, however, would be easy, owing to the undulating surface of the soil, and the nearness of the hills with their perennial streams.

The third portion.

The third part is a vast undulating plateau, broken into numerous valleys by irregular ranges of hills running generally from east to west. The general level of the valleys is 800 or 900 feet above the plains below, and nearly 2,000 feet above sea level.

By far the greater portion of these high-lands is covered with dense jungle. In a few places, such as around Bhiree, Parswara and Bhumlat, there are a few villages, but the

other inhabited spots are mere specks in the jungle, and simply collections of 10 or 12 Gond or Byga huts, which remain for about two years and are then burnt down, while the inhabitants emigrate in search of virgin soil. The soil is very varied, from richest alluvial to stony unculturable, nearer the peaks.

Hills

The district is almost all hilly in the third portion. The highest point in the district are the peaks about Lanjee, the Teepagurh hill and the Bhumsaghât range. In the plains of Dhansoah, Hutta and Lanjee, there are no hills, and in the Mhow Talook none worthy of particular mention.

Rivers.

The principal rivers are the Wyngunga, the Bagh Nuddee, the Deo, the Sone, the Nahra, the Ramgarh and the Bunjar.

The Wyngunga enters Balaghât District at its north-western corner, and thence flows nearly due south, until it enters the confines of Bhundara. It is a considerable stream even in the cold weather, and in the rains is from 150 to 400 yards in breadth. It is navigable from the village of Chiggaon from commencement of rains till the middle of October, and is the high road by which the greater part of the produce of Balaghât District finds its way to Bhundara and other large markets. Long streams of native boats may be seen passing down the stream at this season. There are unfortunately several rocky barriers in this river near Boorha Village.

The Bagh Nuddee flows into the Wyngunga at the south-east corner of the district, and for 40 miles forms the southern boundary of the district; a barrier having been removed five miles from its mouth, this river is now available for cold weather navigation.

Tanks.

There are none worthy of mention in the district, though they could be made at small expense and with great benefit to the rice cultivators; there are a few poorly constructed bunds close round Boorha.

Water-sheds.

Salutekri is the water-shed of both the Nerbudda and Godavery Rivers, as the Bunjur River rises near it and flows into the former, while the Deo Nuddee rising close by flows into the Godavery.

Soil.

Along the valley of the Wyngunga and generally all over the district, the soil is very rich and alluvial, scattered over large plains of light clay, mixed with sand; it is well suited for rice cultivation. It is only on the western, north and north-eastern borders that unculturable hills and ravines covered with dense jungle occur. There are many culturable plains with very fertile soil in the southern portion of the district.

Minerals and products.

Gold is washed from the Sone Deo and Bhag Rivers (by a race known as the Loanjerries of Chutteesgurh, who visit the district every year immediately after the rains) and from some of the other beds, but in very small quantities which hardly repay the labor spent on them. Iron is plentiful, and is smelted in the usual rough native way by the Gonds, and is sold in most of the bazars. Excellent building stone, especially granite, is found all over the district. Antimony ore is found near the village of Burwali in Balaghât, and red ochre about the village of Salutekri, in the Gandi Jemindari.

A peculiar soft and white sandstone is found on the Hila range, from which plates and drinking cups are manufactured and taken to the markets in the district where they fetch a ready sale.

The usual jungle fruits, lac, honey and wax are very plentiful.

Notes on the Bharias by Mr. C. Scanlan, *Assistant Surveyor.*

The Bharias.

I had the pleasure of contributing a few fugitive notes on the Gonds and Korkus of these hills, but this season I have come across a new branch of this family called the Bharias, concerning whom you will perhaps find the following interesting. I have not been able to determine anything of their origin, but I do not hesitate to place them in the Great Gond Family, of which they form a sub-division. In their language, and in some of their customs, they differ totally from the Gonds with whom they neither eat nor drink nor intermarry. I however find they acknowledge the law of lamjhana, which I described last year as imposing a servitude of a certain number of years on a man, who, wishing to marry into a family, could not afford to make the usual marriage settlement, and give certain presents to his bride's relatives. In their caste prejudices, they assimilate with the Gond in a hybrid sort of manner to the Hindu; and so

they will not eat the cow nor wild buffalo, but do not hold back from making food of the pig, the deer, nilgai and all such wild animals. In their marriage ceremonies, they follow suit with the other hill people and impose certain dues on the man marrying; for instance, a dowry from the husband consists of 200 seers kodo, 25 seers dâl, Rs. 7, a pagri, 12 hands long, 2 saris and 2 chotis; and further, when the wife goes to take possession of her future home, her relations have to be entertained with a feast of gur or a deep potation of liquor, to the amount of Rs. 2; the latter invariably, if to be found. When a marriage is about to be celebrated, they proceed to prepare an especial shade in front of the house where the ceremony will take place. A pole of Salai-wood (frankincense) is buried, and around it, so as to form a convenient square, are raised eight other props on which rests the roof, crowned with garlands of leaves and flowers. The middle pole of salai is called Bhoura. Notice is given to all friends when the marriage is to be consummated, and then it is that the bride to be, comes to her intended's village, and takes up her residence opposite to the house he occupies. It will be remembered I explained last year that the villages in these hills are always built in two rows. Both of them are well besmeared with haldi, a custom which I found extensively practised in the Deccan among all classes of the native population. The woman's friends make it a rule to arrive in the morning and the haldi is kept on till evening, but any time during the day the couple to be united are summoned and made to walk round the Bhoura seven times with their clothes knotted together. After this, the girl's father gives her a dowry, when the ceremony is supposed to be over. At night, all present, are entertained to a dinner, which is called Bhoura-ki-roti; Sagai-ki-roti, being the first held after arrangements have been entered into to accept the suitor's proposal; the third being called Chikla Mandi-ki-roti, given on the morning immediately after the marriage, when the girl's relations depart, and it is only after this third feast, that the husband gets possession of his wife. It is strange that when the newly married are blessed with an addition to their familys, they never even invite the young mother's relatives to come and see the child, but allow them to visit if the wish takes them naturally.

Their marriage ceremonies.

They burn their dead, and bury those killed by accident or wild animals; but those killed by a tiger, they will not even so much as touch. They put their relatives out of caste, but re-admit them on their giving a panchait dinner.

Their death ceremonies.

While worshipping the other gods of the Gonds, they hold the "Saj" tree as the impersonation of their chief deity. If you want to test the truth of a Bharia's word, break a leaf of the Saj, put it on his head, and ask him to repeat his assertion; if it be true, he will at once speak it again, if not, nothing will induce him to do so; at least thus spoke my deponent. Narain Deo is represented by a copper ring about an inch in diameter; Sãkrãi Deo by a twisted ring of iron about 2 or 3 inches in diameter; Khouria Khatarpar by a very diminutive stool, about an inch square with 4 legs and about 1½ inch high; Dulha Deo Durga is made of iron and supposed to be figurative of a peacock, it is hollow, and about 1½ inch long. Khutia Bhinsen only exists in name.

Their gods.

When Gonds, Korkus, or Bharias start together in their tilli crops, they take with them some ashes and Indian corn seeds, and as they go along, they keep making circles with their ashes, and place in their centres the seeds of the corn; this practice is supposed to keep away all the bad will of the Deos.

The gathering of the tilli crops.

Their women usually dress like the Gondhis, but if they can afford it, like the generality of Hindu women, and do not wear the ponderous brass ornaments in vogue amongst the former.

The dress of the Bharia women.

These hill people will not let the Lamjana sleep in the same house where his intended lives, nor do they let them converse more than is good for them; if, before they are married, they go astray, they are turned out of caste and the marriage ceremony is not gone through at all; but on their giving a feast after the expiration of three days to their punch, they are re-installed among their brethren as a weded couple.

The Bharia Gots or Clans number 18. Thãkãria, Chãlthia, Angária, Bhãrdia, Dãnriolia, Nãhãlia, Bagotia, Rothia, Gãngia, Paria, Méhénia, Pãchalia, Kurmia, Bijilia, Bãgdãria Khámãren, Goulia, Bagdia, Amoria.

The Bharia Gots.

Relating to the Khapa or Batkagarh Jagir, the following was narrated to me:—

The Khapa or Batkagarh Jagir.

The Gond dynasty was established at Deogar under Jutwa Raja, who was formerly a servant to the 2 Gouli brother princes, Rãmsur and Ghansur. By treason, he deposed them and took possession of the Gãddi, and then, to his assistance, came the three brothers, Ahã Bãnkha, Phonj Bãnka and Mãha Bãnkha, with a force of 2,000 men. During the conflict,

carried on between the opposing forces, Aba and Maha died, and the surviving brother Phonj Bănkha received as a reward for his services, the Bătkăgar or Khapa Jagir. After affairs had been settled and Jatra made quite secure on his usurped throne, he, together with his ally Phonj Bănkha, proceeded to the Nizamut Hyderabad and tendered their conjoint aid to him. They were directed to join the attack on Golconda or Bhăgnăgăr whose Rani revelled in the euphonious name of Năkti Rani Ching Moji Săng Moji. They took her possessions, and for this good turn, Jatwa received in marriage the Nizam's daughter. He of course turned Mahomedan and acquired the new title of Băkhăt Biland, when he returned to Deogurh and assumed the regal purple. His descendant, Suliman Shah Badshah, known as the Gond Raja, now resides at Nagpore, while Gopal Sing, the descendant of Phonj Bănkha, is the present Raja of Khapa, and is put down as the 14th generation.

Extract from the Narrative Report of Colonel G. H. SAXTON, *in charge No.* 3, *Topographical Party, Central Provinces and Vizagapatam Agency Survey.*

NATIVE STATES.
Kalahandy, Bustar, Jeypore.
Country triangulated.

