

GENERAL REPORT

ON THE

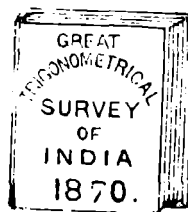
Topographical Surveys of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT, HEAD QUARTER ESTABLISHMENT,

FOR SEASON

1868-69.



BY

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SURVEYOR GENERAL OF INDIA.

SUBMITTED TO THE GOVERNMENT OF INDIA, HOME DEPARTMENT.

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No. 62.

SURVEYOR GENERAL'S OFFICE;
Calcutta, 15th January 1870.

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
HOME DEPARTMENT.

SIR,

I have the honor to submit, for the information of the Government of India, my Annual General Report* on the operations of the Topographical Surveys of India for the past season of 1868-69, together with a detailed account of the Proceedings in the Head Quarter Offices.

* Dated 15th instant.

I have the honor to be,

SIR,

Your most obedient Servant,

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

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GENERAL REPORT

ON THE

Topographical Surveys of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT HEAD QUARTER ESTABLISHMENT

ERRATA.

- PAGE 47—Thirteenth line from bottom, *for inters, read inter-*
,, 48—Second line from top, *for muntice, read minutia.*
,, 67—Second line from bottom, *for I, read It.*
,, ..—Last line, *for here, read where.*
,, 70—Last line, *for Diagram, read Diagrams.*

the several branches of my Head-Quarters Office for the year ending 31st December 1869.

2. NUMBER AND DISTRIBUTION OF TOPOGRAPHICAL SURVEY PARTIES.—The seven topographical parties, the same as in last report, are distributed as follows:—

Three parties (Nos 1, 5 and 7) in the Central India and Rajpootana Native States Agencies; two (Nos. 2 and 3) in the Central Provinces and Vizagapatam Agency of the Madras Presidency; and two (Nos. 5 and 6) in the Lower Provinces of Bengal. Their designation and the Native States and districts through which the operations of each survey extended during the season under review are—

- | | | |
|--|---|--|
| No. I.—Topographical party, Gwalior and Central India Survey | { | Topography in the Native States of Ulwar, Kotah, Boondee, Jeypore and Gwalior. Triangulation in advance in Gwalior. |
| No. II.—Topographical party, Central Provinces Survey | { | Topography in the districts of Baitool, Chindwara and Hoshungabad. Triangulation in Seonee. |
| No. III.—Topographical party, Central Provinces and Vizagapatam Agency Survey | { | Topography in the State of Jeypore of the Vizagapatam Agency, Madras Presidency, and the State of Jugdulpore or Bustar in the Central Provinces. Triangulation in ditto ditto. |

GENERAL REPORT

ON THE

Topographical Surveys of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT HEAD QUARTER ESTABLISHMENT

FOR SEASON

1868-69.

No. 62A Dated Calcutta, 15th January 1870.

INTRODUCTORY.—The last report on the administration of the Topographical Surveys of India, and of the Surveyor General's Department, was submitted with my letter No. 180, dated the 5th February 1869. It illustrated the general results of the operations to the close of season 1867-68. Early in January 1869 I resumed charge of the Topographical Survey Department and my offices at the Presidency on return from a special deputation to England on duty, and this report will therefore embrace a general review of the progress of the Topographical Surveys under my control for the season of 1868-69, and of the work performed in the several branches of my Head-Quarters Office for the year ending 31st December 1869.

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- No. IV.—Topographical party, Chota Nagpore Division Survey { Topography in Sirgooja, Korea and Chang Bhokar of the Chota Nagpore division, Bengal. Triangulation in Sirgooja and Oodeypore of the Chota Nagpore division, and in the northern portion of district Belaspore of the Central Provinces.
- No. V.—Topographical party, Rowah and Bundelcund Survey { Topography in Rowah, Churkaree, Punnah, Kotee and Adjgurh. Triangulation in Punnah and Adjgurh.
- No. VI.—Topographical party, Khasia and Garrow Hills Survey { Topography in North Cachar, Naga Hills, Khasia and Jynteah Hills. Triangulation in the Naga Hills district, North Cachar, and northern portion of Muni-
pore.
- No. VII.—Topographical party, Rajpootana Survey. { Topography in Jeypore State. Triangulation in Jeypore, Boondee, Kotah, Neemuch and Oodeypore or Meywar.