The Saora country is, you are aware, occupied by tribes, who have hitherto resisted and resented all attempts of strangers to enter their territory. A few years ago the Ganjam Collector's tents were cut, whilst encamped in the portion belonging to that Agency, and on the Vizagapatam side the introduction of Police led to considerable losses of life on the Government side, and to severe measures for the punishment of rebels on the other. I rode through what was formerly the chief village of Putosingi, but which was some time ago burnt down by a Semi-Military force, and has not been re-occupied as yet. The whole country is now policed, but in the more unruly portions under Vizagapatam, the Police Stations are fortified, and precautions are necessary to secure strangers against hostility. Under these circumstances, my entire success is very satisfactory, and as I observed nothing to indicate any wish to interfere with my proceedings, I do not anticipate any unusual difficulties for the detail surveyors, who will take up the ground, and I hope to complete it next field-season. The area to be surveyed is roughly about 500 to 600 square miles. The features are bold, and will afford interesting subject for topographical drawing. The hills rise up to 5,000 feet on the eastern side, within a few miles of the sea. From "Mahendargiri" and neighbouring heights, the breakers can be seen for perhaps 50 miles along the coast. The cultivated plain between the sea, and the Saora country on the east, south and western sides extends at very slight elevation above the sea, close up to the hills, which rise abruptly. Fine cultivated valleys intersect the country. The principal one, running from the south almost into the centre of the gap, is only from 4 to 500 feet above the sea, but the others are much higher. The principal one in the north-west portion is about 1,400 feet, another in the north centre is about 1,600, and one in the north-east is 2,400. In this last-mentioned part of the Saora country, the villages are, some of them, as high as 3,500 feet. I have one village station 3,418. A peculiar characteristic of the country is the mode of cultivation. Some of the hills rising to nearly 3,500 feet, are cultivated to the top, and terraces, supported by stone revetments, often of considerable height and very substantially built, cover the hills and valleys, and are used for both wet and dry cultivation. It is said that the building up of these revetments is the work of the women generally. In one instance, the women and girls of all ages (all smoking tobacco), came to assist me in erecting a station mound of stones. This circumstance I noticed in contrast with my general experience, which has been quite the contrary, in the wilder portions of the country. Frequently not a single woman or child has appeared in or about the villages, as long as my camp remained in the neighbourhood. The Saoras are, like the other hill tribes I have so long been amongst, addicted to drinking to excess. An instance occurred at the last village I encamped at, where it appeared that every man, woman and child was drunk. The country in which our further triangulation (interpolating extra points) was done, is mainly in the detail maps now being submitted, some points come into the ground, which will be taken up next season. An inspection of the maps will show the peculiarities of the country. The chief features are extensive plateau, one running for about 12 miles, with a flat tree-less surface, averaging nearly a mile in width, and a general height above sea level of about 4,100 feet, and another of still greater height,* but not more than six miles in length. These plateau extend more or less all along the eastern side of the highlands, which in clear weather are visible from the sea, running parallel with the coast, west of the Ganjam and Vizagapatam Collectorates.

* In one part even above 5,000 feet.

Extract from the Narrative Report of LIEUT. M. T. SALE, R. E., *in charge No.* 4, *Topographical Party, Chota-Nagpore Division Survey, for season* 1869-70.

NATIVE STATES.
Sirgooja Peslepoor.
Remarks on the country passed over by the triangulation and detail survey.

The country passed over by the principal triangulation this year is of an interesting character, including the source of the Sone, the Johilla, the Nerbudda, and also tributaries to the Mohanadi.

The water-shed between the Johilla (a tributary of the Sone) and the Nerbudda, presents a very curious and deceptive topographical appearance to any one viewing the valleys of these rivers; it appears that the range of hills, which forms the water-shed between the two, dies away towards the west, and that the valleys coalesce and the rivers join. This appearance is deceptive; in reality, the Johilla takes an abrupt turn to the north, breaks through what appears to be a connected range of hills, and joins the Sone.

From this appearance, a strange old Hindu legend has arisen, which represents the Johilla as going to meet the Nerbudda in marriage procession, but becoming frightened, turning and running away.

The country taken up by the detail Surveyors was of a very uninteresting character and was for the most part low, undulating hills, covered with jungle, without any marked features, with here and there a tract of more fertile cultivated country; such ground does not admit of the rendering of much detail, and presents no great scope for hill drawing.

Extract from the Narrative Report of Captain R. V. RIDDELL, *in charge No. 5, Topographical Party, Bundelcund Survey.*

Bundela States.
Remarks on the country triangulated.

The northern half of the country triangulated about Mahoba, Chatterpore, Rajnagar, Isanagar, and along the right bank of the Dessan, was very favorable for triangulation, consisting, generally speaking, of a plain from which numbers of isolated hills and small groups of hills rise up to 600 feet or a little more above the plain. This will not prove so easy for detail survey however, for the greater portion of the ground between the hills is covered with thick jungle very troublesome to a plane tabler. South of Bijawar and Silon, however, the ground is hilly, wild, and covered with forest. Here the "Bindia-chal" range, on which Punnah, Kissengarh and the Great Trigonometrical Station of Kusmăr are situated, becomes much more broken, the steps and spurs are infinitely more varied, in both height and form. This portion of the country is very picturesque. The valleys well watered and more or less cultivated, bordered by slopes of every gradient, and numberless shapes form a striking contrast to the almost abrupt wall, or scarp, running from Rajgarh, almost to the eastern extremity of the Rewah territory; the pass through which the East India Railway runs, forms almost the only exception to the continuous scarp extending across more than two degrees of longitude.

Remarks on the country plane tabled.

The country plane tabled, starting from the Saugor road (for about 45 miles west of its junction with the great Deccan road) gradually rises from 1,200 feet on the eastern side, and nearly 1,400 feet on the western, to a nearly uniform height of 1,700 feet, on the eastern side about 35 miles, and on the western side about 16 miles from the Saugor road, forming a ridge, running from south-west to north-east, parallel to the Kaimore range; for this I have not been able to find any name, but it seems a continuation of the Bundair hills; locally it is known as the Pathar probably from the rocky character of the plateau. Through this ridge, two large streams, the "Cane" (or "Kian" as it is generally called in that locality) and the Patna with numerous smaller tributaries find their way northwards. This tract is very scantily populated and cultivated in proportion; the neighbourhood of the Cane River seems most favored. North of this ridge is an abrupt fall of about 600 feet, and then a valley about 16 miles in width stretches away parallel to the ridge. In this, the city and station of Nagode are situated. The valley is thickly populated and well cultivated in it; at about 12 miles to the west of Nagode there is a water-shed from 1,100 to 1,200 feet above the sea, running roughly at right angles to the direction of the ridges of the hills, west of which, the drainage runs off to the west into the Cane or Kian, and east of which the drainage goes east into the Satna. To the north of this valley, the ground rises again gradually to a height of about 1,550 feet, at a distance of 8 or 9 miles, and then again, there is an abrupt drop of about 250 feet; on various parts of this ridge, however, there are several isolated hills, such as those on which the Trigonometrical station of Talgoun, Akoula, Sarang and Dho are situated; these rise to 1,770 feet. This ridge is called the Bindia-chal range, and is chiefly covered with jungle; there are very few villages on the south slope of it. North of the ridge of the Bindia-chal range, there is a lower plateau from 1,300 feet to 1,500 feet above the sea, extending northwards from 3 to 8 miles in width, and then there is a fall of 800 feet on an average, at the foot of which Adjygurh, Kalinjir, Patar-kechar, &c., are situated, and from these to the valley of the Jumna there is no continuous ridge of hills; isolated hills appear, more or less thickly grouped, and the general level of the plain is between 500 and 600 feet above the sea.

Rivers.

The rivers met with in the season's work, are the "*Cane*" or "*Kiau*" which springs in the Jubbulpore District about 10 miles south-west of Sainagar, (a Thannah of the Punnah State) passes Sainagar and then runs on a northerly direction for about 22 miles, then turns to the west and follows that course for about 25 miles, when shortly after being joined by the "Patna" it takes a north-westerly direction, and being joined by the Sonar at the southern side of the Bindia-chal range, cuts its way through that range of hills, and then takes a north-easterly course till it reaches the Banda District.

The "*Patna*" springs to the west of "Boorabun" in the Jubbulpore District, enters Bundelcund to the south of Raipur, a Thannah of the Punnah District; then takes a north-easterly course through the hills for about 30 miles, and sweeps round to the north-west and joins the Cane. The "*Biarme*" which rises in the southern part of Dumoh or Saugor District, runs in a north-easterly direction till it joins the "Sonár", a few miles from the junction of that river with the Cane. From north of latitude 24° to its junction with the Sonár, the Biarme forms the boundary between the Dumoh district and the independent states of Bundelcund. There is no navigation on these rivers or boats larger than log canoes used at ferries, and by a few fishermen.

The "*Cane*" at Sainagar is a small stream about 30 yards in width before it enters the Bindia-chal range; it is over 300 yards in width, and crossed by a ferry at Singora after it emerges from the hills, it becomes a much wider stream from bank to bank over 500 yards, in general thickly studded with small islands.

There are numerous fords and ferries across the Cane during the cold season, the best of which are as follow:—

1 East of the village Sunbari on the road from Murwári to Khopa and along the foot of the hills (not a very largely used road).
2 At Sigasar, on the road from Kakarati to Khopa and Sainagor.
3 Between Mohov and Bhaiswara.
4 Near Tigra on the road from Saugor to Nagode. This is a road much used for traffic, beasts of burden being the means of carriage, and this ford is the best of those I have named.
5 Noughat, north of the Bindia-chal range, on the old road from Nagode to Punnah to Chutterpore and Nowgong, a good ford for carts, except during the rains, when ferry boats capable of carrying horses and cattle ply from bank to bank.
6 At Bariarpur, on the road from Rajgarh to Kartal.
7 At Bhanpur about a mile south of the village, on the road from Charkaree *viâ* Bachone to Adjygurh.
8 Directly north of Bhanpur, on the road from Kartal to Adjygurh, a good ford except in the rains used for carts, as well as for beasts of burden, there are other fords and ferries on the Cane River, which are locally used.

The best ford over the "*Sonar*" is south of the village of Koni, on the road from Nagode *viâ* the Tigra ford to Kissengarh.

The best ford over the "Biarme" is opposite Gaisabad, on the Saugor and Nagode road. There are, however, numerous others, at which cattle and foot passengers can cross, such as those near the villages of Ganiari, Mohona, Etma, Deori, Hardua, Chandrawal and Choto Bijawar.

Inhabitants.

The inhabitants of these Bundelcund States are, as far as we are concerned, very well behaved. Thanks to the assistance granted to us (at the intercession of Dr. Stratton, the Political Agent for Bundelcund) by the Chiefs of the States in which we were employed; we never had the least difficulty in procuring coolies of all descriptions at the current rates of wages, and I very rarely heard of any complaints against the members of the party or their camps; a few there were, but I lost no time in having the aggrieved parties righted, and, on the whole, I think our work was carried on as smoothly as possible.

Extract from letter No. 41*A*, *dated Camp Aghar Kote, the* 25*th March* 1870, *from Major* GODWIN-AUSTEN.

Garrow and Naga Hills.

As far as the accuracy of the geographical information now given is concerned, I may state that the work is based on the trigonometrical points, fixed this season on the Tura range of hills, Kylas peak, &c. The detail was all sketched on the ground from points on or near the line of route fixed by intersection of rays, taken on the plane table from the known stations previously observed at, so that the accuracy is superior to ordinary reconnoissance; all villages not actually intersected on the plane table are marked with a query, the greater number of these, however,

are within half a mile of the true position of the present village site, and in most instances mark that of the village clearing, only the most distant independent villages are inserted from native information.

It will be seen from this map, how small is the limit of the independent country, and how rapidly we may expect this to contract. The area covered by independent villages, I do not think can now exceed 200 square miles. The road to Seramphanghât strikes directly into the heart of it, and is known to the survey from the side of Baduri and Rongmagirri.

I have entered triangulation observed or in progress, and that proposed, which I trust will be eventually carried out, only one hill lying north of Kogiduk might be difficult to get to at present without a guard and the presence of the Deputy Commissioner. It was most satisfactory (it surprised me) to see the willing manner in which the Garos turned out at the summons of a single constable of the Garo Hills Police, and one heliotroper of this party sent by Mr. Belletty to clear the forest clad hill of Moonghri, when it is remembered that these very Garos of Khakwa-girri, Bowi-girri, and Neg Mundal were only last year independent. Every able-bodied man they could spare turned out, and proceeded eight or ten miles the distance of the hill from their village and remained there two days; this says a great deal for the people and the change that is coming over them; it appears certain, that intercourse and further acquaintance with Europeans is all that is necessary to bring these people into the same quiet state, as their neighbours in the Khasi Hills. Mr. Belletty speaks in the same terms of the willingness of the Garos he has come across, and who cleared Meimanram and other peaks for him. The good effect of our entry into these hills, there is no gainsaying, and it is much to be regretted that the Garo Hills have been so little visited for years past, almost up to the present time, by the many officers of Government residing in the districts adjacent, left to the Rajah of Shooshung, other petty zemindars and the Seem of Nongstein. Nothing but our absence in the hills can account for their having been so little known, and the people so little understood. The country presents no greater difficulty than North Cachar, if so great; in fact its features are less formidable in many ways, very much of the ground is level or undulating, broad flats extend along the courses of the valleys for long distances, and render a journey across the hills rapid and easy, the hills being of low elevation, the ascents are easy and short; only as we approach the Tura range does the country present a mountainous aspect, and even here it would be easy to carry a good bridle road. Two points present themselves, one near Meimanram, and another near Dapsigirri, the last is a low depression in the range and much traversed. The height of 35 villages and hills will be hereafter given from Aneroid readings.

In the upper valley of the Shemshang (Summessary) some splendid forests of sâl were seen, some of the trees of huge proportions; I have never seen finer any where. This timber, could it by any means be got out of the country, would be of immense value, seeing what a large quantity of timber is now annually required for the great works now in progress, and will be required for many years to come. North of Moonghri, in the valleys towards Meijol-girri, fine sâl timber covers large tracks standing in grounds, whence it could be transported with greater facility than elsewhere.

The Shemshang in the upper part of its course is a quiet sluggish stream, with an occasional small rapid, but these not of sufficient fall to prevent "kundas" ("dugouts") from being used all the way up from Shemshang girri to Sarramphanghat. Many of these canoes are to be found at the different villages along the banks. The breadth of the river is about 80 to 100 yards from bank to bank; water during the cold season kneedeep at the fords; below Shemshang-girri the hills rise and close in upon the river, and its course becomes less open, and the rapids are strong, and its bed filled with large rolled blocks. The scenery in the gorge, where it takes its great bend south, is extremely fine, particularly at Katchu, where the river has a very considerable fall and rushes through a deep cleft or fissure in the gneiss; it must here present a grand sight in the height of the rains, pouring over this sudden fall into the deep pool below. The Shemshang river receives a great number of tributaries, and drains a very large area; its water-shed lies far to the north; this area is close on 1,000 square miles. After reaching the limestone at Siju, there is a very apparent diminution in the body of the water, as seen higher up, during the cold weather, when the water is low. I attribute this to a large amount of water finding its way through and below the limestone strata.

The more elevated hills are still covered with heavy forest, the most extensive lying north of Koylas, the plateau east of the Shemshang and Tura range, from Dorengo to Meimanram and its continuation westward to Tura itself. Moonghri and its northern slopes are still covered with virgin forest, but the western extension of the water-shed towards Norek and Sokadum have long since been cleared, and extensive clearances are still being carried on. I noticed that the older clearings here on becoming exhausted and given up, are again covered with a dense scrubby jungle intermixed with bamboos, or grown over entirely with this last alone. The rank high grass which is to be seen replacing, the "joomed" land of the northern Cachar Hills, and which is so difficult to eradicate and which chokes all that would otherwise grow, is not seen in the Garo Hills, and the people do not move in consequence either so far

or so often from the village sites, and the country is not here the utter waste that the old Kookie lands present for miles and miles on the Kopoli and its tributaries.

Of the geology of the tract we passed over, there is a great similarity between the sections here and those on the Khasi side as might be expected. Mr. H. B. Medlicott, of the Geological Survey, has given in full detail that portion up to Siju (so there remains but little to add), where the gneiss comes in. Koylas, one of the highest points, is of cretaceous sandstone, resting on the gneiss and evidently the result of local elevation over a very confined area. The sandstone dips in all sides from it at a high angle. Pandangroo, further east, is on its eastern face, a repetition of a like producing cause, the sandstone there bends over suddenly to the perpendicular, immediately under the cliff that marks the present north and south run of that sudden rise in the hill range, and where the sandstone is almost horizontal; no sandstone caps any portion of the Tura line of highest elevation, west of Koylas. This secondary sandstone is found however at the base of the range on its northern face, horizontal in the lower portion of the valley of the Shemshang, and the river owes its quiet course here to this fact, the level sandstone strata much reduced in thickness, abuts against the gneiss and granite hills of Sokadum. Moonghri being of the latter rock, the strike of this granite is thence continued in a north-east direction, well marked by the steep straight line of slope that bounds Manda Valley on the south; it is the same granite in every respect as we find on the northern side of the Khasi hills. North and to the east of the Shemshang, the secondary rocks are not seen beyond Swan-girri, a blue colored coarse sandstone is conspicuous in the lower part of the series, the higher is mostly composed of very fine white clays and sands of de-composed granitoid rocks, the finer beds contain indistinct vegetable remains; no coal is to be found over this northern extension of the cretaceous series. Near Pandangroo, however, where this is of very great thickness, some fine seams of coal occur, and it is the only place where further exploration would be of future good, and perhaps yield a profitable supply of this useful substance in this quarter. No intrusive rocks occur over the whole of the area passed over.

The Migam Ligam or Langam Garos, as they are severally called by the Garos, on the west or the Khasias on the east, are all under the Seem of Nongstein, and are principally confined to the tributaries of the Um-Blei; they have a dialect of their own which I am sorry I did not obtain. Another small community, for they can hardly be termed a tribe, although they have also a distinct dialect, is the "Atong" Garo; they are now to be found near Koylas at Chikmang, Rongsu, &c.; a cursory comparison of vocabulary taken by myself with those in Colonel McCulloch's account of the valley of Munipore and its hill tribes, shews a closer affinity with the "Undro" and "Shengmai" than any other dialect spoken in these hills. As we now find even thus far from Munipore settlers from that valley, in the plains of Mymensing, it is not improbable that at some far distant date, a body of these wandering cultivators seeking new ground, found their way along the base of the Jyntea and Khasi Hills into the Garo wilds; they differ not a little in appearance from the true Garo, their dialect being of course full of words common to both as might be expected from long intercourse. Migams and the Garos on their west do not intermarry, and it is surprising how suddenly a language ends and another takes its place. Khasi is unknown to the Atong Garos, and but few Migams can even speak it.

Extract from the Narrative Report of Captain GEORGE STRAHAN, *in charge No. 7 Topographical Party, Rajpootana Survey, for season* 1869-70.

NATIVE STATES.
Jeypoor, Jodhpoor, Udeypoor, &c.