3. Of nearly all the ground allotted to these survey parties no reliable maps exist, and in reality the tracts through which the operations of Nos. 2, 3 and 6 topographical parties are extending are even unexplored and have rarely been visited by Europeans, so that these portions of country are represented on the existing preliminary maps as almost vast blanks; or where from hearsay, or other unreliable sources, the sites of a few villages appear, the information given is more likely to mislead than to help those who have occasion to consult the old maps. The area produced will be of great value in representing many parts of India which have hitherto defied all attempts at conjectural geography. The atlas sheets thus affected are described in the remarks on the executive surveys.

4. **OBJECT AND SYSTEM OF SURVEY.**—The objects of the Topographical Survey operations, and the system of survey adopted, have been fully explained in my previous printed reports on the administration of the department, briefly they may be described as follows:—The object is to obtain fairly reliable maps on a moderate scale (one inch to the mile), and at a small cost, of wild, hilly and unremunerative and non-regulation districts within British jurisdiction, as well as of Native States, for purposes of administration, civil and military, and to obtain geographical information on a reliable basis, for the sheets of the Great Indian Atlas, of vast tracts of country which, under any more expensive and elaborate system, would take upwards of a century to complete.

5. The system of survey is most effective, rapid and certainly the cheapest which could be adopted for similar operations in unhealthy, wild and rough ground. It is based on a net work of secondary triangulation conducted with the larger class of Vernier Theodolites, closely connected with, and verified by the Great Triangulation of India, and the detail work, or topography, is filled in by means of the plane table, checked by routes or traversing between the stations fixed by triangulation wherever the nature of the ground will admit of such test, or else examined by a competent officer in the field, by intersections to surrounding objects from the points of triangulation.

6. **TOTAL AMOUNT OF WORK COMPLETED.**—The aggregate area of final survey completed during the season of 1868-69 by the seven parties is 16,801 square miles, of which 13,840 square miles is rendered on the scale of one inch to the mile, and 2,961 square miles (Khasia Hills Survey) on the smaller, or half inch to the mile scale. The triangulation in advance of the details, as a basis for future plane tabling, has been extended and is now ready and computed out over an area of no less than 15,592 square miles.

7. Observations were taken at 390 stations by which the positions of 1478 points were trigonometrically determined—with 1224 determinations of heights.

8. The entire cost of the season's operations, inclusive of all charges for the seven parties, amounts to Rs. 3,68,608; of this Rs. 53,522 is on account of miscellaneous contingent charges, which of late years have increased so much, owing to the enhanced cost of cooly labor, the feed and keep of elephants, the clearing of rays, and every other item.

9. The amount of work accomplished by each party, and the total cost of each, including every charge for the season of 1868-69, are given in the following statement, which is full of detail, and useful for comparing at a glance the relative out-turn and results of the labors of each executive.—