The reconnoissance and triangulation occupied me nearly three weeks, including the computations which were obliged to be completed on the spot before taking in hand the traverses. The whole of the work at Aboo was completed by February 9th, and the boards ready mounted and projected, and left in charge of the overseer of the Public Works Department there. The scale on which the map was to be made, 6 inches=1 mile, necessitated a large number of fixed trigonometrical points. It also appeared to me advisable to traverse with theodolite and chain the chief roads and paths of the station for the cantonment plan on 24 inches to a mile, as I understand the want of such traverses has been felt in the survey recently executed of Mussooree.

On leaving Mount Aboo, I set about laying out a principal series on the meridian of as 74, a basis for future work, there being no triangles of the Great Trigonometrical Survey within available distance. You will see on consulting the chart of the Great Trigonometrical Survey, that after passing westward of the Goorhagarh series, no more of their principal work is met with till we reach the Indus, a distance of 350 miles. It becomes then a matter of some importance how our triangulation can be extended over this enormous area, without risk of undue accumulation of error.

The plan I proposed, and which met with your approval during a conversation at my office last year, was as follows;—To lay out a principal series along the meridian of 74, emanating from the Karachi longitudinal series, near Erinpoora, and on reaching the parallel of 26 to turn eastwards and run into the Goorhagarh series, a little south of Ajmere. This series is to be reduced by the method of least squares, polygon by polygon, and the errors at the close of the series to be re-distributed throughout, by a method similar, though not so rigorously accurate and laborious, as that employed by the Great Trigonometrical Survey in the reduction of the north-west quadrilateral. On the completion of the area thus enclosed, *viz.*, degree sheets XIII and XXI, the series will be continued along the meridian of 74, and then again turning eastwards will unite with the Goorhagarh series again on the parallel of 27. The reduction of the errors will be effected in the same way as before. The same process will be continued till the northern limit of our survey is reached about the parallel of 30, and by that time it is not improbable that some new Great Trigonometrical series may be contemplated, or perhaps finished through the centre of Bikaneer.

It would no doubt be better, if the whole series along the meridian of 74 could be completed, before any of the junctions with the Goorhagarh are effected, but it is obviously impossible that any officer in charge of a Topographical Survey can leave his legitimate work for such a purpose, for long before it was completed, there would be a demand for more triangulation, when there would be no data available for basing it on.

In accordance with this plan, I therefore started from the base Kanagar to Raonak of the Great Trigonometrical Survey near Erinpoora, and laid out and observed a quadrilateral and hexagon along the meridian of 74, which two figures have carried the series up to within about 35 miles of Jodhpoor, from whence I shall turn eastwards as explained above. These angles were all observed with a 14″ theodolite, and the signals were luminous—four zeros and four changes of face were made use of, with the satisfactory result of only 1·4 seconds of triangular error. These two figures have already been reduced by the method of least square.

The country over which the first part of the series passes was easy, being open and sandy with detached rocky hills, forming very convenient stations, the northern part is very flat, and the sides must necessarily be very much reduced in length. Owing to misty weather and bad signallers, I was so much delayed in this work that the duty of checking plane tables devolved on Mr. Horst, and I only reached Deoli in time to commence the homeward march to Agra.

He (Mr. Horst) informs me that the country he has triangulated this season is for the most part easy, being flat with isolated hills well suited for stations. The only difficult part is in the Arabulla range, which run north-east and south-west, cutting off the north-west corner of the Degree sheet XIII. The range is here about 16 miles wide and pretty thickly covered with jungle. The highest point reached this year (Goram by name) is 3,066 feet above the sea, and fully 2,000 feet above the plain on the western side. The number of points laid down, exclusive of stations, is 487, most of them with double values giving on an average one point to 7·3 miles, and one height to 11·2 miles.

"Up to the end of January, the famine was very severe, wheat atta was selling at 5 or 6 seers for the rupee, and procurable at that rate even with difficulty. Maki or Indian corn, the staple food of the poor, was about 10 seers, but was not always to be obtained, as locusts had destroyed a great part of the crops as they were ripening, and it was not until it was certain that the yield of wheat would be satisfactory, that the bunyas opened their stores of grain, when the pressure was somewhat relieved. Even in Ajmere and Mairwara, although these are British territories, and several relief works were in operation, the distress was very great. Mortality among the poorer classes was excessive, whole villages have been depopulated, and in numerous places I have seen corpses and skeletons lying about, making it too evident that the deceased had no friends or relatives to bury or burn their remains. The country is not likely to recover itself for several years, as the strong and serviceable cattle have died. Large tracts of land suitable for wheat crops are untouched, either because their owners have died, or that they have no plough cattle remaining. At Toddgarh in Mairwara, there is a Missionary, Mr. Robb, who has been indefatigable in his endeavours to relieve those unfit for work, and maintains a large orphanage at the expense of the mission."

"My thanks are due to the Deputy Commissioner of Ajmere, who rendered me great assistance while in his district. In the Udeypoor State, I met with a good deal of annoyance at the commencement of the field season, but on my complaining to Colonel Keatinge, the Governor General's Agent, who was passing through my ground on his tour, and subsequently to Colonel Nixon, the Political Agent, I had every assistance rendered me. The latter on my representation had the Thakoor of Bednor, a jagirdar deriving an annual revenue of three lakhs, and subject to the Udeypoor Rajah, heavily fined for refusing me permission to erect stations on his land, which punishment had a most salutary effect on the neighbouring thakoors, who became not only civil but subservient."

The maps completed during the recess are two standard maps Nos. 27 and 32, plans of Kotah and Boondi cities, for reduction from 12 inches to a mile to 6 inches, and one sheet of the plan of Mount Aboo on the scale of 6 inches to a mile, and a fair copy of the report on the triangulation connected with it. It was confidently expected that the whole map of Aboo would have been submitted by the end of this recess, but the fog and rain have been so dense and constant during the past rainy season, that for weeks together no field work could be done, and the remaining sheet of the general plan, and the cantonment plan on the 24 inch scale, cannot be received in time for transmission to Calcutta this recess.

Three standard maps have been drawn as far as materials exist, and also a fair copy of the triangulation chart of Degree Sheet V, and the general report of that degree sheet is also in course of preparation and nearly complete. Sixty sheets of zincographed standard maps received from Calcutta have been colored and returned, and 30 more colored for record in my own office.

The computations of the season's triangulation have been quite completed, and I have great pleasure in reporting that no arrears of any kind, either in mapping or computation, exist in the party.

The out-turn of detail survey is not so large, as has been usual hitherto in this party, for the following reasons, 1*st*, that the ground is far more difficult than any before met with in Jeypoor or Bikaneer; 2*nd*, that two large scale plans of cities (Kotah and Boondi) were also completed; 3*rd*, that two of my European assistants and one Native were obliged to leave their work early to go to Mount Aboo; and 4*th*, that we were not able to take the field till a little later than usual, owing to the famine then prevailing in Rajpootana.

The programme for the approaching season is as follows:—

I shall myself complete the principal series from Jodhpoor to the Goorhagarh series alluded to above, and then inspect and check the plane tables.

Mr. Horst will lay out a little triangulation in the early part of the season, and then take up plane tabling. The other assistants, both European and Native, will be at first employed on the detail survey of Degree Sheet V, of which about one-third is remaining, and will then be moved into Sheet XIII, of which I hope to complete about one-third or perhaps half during the season. Care however will be taken to ensure the completion of Sheet V at any rate.

APPENDIX B.

DRAWING AND COMPILING BRANCH, SURVEYOR GENERAL'S OFFICE.

The most important compilations in progress and maps completed are as follows :—

INDIA.—Standard Map, scale 32 miles = 1 inch, in 6 sheets.

Sheet No. 1 contains the Punjab and its dependencies, Afghanistan, the Northern portion of Rajpootana, and the Western portion of the North-West Provinces. The Punjab and its dependencies have been reduced and drawn, writing of names in progress. Afghanistan and portions of the North-West Provinces to be added. From this sheet, a photograph will be taken of the Punjab portion and made over to the engravers for a new map of the Punjab in outline, required by the Local Government to illustrate administrative reports.

Sheet No. 2 has not been taken in hand yet, as it embraces portions of Nepal, Bhootan, Thibet and Chinese Tartary, of which no reliable geographical materials are available.

Sheet No. 3 contains portions of the Rajpootana and Central India Agencies, Sindh, and the greater portion of the Bombay Presidency. As it is not likely that better materials than exist at present for the northern portion of the Bombay Presidency are likely to be forthcoming for many years yet, or probably until a regular survey is organized and started, the principal drainage and chief towns have been taken from the Quarter Master General's map of that Presidency. The Province of Sindh is under insertion from the results of the recent revenue survey.

Sheet No. 4 contains Bengal, Behar, Orissa, Oudh, the greater portion of the North-West Provinces, British Burmah and portions of Nepal, Bhootan, &c. All the results of topographical and revenue survey in British Districts and Native States have been inserted; several blanks still remain to be filled.

Sheet No. 5 contains the southern portion of the Bombay Presidency and a large portion of Madras with Mysore, the Nizam's Dominions, Ceylon and the Lacadive and Maldive Islands. The outlines have been completed.

Sheet No. 6 includes the southern portion of British Burmah or Tenasserim Province and the Malayan Peninsula, Andaman and Nicobar Islands, Singapore, &c. Coast line, names of ports, &c., along the coast inserted from the latest Admiralty charts.

The publication of the final and complete edition of this map must necessarily be deferred for many years, or until the many blank portions of the peninsula come under survey; but meanwhile it is intended to publish the sheets as preliminary maps with the unsurveyed portions filled up from the best available sources.

A reduced map on half the scale (64 miles=1 inch) will be taken in hand immediately.

For a general atlas of the world, scale 10 miles=1 inch, publishing by Sir H. James, R. E., Director of the Ordnance Survey of Great Britain. The central section of Bengal containing the metropolis of India and surrounding districts was completed last year, but has been detained for the correction of boundaries of districts, all of which have of late years undergone many changes. The required information is still delayed; a photograph of the sheet in its present state will, therefore, be sent to the Ordnance Office to be engraved, and the boundaries and names of districts will be given hereafter on outline proofs of the sheet. A few additions have been made to the sheet, such as new roads, canals, chord-line railway, &c.

The Eastern Bengal Section of the above map, parallels 20° to 25° and meridians 90° to 94°, includes a good portion of the Eastern Frontier, Burmah, Munneepoor, &c. It has been completed as far as survey results will admit. The portions beyond our fontier must await further explorations. A photograph will be sent to Sir H. James shortly, with the object of the engraving being commenced of the completed portion of the sheet.

Other sheets will be taken up hereafter.

NORTH-WEST PROVINCES.—A complete map of the North-West Provinces, Oudh, and adjoining Native States, scale 16 miles = 1 inch, intended as a hand map, has been revised up to date and is being lithographed.

OUDH.—Quarter Atlas Sheet No. 87, South-West, containing the city of Lucknow, has been engraved and issued. All the other quarter sheets are in a forward state in various stages of engraving. Names have been added to the engraved outlines.

The old Atlas Sheets 68 and 88 (full plates, double elephant size) which contain portions of Oudh, were completed from the results of survey, and are being engraved. Both plates are well advanced.

SINDH.—Quarter plate Atlas Sheet, 1 North-East portion of Sindh. Additions made to proof and sent to the geographer at the India Office.

Quarter plates of Atlas Sheets, 10.—Compiled parts of Khyrpore Native State and districts Halla and Omerkote of Sindh. Engraving of North-West quarter commenced. The blank portions are parts of the Rajpootana Agency not yet surveyed.

RAJPOOTANA AND CENTRAL INDIA AGENCIES.—Quarter plates of Atlas Sheet 34. Graticule projected and portions of the Native States of Jeypore, Tonk, Boondi, Kishengurh and Gwalior completed on quarter sheet North-East.

Atlas Sheet No. 51. Quarter Plates North-West and North-East. Engraving in England. Portions of Gwalior, Dattiah, Jeypoor and Kerowli inserted on unfinished proofs and sent to the geographer at the India Office for completion of the sheets.

Quarter Sheet No. 51. South-East, Hills added. Engraving well progressed.

Atlas Sheet No. 70. Quarter Plate South-East. Engraving in England. Portions of Punnah, Myhere, &c., in Bundelcund added on a proof and sent to the geographer at the India Office for completion of the plate.

BENGAL.—Quarter Atlas Sheets No. 125, South-East containing portions of Sylhet and Cachar, engraved and issued. 125 South West, portions of districts Mymensing and Sylhet, names completed; engraving well advanced—125 North-West and North-East Khasia and North Cachar hills outlined. Hills in progress.

Atlas Sheets No. 124, South-West and South-East, completed portions of the Khasia and North Cachar Hills in outline; engraving in progress.

Quarter Atlas Sheet No. 131, South-West, containing portion of Cachar, graticule projected and drawing completed. The portion of the Native State of Munneepore which falls on this sheet will be left blank till the country is brought under topographical survey.

CHOTA NAGPORE DIVISION.—Scale 8 miles = 1 inch. This map was originally drawn to illustrate in outline the boundaries of the British Districts and Native States in the Division; it is now under compilation as a final map for publication.

The Western half of the Chota Nagpore Division, scale 4 miles = 1 inch, is also under compilation from the result of topographical survey, as this portion is urgently required to complete the geographical map of the division which is much needed for local administrative purposes, and also for the completion of the two quarter plates of Atlas Sheet No. 105, North-West and South-West, to be engraved in England.

MAP OF THE WESTERN PORTION OF BHOOTAN, with the Dalingkote Sub-Division of district Darjeeling and a portion of the Bengal Dooars in the newly formed district of Julpigoree, scale 4 miles = 1 inch, compiled from Major Godwin-Austen's and Lieutenant Chas. Strahan's military surveys of parts of Bhootan and from revenue survey. A potograph of this map will be sent to the geographer at the India Office for additions to Atlas Sheet No. 118. The map is nearly ready.

In addition to the above, many small maps of a miscellaneous kind have been compiled or fair drawn, together with charts of triangulation and standard sheets of topographical surveys, boundary maps and tracings, details of which are given in following statement.

COMPILING, DRAWING AND GEOGRAPHICAL EXAMINING BRANCH, SURVEYOR GENERAL'S OFFICE.

STATEMENT showing the nature of the work performed and the progress made from 1st January to 31st December 1870.

Maps.	Scale.	Progress and Remarks.
	Miles. Inch.	
India.—Standard Map, Sheet 1; Punjab and North-West Frontier and part of the North-Western Provinces.	32 = 1	Districts in the Punjab completed, outline and hills of Kashmir and the Hill States inserted; names in progress.
India.—Sheet 3; Central India, Rajpootana, Sindh and Bombay Presidency.	32 = 1	Outlines of portions of Cutch, Guzerat, &c., completed. Sindh in progress.
India.—Sheet 4; Eastern Portion of Upper India.	32 = 1	Portions of Oudh and North-West Provinces completed. Portions of Chota Nagpore Division in progress.
India.—Sheet 5 and 6; Southern portion of India.	32 = 1	Madras Presidency, Ceylon, Maldive, Lacadive, Nicobar and Andaman Islands inserted in outline.
India.—For a General Map of the World publishing by Sir H James; Eastern Bengal Section, between Latitude 20° and 25,° Longitude 90° and 94.°	10 = 1	Hills in Akyab and Chittagong inserted. Writing completed. Sylhet and Cachar portion in progress.
Orissa Division.—For the Gazetteer ...	12 = 1	In progress. Outlines nearly completed. This map is to be engraved.
Chota Nagpore Division	8 = 1	Outline and names in progress.
Chota Nagpore Division.—Office compilation from results of topographical survey.	4 = 1	Western half of the division outlined. Streams, &c., partly inked.
Reconnoissance of the Garo Hills by Major H. Godwin-Austen.	4 = 1	Drawn for reproduction by photozincography. Completed and printed.
Western half of Bhootan from a military survey by Major H. Godwin-Austen and Lieut. C. Strahan, B. E., with the Dalingkote Sub-Division of District Darjeeling and the Northern portion of the Bengal Dooars.	4 = 1	Compiled and fair drawn. Hill shading in progress.
Boundary between Pergunnah Shooshung of District Mymensing and the Garo Hills.	2 = 1	Fair drawn for photozincography, and a trace made for the Commissioner, Kooch Behar Division.
Gwalior and Central India Topographical Survey.—Standard Sheets, Nos. 3 (b), 5 (a), 6 (b), 7 (b), 10 (a), 10 (b).	1 = 1	Projected and fair drawn from plane table sections. Completed and published.
Gwalior and Central India Topographical Survey, Standard Sheets Nos. 6 (a), 11 (a) and 11 (b).	1 = 1	Ditto ditto. In progress.
Gwalior and Central India Topographical Survey, Degree Sheet V.	2 = 1	Exaggerated specimen map in two sections. Drawn on reduced blue prints.
Rajpootana Topographical Survey, Degree Sheet.	1 = 1	Exaggerated copies of sheets 1, 2 and 2 (a) redrawn for reduction to ¼th scale. Completed and published.
Chota Nagpore Division Topographical Survey, Sheets 42, 43 and 54.	1 = 1	Projected and redrawn from the original plane table sections. Sheet 42 completed. 43 and 54 in progress.
Central Provinces Topographical Survey, Sheets 11, 15, 16 and 17, Standard Maps.	1 = 1	Projected and traced from the original plane table sections. Outlines and writing of sheets 11, 15 and 16 completed. Sheet 17 in progress.
Central Provinces Topographical Survey, Degree Sheets 2, 4 and 6.	2 = 1	Blue print reductions from standard maps. Outlines and writing in progress.
Central Provinces Topographical Survey, Chart of Triangulation for Season 1868-69.	2 = 1	Projected and drawn for reduction by photozincography. Numerical data under insertion.
Ganjam and Orissa Topographical Survey, Charts of Triangulation Sheets 1, 2 and 9.	4 = 1	Projected and drawn. In progress; numerical data to be inserted. Each sheet gives 2° of Latitude by 1° of Longitude.
Central Provinces and Vizagapatam Agency Topographical Survey, Charts of Triangulation Sheets 7 and 8.	4 = 1	Ditto ditto.
Atlas of India, Quarter Sheet 1, N. E. ...	4 = 1	Inserted portion of District Nowshera and the Native State of Khyrpore in Sindh on proof for the geographer at the India Office.
Atlas of India, Quarter Sheets 10, N. E., N. W., S. E. and S. W.	4 = 1	Compiled and drawn portions of Sindh and made over for engraving.

STATEMENT showing the nature of the work performed and the progress made from 1st January to 31st December 1870—continued.