| Designation of Survey. | Topography completed in square miles. | Triangulation completed in square miles. | Stations observed at | | Square miles to each point. | Heights determined. | Square miles to each height. | AREA OF FINAL MAPPING EXECUTED. | | Total cost. Rupees. | REMARKS. |
|--|---------------------------------------|--|-------------------------|-------------------------|-----------------------------|----------------------------------|------------------------------|---|--------------------------------|---------------------|---|
| | | | Number of points fixed. | Number of points fixed. | | | | 1 inch scale standard. | 1 inch scale exaggerated. | | |
| No. 1 Topographical party, Gwalior and Central India Survey. | 1,577 | 2,007 | 54 | 309 | 8 | 234 | 11 | 1,080 | 4,080 | 48,632 | Ground broken; in parts low hills and forest. |
| No. 2 Topographical party, Central Provinces Survey ... | 1,812 | 1,663 | 89 | 140 | 11 | 47 | 33 | 2,409 | 3,560 | 49,655 | Ground very difficult; covered with forest, very hilly. |
| No. 3 Topographical party, Central Provinces and Vizagapatam Agency Survey ... | 1,968 | 1,500 | 38 | 131 | 9 | 137 | 9 | 1,868 | 2,221 | 66,833 | Ground very difficult; hilly and forest clad. |
| No. 4 Topographical party, Chota Nagpore Division Survey ... | 2,573 | 3,239 | 60 | 268 | 12 | 202 | 16 | 2,755 | 3,084 | 40,950 | Ditto ditto. |
| No. 5 Topographical party, Rewah and Bundelcund Survey ... | 1,838 | 1,215 | 50 | 155 | 8 | 340 | 4 | 1,838 | 2,138 | 51,653 | Ground very difficult in parts. |
| No. 6 Topographical party, Khasia and Garo Hills Survey ... | 3,289* | 1,300 | 40 | 162 | 8 | 71 | 18 | 4,000 on $\frac{1}{2}$ inch 640 on 1 inch. | 1,087 on $\frac{1}{2}$ inch | 60,508 | Ground very difficult; high hills covered with forest. * 2,061 on $\frac{1}{2}$ inch scale. 327 on 1 inch scale |
| No. 7. Topographical party, Rajpootana Survey ... | 3,337 | 4,168 | 54 | 309 | 14 | 193 | 8 | 3,077 | 4,723 | 41,477 | Ground mostly open and easy. |
| TOTAL ... | 10,801 | 15,592 | 390 | 1,476 | Average. 10 $\frac{1}{2}$ | 1224 & Darom. 22 $\frac{1}{2}$. | Average. 12.7 | 18,265 | 20,801 | 3,68,609 | Average rate of final survey per square mile equals Rs. 21-15. |

10. AVERAGE RATE OF FINAL SURVEY AND REMARKS THEREON.—The average cost of the

| Season | Square Miles. | Total cost | Mileage Rate. |
|---------------|---------------|--------------|---------------|
| 1867-68 ... | 20,201 | Rs. 3,64,211 | Rs. 18-0 |
| " 1868-69 ... | 16,801 | " 3,68,608 | " 21-15 |
| | —3,400 | + Rs. 4,391 | + Rs. 3-15 |

final topography completed, including the cost of the triangulation, is Rs. 21-15 or £2-4 per square mile. This average rate is very moderate but in excess of the cost of the previous season, and the increase is entirely due to the

very exceptional season we have had throughout Central India, Rajpootana, the Central Provinces and Bundelcund. Owing to these provinces being on the verge of a famine, the duration of the field season was shortened by two months, and increased wages were of necessity paid to the native establishments to compensate for the dearness of provisions, or in fact to enable able-bodied men to subsist at all. So that, while owing to the shortness of the field season there is a decrease over the preceding year in the out-turn of final survey of 3,400 square miles, there is a slight increase of expenditure of Rs. 4,391 in the total cost of the seven parties, which raises the mileage rate by Rs. 3 and 15 annas.

11. As a set off against the decrease in the area of topography completed, there has been

| | 1867-68. | 1868-69. | Increase. |
|--|----------|----------|-----------|
| Area triangulated in advance in square miles ... | 14,332 | 15,592 | 1,260 |
| Points fixed trigonometrically ... | 821 | 1,476 | 655 |
| Elevations determined trigonometrically ... | 504 | 1,224 | 720 |

an increase in the area triangulated in advance, and a marked improvement in the number of points fixed by the triangulation, and the number of heights or elevations determined, both of which elements are of great importance—results

which were greatly desired, and to which the attention of the Deputy Superintendents of Survey was specially directed.

12. In the season 1867-68 the general average was for—

| | | | | |
|-------------------------------|-----|-----|-----|----------------------|
| Points fixed by triangulation | ... | ... | ... | 1 to 19 square miles |
| Elevations | ... | ... | ... | 1 to 28 " " |

The general average for the season under review, 1868-69, gives—

| | | | | |
|-------------------------------|-----|-----|-----|-----------------------|
| Points fixed by triangulation | ... | ... | ... | 1 to 10½ square miles |
| Elevations | ... | ... | ... | 1 to 12½ " " |

or an increase in favor of 1868-69 of nearly 100 per cent. in the number of points fixed, and of 110 per cent. in the number of elevations determined.