Maps.	Scale.	Progress and Remarks.
	Miles. Inch.	
Atlas of India, Quarter Sheet 34, N. E. and S. E.	4 = 1	Sheet 34, N. E., completed portions of Central India and Rajpootana Native States as far as materials have been received. Sheet 34, S. E. part of Gwalior, completed. Engraving in progress.
Atlas of India, Quarter Sheets 51, N. W., N. E. and S. E.	4 = 1	Portions of Gwalior and Duttiah inserted on quarter N. E. for the geographer at the India Office. Quarter S. E. compiled and outlined. Writing in progress.
Atlas of India Old Sheet No. 68 (Double Elephant Size Plate).	4 = 1	Compiled and drawn portions of the Districts of Seetapore, Hurdui and Oonao Districts in Oudh. Engraving in progress.
Atlas of India, Quarter Sheet 70, S. E. ..	4 = 1	Portions of Bundelcund States completed on a proof for the geographer at the India Office.
Atlas of India, Quarter Sheets 87, N. E., N. W., S. E. and S. W.	4 = 1	Completed. Names written, &c. Engraving in progress.
Atlas of India, Old Sheet No. 88 (Double Elephant Size Plate).	4 = 1	Portions of Oudh compiled and drawn; writing in progress. Engraving of outlines in progress.
Atlas of India, Quarter Sheets 124, S. E. and S. W.	4 = 1	Outlines and writing completed of portions. Hills drawn of portions of Khasia and North Cachar Hills. Engraving in progress.
Atlas of India, Quarter Sheets 125, N. E. and N. W.	4 = 1	Portions of North Cachar and Khasia Hills added in outline. Hills drawn on 125 N. W. Engraving in progress.
Atlas of India, Quarter Sheet 131, S. W. ...	4 = 1	Eastern part of District Cachar inserted. Engraving in progress.

Miscellaneous Maps, Tracings and Extracts of Maps, of Plans, Charts, &c.

Postal Map of the City of Calcutta ...	.....	Reduced and drawn.
Mayo Salt Mines and Geological Sections in 3 Sheets.	.....	Fair drawn for photographic reduction.
Sketch Map of the Ancient Subah of Berar ...	32 = 1	Drawn on transfer paper for the Commissioner, West Berar.
Countries between Peshawur and Badakshan ..	4 = 1	Two tracings made; names in Persian.
Plan of the Boundary of Tinnivelly District ..	Various.	Three maps; tracing for the Madras Revenue Survey.
Map of the Countries on the South-West Frontier extending from Palamow to Bundelcund.	3½ = 1	Trace for the Boundary Commissioner, Chota Nagpore Division.
Sketch of the South-Western Frontier with the adjoining Districts of Bundelcund and Sirgoojah.	7½ = 1	Ditto ditto.
Maps of Pergunnahs Jameerah, Mukrumpoor, Arungabad and Karribaree of District Gowalpara.	1 = 1	Tracings for the Officer in charge Brahmapootra Series G. T. Survey.
Extracts from Charts of the Great Trigonometrical Survey with numerical data.	4 = 1	24 Extracts for Revenue Surveyors and other Government Officials.
Extracts from Charts of Topographical Survey triangulation with numerical data.	4 = 1	5 Extracts from various Charts for Revenue Surveyors, &c.
Corrections and Additions to Topographical Survey Standard and Exaggerated Maps and Charts.	.....	Corrections and Additions made to 88 original sheets to suit the requirements of photozincography, &c.
Various small extracts, &c, too numerous to detail.		

Cantonment and City Plans.

Plan of Seetapore	1 = 8	One sheet redrawn for photozincography.
Plan of Fyzabad	1 = 8	Ditto in progress.
Plan of Yangishahar and Yarkund ..	.....	Exaggerated map drawn for photozincography.

Coloring of Lithographed, Photo-zincographed, and Engraved Maps, Plans, &c., Examining of Proofs of Maps, Plans, Charts, &c.

Maps.	Scale.	Progress and Remarks.
	Miles. Inch.	
Lithographed and Photozincographed Maps and Plans.	Various.	10,629 sheets colored.
Engraved Atlas Sheets	4 = 1	1,115 sheets colored.
Proofs of various kinds examined and revised	Various.	219 sheets—many twice revised.
Boundaries revised, Railway Line and Stations inserted, &c., on Lithographed Maps and Atlas Sheets.	Various.	On 2,230 sheets.

Work performed by Extra Draftsmen and out of Office hours, for which payment has been received.

Portions of Districts Mirzapore, Benares and Ghazeepore.	1 = 1	Compiled and drawn for photozincography in 13 double elephant size sheets, completed and published.
Killah Nyagurh, Cuttack Tributary States ...	1 = 1	Drawn on transfer paper for zincography; printed.
Skeleton Map of India, showing telegraph lines and stations.	32 = 1	Drawn for reduction and multiplication by photozincography; printed.
General Chart of the Nicobar Islands ..	.....	Compiled and reduced from several sheets of Austrian Charts; completed.
South Andaman and adjacent Islands with Port Blair, &c., showing the proposed telegraph lines and cables, in 3 sheets.	.....	Fair drawn from existing Charts reduced and photozincographed.
Extracts from the Original Field Maps of the Hyderabad Topographical Survey.	1 = 1	Four large tracings with complete details for the Superintendent, Geological Survey of India.

Surveyor General's Office,
The 31st December 1870.

(Signed) J. O. N. JAMES,
Asst. Surveyor General.

APPENDIX C.

ENGRAVING BRANCH, SURVEYOR GENERAL'S OFFICE,

CALCUTTA, 31ST DECEMBER 1870.

C. W. Coard, Esq., Superintendent.
Mr. F. J. T. Walsh, Etcher.
„ J. M. Dalziel, Engraver.
„ W. Donaldson, ditto.
„ M. H. West, ditto.
„ H. James, ditto.
„ A. Madge, Apprentice.
„ A. Houghton, Printer.

The staff of European Engravers consists of seven with one European Plate Printer.

The staff of Native Engravers and Apprentices are eleven in number, and there are ten Native Copper Plate Printers and Pressmen, making in all of the Native staff twenty-one.

The work completed and in progress is as follows:—

Quarter Plates, Atlas Sheets 87 South-West, containing part of Oudh and 125 South-East portions of the Districts of Sylhet and Cachar have been completed and issued.

Quarter Plates 125 South-West, 125 North-West, and 125 North-East are in various stages of progress. The first (125 South-West), containing portions of the Districts of Mymensing and Cachar, is well advanced towards completion.

Quarter Plates 124 South-West and South-East, North Cachar and Khasi Hills, have been outlined in part and the writing is in progress.

Quarter Plate 131 South-West contains a small portion of the Cachar District. Outlines completed; writing in progress.

Quarter Plate 51 South-East portions of Gwalior and Dattiah. Outlines and writing completed; hill etching in progress.

Quarter Plates 87 North-West and South-East have been well advanced. Outlines and writing partly completed.

Full plates 68 and 88 (old double elephant size plates) containing portions of the North-West Provinces and Oudh. Eastern and Western portions of Oudh under insertion.

The quarter plates of Atlas Sheet 10, Sindh, have just been taken in hand.

Map of India in outlines to illustrate the operations of the Great Trigonometrical Survey, scale 96 miles = 1 inch, engraved and published.

Index Map to the Sheets of the Indian Atlas and Great Trigonometrical Survey, scale 96 miles = 1 inch. The old copper plate received from England has been corrected up to date, and a new edition published.

Small Index to Indian Atlas Sheets, nearly ready for publication.

Sheets of the large plan of the City of Calcutta. Additions and corrections up to date on several plates in progress.

Plates to illustrate the Pendulum operations report of the Great Trigonometrical Survey. Two plates engraved and printed.

A few other miscellaneous jobs, such as ruled tints and scales, &c., were also completed, details of which are given in the following statement.

During extra hours Mr. C. W. Coard engraved a series of 24 plates to illustrate the cholera report, for which job payment was received. A very large number of impressions from these plates were printed for the Sanitary Commissioners and Dr. Lewis' cholera reports.

The following statement shows the number of the Indian Atlas sheets in hand, progress made, and the time it will probably take to complete some of them. Details are also given in it of miscellaneous work completed and in progress:—

Quarter plates	87 S. W. and 125 S. E., completed and printed.		
Quarter plate	125 S. W.	will be finished in	3 months.
Ditto	125 N. W.	ditto	7 „
Ditto	125 N. E.	ditto	8 „
Ditto	124 S. W. and 124 S. E. will be finished each in 4 months.		
Ditto	51 S. E. Hills in progress	ditto	5 „
Ditto	51 S. W. materials just received will be finished in 10 months.		
Ditto	87 N. W. and N. E. waiting for drawings.		
Ditto	87 S. E. well advanced will be finished in 1 month.		

Full plates 68 and 88 (old full plates), outlines engraved, writing in progres, will be finished in 18 months.

Quarter plates 34 S. E. and N. E. border and projection done.

Ditto 10 N. W., 10 S. E., 10 N. E., tracing commenced.

Ditto 10 S. W. outlines commenced.

Ditto 131 S. W. outline done, writing in progress, will be finished in 2 months.

Full plates 17, 48 and 49 (old plates).

Railway Lines and Stations added.

There is still a want of materials for several of the quarter plates in progress, and dry proofs will be furnished of these for drawings, as survey results are received.

Index to the Great Trigonometrical Survey of India and Sheets of the Indian Atlas. Additions and corrections up to 1869 completed.

Map of India in Outline to illustrate the Triangulation and Astronomical operations of the Great Trigonometrical Survey (completed and printed).

Two plates pendulum operations completed and printed.

Scale of chains and inches for Mathematical Instrument Department completed and printed.

Circular protractor, 12 inch diamater, redivided, and figures engraved for the Public Works Department, Punjab (completed and printed).

Tints of various sizes and shades for the use of the Lithographic Press. Various tints ruled and transfers supplied.

Plates of tree and bush jungle. Various tints ruled and transfers supplied.

City of Calcutta old copper plates under correction up to date. In progress.

Impressions, proofs and transfers taken from copper plates.

Proofs of various kinds	444
Impressions (final) from plates	26,177
Transfers of tints, &c.	769
Total impressions ...	27,390

Mr. Houghton, Copper Plate Printer, reported his arrival in India on the 22nd December 1869.

The European staff of engravers have enjoyed much better health this year; they have made good progress with their work, though much of their time has been taken up with drawing in the work for the Native staff; for I find in the latter that their judgment for spacing, writing and drawing in work for engraving is bad, therefore I have made it a rule, till they are further advanced, to have every thing drawn in for them. The Native engravers and apprentices have made rapid progress with the graver, and two of them, Amanatollah and Kristo Shaw, I have every reason to believe, will turn out good etchers. They are both working on the Atlas sheets.

The Native staff of Plate Printers under Mr. Houghton have got on very well, and the progress made during the year is very creditable.

During the past year I have done all in my power to push the work forward by dividing the various parts of engraving between the whole staff; I have found by so doing that I have been able to put more plates in hand, and consequently many subjects have been engraved and printed independent of the atlas sheets of India.

Surveyor General's Office,
The 31st December 1870.

(Signed) C. W. COARD,
Superintendent, Engraving Branch.

APPENDIX D.

Abstract of the work executed in the Surveyor General's Office, Lithographic Branch, from 1*st January to* 31*st December* 1870.

Scale, &c.	New maps, &c., the lithographic drawings of which were completed during the present year.	Size.	No. of sheets.
	General Maps.		
16 miles = 1 inch ...	Punjab Compilation, with chalk hills on stone ...	Atlas ...	4
32 „ „ „ ...	Central Provinces	Double Elephant	1
	Hills of Saugor District on stone	Super Royal ...	6
	Central Europe	Atlas ...	1
16 „ „ „ ...	Berar	Royal ...	1
16 „ „ „ ...	Gazetteer Map of Shahabad	Foolscap ...	1
	Hills to Kashmir Route map on stone	Atlas ...	1
4 „ „ „ ...	District Seonee, on stone with chalk hills	Atlas ...	1
2 „ „ „ ...	District Goojranwalla	Super Royal ...	4
16 „ „ „ ...	North-West Provinces	Imperial ...	4
2 „ „ „ ...	Jamoo Territories, sheet 1 on stone	Special ...	1
4 „ „ „ ...	Sindh Compilation map, with chalk hills Nos. 7, 12 and 13 on stone	Imperial ...	3
12 „ „ „ ...	Orissa and Tributary Mehals	Atlas ...	1
32 „ „ „ ...	China Compilation map	Imperial ...	4
	Index to Ganjam and Orissa T. S.	Double Elephant	1
12 „ „ „ ...	Index to Sheet maps of Chanda	Royal ...	1
8 „ „ „ ...	Index to Jessore Sheets	Ditto ...	1
8 „ „ „ ...	Index to Lohardugga Sheets	Ditto ...	1
300 „ „ „ ...	India map No. 1, colored, stones prepared, 1st and 2nd edition	½ Sheet Royal ...	1
160 „ „ „ ...	India map No. 2 and 2A, colored, stones prepared ...	Imperial ...	1
	Revence Survey Circuits.		
	1 *Mile* = 1 *inch.*		
1 mile = 1 inch ...	Noacolly District on stone, Nos. 8, 9, and 10, 11, 12, 13, ...	Special ...	4
		Antiquarian ...	2
1 „ „ „ ...	Bhandara District, Nos. 12, 13, and 16, 17 ...	Double Elephant	3
1 „ „ „ ...	Balaghat District, Nos. 11, 20 and 18, 19	Atlas ...	3
	Sheet Maps.		
	1 *Mile* = 1 *inch.*		
1 mile = 1 inch ...	Sindh Revenue Survey Sheets, Nos. 20, 22, 23, 28, 29, 30, 31, 32, 33, 36, 40, 41, 53, 55, 66, 67, 70, 71, and 85; 3 are at work on stone, and in various stages, 21, 51, and 54	Double Elephant	19
1 „ „ „ ...	Oudh Revenue Survey Sheets, Nos. 28, 37, 42, 48, 49, 50, 51, 52 and 53	Ditto ...	9
1 „ „ „ ...	Jessore Revenue Survey Sheets, Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9	Ditto ...	9
1 „ „ „ ...	Chanda Revenue Survey Sheets, Nos. 1, 2, 4, 5, 6, 8, 9, 10, 12, 13, 14, and 16	Ditto ...	12
1 „ „ „ ...	Lohardugga Revenue Survey Sheets, Nos. 1 and 2 ...	Ditto ...	2
	Plans of Cantonments and Civil Stations.		
10 chains = 1 inch...	Bhurtpore, City and Fort	40 × 40 ...	1
1 mile „ 6 inches.	Gwalior, City and Fort	Atlas ...	4
1 „ „ 6 „	Lucknow, City and Environs on stone	Antiquarian ...	1
1 „ „ 8 „	Rewah City, on stone	Atlas ...	1
1 „ „ 24 „	Jhansie	Imperial ...	1
1 „ „ 16 „	Nagpore on stone	Ditto ...	6
1 „ „ 8 „	Jubbulpore	Double Elephant	2
300 feet „ 1 inch.	Bukloh Cantonment	Atlas ...	1
	Thannah Maps.		
	Thannah Mirzapore, Sub-Division Jungypore, District Moorshedabad	Atlas ...	6
	Thannah Nyehatee, Sub-Division Baraset, District 24-Pergunnahs	Ditto ...	6
	Thannah Bhurtpore, Sub-Division Jamookandee, District Moorshedabad	Ditto ...	12
	Thannah Sooty, District Moorshedabad	Ditto ...	6
	Thannah Bhugwangolla, District Moorshedabad ...	Imperial ...	8
	Thannah Goas, District Moorshedabad	Ditto ...	16

Abstract of the work executed in the Surveyor General's Office, Lithographic Branch, from 1st January to 31st December 1870—continued.

Scale, &c.	New Maps, &c., the lithographic drawings of which were completed during the present year.	Size.	No. of sheets.
	Barrack Plans.		
	Saugor	Double Elephant	18
	Umballa	Imperial ...	51
	Delhi	Ditto ...	7
	Nowshera	Ditto ...	8
	Pergunnah Maps.		
	District Cawnpore	Atlas ...	13
	Ditto Furrackabad	Double Elephant.	4
	Ditto Mynpoorie	Atlas ...	8
	Geological maps, with 31 colored, stones prepared ...	Various sizes ...	9
	Medical Department maps with 1 tint stone for vaccination map	Ditto ...	19
	Railway maps	Ditto ...	8
	Sanitary Commissioner's Report	Ditto ...	4
	Route maps	Ditto ...	4
	Foreign Department maps	Ditto ...	7
	Military Department maps	Ditto ...	24
	Index maps	Ditto ...	3
	Miscellaneous Maps, Plans, &c., &c., &c.		
	Forest map of Bengal	Double Elephant	1
	Irrigation map, North-Western Provinces	Ditto ...	2
	Wreck Chart for 1869	Ditto ...	1
	Chanda District Sketch map	40 × 40 ...	1
	Hazaribagh District, part of Skeleton map ...	Imperial ...	1
	Seistan, Sketch map	... ...	1
	Rajpootana and adjacent countries	Double Elephant	4
		Atlas ...	9
	Geneological Trees	... ...	3
	Postal map of Bengal with 4 colored stones prepared ...	Imperial ...	4
	Wharf Wall for the River Hooghly	Atlas ...	1
	Light Houses on Bay of Bengal with 8 colored stones prepared	Various sizes ...	5
	Flags for Madras Government Gazette	Foolscap ...	4
	Map of the Punjab and Sindh Frontier	Double Elephant	1
	Sketches, Plans, Diagrams, &c.	Various sizes ...	20
	Map of the Territories of the Hill Tribes of Rajunpore Frontier	Double Elephant	1
	Boundary and Tuhseel names of Districts and main circuit maps of Sylhet and Backergunge 13 colored stones prepared	... ...	...
			419

Abstract of the printing performed during the year, showing the value or selling price of the same.

SUBJECT.	No. of sheets.	No. of copies.	No. of pulls or impressions.	Value or selling price.
				Rs. A. P.
District and general maps on various scales from 2 miles = 1 inch and upwards	32	7,942	25,972	9,076 0 0
Index Maps	9	830	830	Gratis.
Revenue Survey Circuit maps, scale 1 mile = inch ...	16	4,680	5,304	8,580 0 0
Ditto Sheet maps ditto	56	18,062	22,228	27,012 0 0
Thannah maps, scale 4 inches = 1 mile ...	66	600	4,950	4,000 0 0
Plans of Cantonments and Civil Stations, &c. (large scale)..	7	1,068	1,628	1,760 0 0
Pergunnah maps for Irrigation Department, North-Western Provinces	33	2,468	3,966	2,468 0 0
Block plans of Barracks, &c., for Secretary of State ..	104	9,108	9,568	4,486 0 0
Reprint of old maps	63	5,002	9,444	7,979 0 0
Colored boundaries on ditto	...	...	1,704	304 0 0
Miscellaneous maps, sketches and diagrams	139	51,850	1,20,877	23,144 0 0
Estimated cost of transfers, headings and footnotes to the published maps of this Department	...	...	...	600 0 0
	525	1,01,610	2,06,471	89,409 0 0

Abstract of the Printing performed during the year, showing the value or selling price of the same—continued.

SUBJECT.	No. of sheets.	No. of copies.	No. of pulls or impressions.	Value or selling price.
				Rs. A. P.
Forms for the use of the Department	...	24,231	43,240	
Topographical and Revenue Survey orders and memoranda	...	94,373	1,30,533	
TOTAL ...	...	1,18,604	1,73,773	
Cost of the above ...	....	...	...	2,900 4 0

COST OF THE LITHOGRAPHIC BRANCH.	Rs.	As.	Pie.
Permanent Establishment	29,511	8	11
Contingent expenses	5,176	9	0
Extra Contingencies	3,658	8	1
Actual cost of paper*	6,306	0	0
TOTAL ...	44,652	10	0

* Lithographic paper of all sorts, 160 reams..
Proof papers ditto 119 „ ...
Writing papers ditto 94 „ ... } Rs. 6,306

(Signed) W. G. MURRAY, *Captain,*
Assistant Surveyor General.

APPENDIX E.

SURVEYOR GENERAL'S OFFICE;

PHOTOGRAPHIC BRANCH,

Calcutta, 1st January 1871.

FROM

LIEUTENANT J. WATERHOUSE,

Assistant Surveyor General, in charge Photographic Branch,

TO

COLONEL H. L. THUILLIER, R. A., C. S. I.,

Surveyor General of India.

SIR,

I have the honor to submit for your information a Tabular Statement, showing the amount, progress and nature of the work performed in the Photographic Branch of your Office during the past thirteen months, extending from 1st December 1869 to the 31st December 1870. The amount of work may briefly be stated as follows: 704 original maps have passed through the office, of which 60,116 complete printed copies have been struck off, besides 3,865 silver prints.

2. PROGRESS.—The progress made in this branch during the past thirteen months shows a very large increase in the out-turn over that of last year, as will be seen from the subjoined table :—

	Subject.	Negatives.	Silver prints.	Photo transfers.	Transferred to zinc.	No. of pulls.	No. of complete copies.
December 1868 to Nov. 1869 ...	578	1,784	3,773	2,273	487	51,059	44,092
„ 1869 to „ 1870 ...	630	2,078	3,796	2,076	501	88,212	54,952
	+52	+294	+23	—197	+14	+35,409	+10,860
December 1869 to Dec. 1870 ...	704	2,290	3,865	2,265	543	96,366	20,116
		—5,28,740 sqr. miles.	7,09,128 sqr. miles.	5,28,982 sqr. miles.			
Difference during the 13 months	+116	+506	+92	—8	+56	+43,453	+16,024

3. For the sake of comparison, the totals for the year ending November 30th, 1870, are also given, but it will be seen that the increase is proportionally large.

4. ORIGINAL MAPS.—The number of sections received for reproduction during the past 13 months has been 704, showing an increase of 116 over last year. There has been a great improvement throughout the Department in the style of drawing maps for reproduction by photozincography, and very few maps are now received which cannot be reproduced in that manner. The new system of drawing the exaggerated maps over blue print reductions on the $\frac{1}{4}$" scale, referred to in my report for last year, has been introduced into the topographical surveys; but as yet it has not been practically tested to any extent, but next year I hope it will be in thorough working order, and answer all expectations.

5. NEGATIVE DEPARTMENT.—The number of negatives taken during the 13 months has been 2,290, showing an increase of 506 over last year, with a total of 528,740 square inches. Since my last report, a very fine camera and lens for taking pictures, 22 × 20, was received from Mr. Dallmeyer, and a great deal of work has been done on large sized plates, thus saving time and chemicals; 2 cameras have been kept constantly at work during the year. I am

glad to report that the glass house erected last year has been found to answer perfectly, and the operators have been able to work in great comfort throughout the hot weather and rains. The old apparatus has been considerably improved, and the work turned out is very satisfactory.

6. Silver Printing.—The number of silver prints produced during the 13 months is 3,865 (7,09,128 square inches), showing an increase of 92 over last year. There is now very little silver printing of map work, most of the maps received being fit for photozincography. Several jobs for other departments have been done and have kept the assistants at work.

7. Photo-transfer printing.—The number of photo-transfers printed during the year has been 2,265 (5,28,982 square inches) against 2,273 of last year, showing a decrease of 8, which may be accounted for by the fact of the transfers being on an average of a much larger size than formerly, and further from no failures being counted in. The processes have remained the same, and very little difficulty has been experienced in the working. A good stock of suitable retransfer ink was received from England, and our former troubles on this score have entirely ceased.

8. Zincographic Printing Department.—The number of transfers to zinc during the past 13 months has been 543 against 487 of last year; of complete copies 60,116 against 44,092; and of pulls 96,366 against 51,059, showing a very large increase in the amount of work performed. This is partly attributable to an increase in the number of copies printed of the 1″ sheets of the topographical survey, of several of which new editions have been called for.

9. During the hot weather, great advantage was found in the use of ice for cooling the damping solution, and we were thus enabled to continue printing throughout the forenoon in the hottest weather.

10. Zinc correcting.—I am glad to report that the necessity for making corrections on the zinc plates has somewhat diminished, and some of the zinc correctors have been usefully employed in coloring maps for the Drawing Office. The zinc correctors are improving greatly in the style of their work.

11. Anastatic Process.—The anastatic process has been usefully employed in the reproduction of several old records out of print, among them may be mentioned the map of Rajpootana 8 miles=1 inch, and several of the 1″ maps of District Mymensing, Rungpoor and Rajshahye.

12. Supply of Chemicals.—A great saving has been effected by obtaining all stores from England direct, as they are not only of better quality, but are nearly 50 per cent. cheaper than can be obtained in the local market.

13. Experimental Work.—A few experiments have been made in simple carbon or pigment printing without transfer. This process might will be used to supersede silver printing, but unfortunately the only maps from which silver prints are taken are those which are unsuitable for photozincography, and therefore equally unsuitable for simple carbon printing.

14. In phota-engraving a few experiments have been made, but I find that in practice so few subjects are received which could be reproduced in this manner, that it seems useless to proceed with them. I have lately been trying a few experiments on the new heliotypic processes, which are capable of superseding both silver printing and photo-engraving. My experiments have given me a prospect of success, and I hope that with further practice, I may overcome the difficulties of manipulation.

15. Expense of working.—The total expense of working the office during the past 13 months has been Rs. 54,892-14-6,. and the approximate value of the work executed Rs. 89,659-12-0, showing a profit of Rs. 34,766, as shown in the annexed statement, from which it will be seen that the working expenses have been far less in proportion to the amount of work turned out, than they were last year, especially as this year I have been able to include the cost of chemicals received from the Medical Store Department, and the average cost of the paper consumed, for both of which I had no data last year.

The cost of establishment is increasing, owing to promotions, but a very large saving has been made in the contingent expenses by purchasing stores from England, and I hope that further reductions may yet be made.

16. Processes.—The processes have remained the same as last year in all departments of the work.

Conduct of Establishment.—I am glad to be able to report favorably on the conduct of all the Assistants, both European and Native; the former have efficiently supervised their various departments, and the latter have all made great progress during the year.

17. Concluding remarks.—In quality and quantity of the work turned out, the hope I confidently expressed last year has been fully realised, and but for the stoppage caused by want of paper, the out-turn would have been still larger.

18. The arrangements of the office are now tolerably complete, but further improvements will be gradually introduced as opportunity offers. I can only hope that now that the office is in thorough working order, and due arrangements made for ample supplies of chemicals and printing paper, our out-turn next year may be far larger, and the working expenses less in proportion.

I have the honor to be,

Sir,

Your most Obedient Servant,

(Signed) J. WATERHOUSE, *Lieut.*,

Assistant Surveyor General,
In charge Photo. Branch,
Surveyor General's Office.

A.

Abstract of work performed in the Photozincographic Branch of the Surveyor General's Office from 1st December 1869 to 31st December 1870.

Maps Photographed.	No. of Sections or Sheets.	No. of Negative Plates.	Prints. Silver.	Prints. Carbon.	Transferred to Zinc or Stone.	No. of Pulls.	No. of complete Maps.	Remarks.
Topographical Survey Maps	138	450	1,588	525	137	20,098	19,732	220 Zincographed.
Revenue Survey Maps ...	117	386	157	398	90	16,862	13,852	1,370 Anastatised. 160 Zincographed.
City and Cantonment Plans	261	988	63	964	*196	29,747	6,537	*1 on stone. 160 Anastatised.
District Maps ...	21	65	70	88	16	8,690	1,150	175 Anastatised.
General Maps ...	36	141	869	116	†46	10,824	6,392	1,005 Anastatised. †4 on Stone.
Miscellaneous Maps, Plans, Subjects, &c. ...	131	260	1,118	174	‡58	8,291	12,153	629 Zincographed. 265 Anastatised. ‡2 on stone. 1,390 Zincographed.
Proofs	...	...	...	...	...	1,854	...	
Zincographic and Anastatic Transfers	...	...	...	...	104	...	...	
Total ...	704	2,290	3,865	2,265	647	96,366	60,116	Exclusive of silver prints.

J. WATERHOUSE, *Lieut.*,
In charge Photographic Branch,
Surveyor General's Office.

B.

Statement showing cost of working the Photozincographic Branch of the Surveyor General's Office from 1st December 1869 to 31st December 1870.

Dr.	No. of Complete Copies.	Rs.	A.	P.	Cr.	Rs.	A.	P.
Topographical Maps.. ...	*19,512	17,508	0	0	Superintendent's salary from 1st			
Revenue Maps	12,322	15,081	0	0	December 1869 to 31st Decem-			
City and Cantonment Plans ...	6,377	27,022	0	0	ber 1870	7,057	0	2
District Maps	1,275	7,557	8	0	Sanctioned Establishment and			
General Maps	4,767	9,538	0	0	house rent from 1st December			
Miscellaneous Maps	10,508	1,475	8	0	1869 to 31st December 1870...	23,689	4	1
Anastatised	2,975	4,785	4	0	Contingencies, inclusive of che-			
Zincographed	2,380	895	0	0	micals received from Govern-			
Silver Prints	3,865	5,797	8	0	ment Medical Store Depart-			
					ment	10,573	12	8
					Cost of Paper	13,572	13	7
					Balance in favor of the			
					Department ...	34,766	13	6
Total ...	63,981	89,659	12	0	Total ...	89,659	12	0

The apparent discrepancies between these totals and those on Table A. are caused by several maps entered in table A., as Topographical, Revenue, &c., being entered in this Table as anastatised and zincographed.

J. WATERHOUSE, *Lieut.*,
In charge Photographic Branch,
Surveyor General's Office.