13. The topography completed bears evidence of careful execution, is favorably reported on by the several Deputy Superintendents of Survey, and has for the most part satisfactorily stood the tests which have been applied to it. The check in No. 1 Gwalior party has been deficient, and the attention of the executive officer drawn to the subject.

14. RESULTS OF TRIANGULATION, &c.—The results of the season's triangulation, and the number of plane table stations, or fixings, per square mile in each survey are given in the following table:—

| SURVEY PARTIES. | NUMBER OF TRIANGLES. | | | | TRIANGULAR ERROR IN SECONDS. | | MEAN DIFFERENCES IN COMMON SIDES IN INCHES PER MILE. | | | | Number of Plane Table fixings or stations 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 Topogr. party. | | 111 | 35 | 595 | ..... | 7" 3 | ..... | 3 8 | 7 0 | 12 0 | 6 8 | | |
| No. 2 ditto | | | 167 | 108 | ..... | ..... | ..... | ..... | 5 4 | 6 7 | 4 1 | | |
| No. 3 ditto | | | 329 | ..... | ..... | 10 0 | ..... | 12 Inches. |  | ..... | 6 7 | | |
| No. 4 ditto | | 17 | 202 | ..... | ..... | 4 3 | ..... | 3 4 | 9 93 | 22 0 | 4 7 | | |
| No. 5 ditto | | 9 | 27 | 321 | | 37 | 0 8 | 13 5 | 1 0 | 16 3 | 27 7 | | 6 9 |
| No. 6 ditto | | 9 | 66 | | | 204 | 5 5 | 23 0 | 6 5 | 8 0 | | 01 0* | |
| No. 7 ditto | | | 89 | 29 | | 507 | | 4 8 | 3 0 | 9 5 | 11 9 | | 3 6† |

* Intersections to hill peaks—no marks.
† Country open and easy.

15. The triangulation generally is of good quality, and there is an improvement in the number of plane table stations for each square mile of final topography.

16. TOTAL AMOUNT OF FAIR MAPPING COMPLETED AND RENDERED.—The total area represented by the standard inch scale and half inch scale maps, in sheets or sections of 15 minutes of Latitude by 30 minutes of Longitude, is 18,265 square miles*; the greater portion of these sheet maps, only received a month or two ago, have been already reproduced to scale by the photo-zincographic process, and the remainder are in course of transfer to zinc. Hundreds of copies of these maps have already been issued to local Governments and Administrations, Railway Engineers, the Geological Survey Department, and other branches of the public service, and it has been found necessary to print larger editions than usual, owing to the constantly increasing demand, and as the supply of those of former season's survey has in many instances been completely exhausted, necessitating the publication of second editions.

17. EXAGGERATED MAPS DRAWN FOR REDUCTION TO ONE-FOURTH SCALE.—The area represented by the exaggerated maps, drawn specially for reduction by photography to the geographical scale of 4 miles to the inch, or the natural scale of 1: 253,440, amounts to 20,901 square miles.† These sheet maps, after reduction by the camera, are joined together and transferred to zinc by the carbon process, and are published in the form of complete degree sheets and half degree sheets, according to the extent of materials received. Several of these geographical scale maps, obtained from the results of the past season's survey and mapping, have already been published and issued

* 13,665 on 1 inch scale.
4600 on ½ ditto.

† 19,814 sq. mls. on the inch scale.
1,087 ditto on ½ inch scale.

18. REMARKS ON THE SEASON'S FAIR MAPS.—The distribution of area actually mapped during the season under review, and published or now under publication, in the British districts and Native States under survey is as follows:—

| | | | |
|--|---|--------|---------------------|
| | No. 1 PARTY.—In Gwalior, Jeypore, Ulwar, Kotah and Boondee | ... .. | 1,080 square miles. |
| * 407 square miles of the previous season's survey | No. 2 PARTY.—In the districts of Baitool, Chindwara and Hooshungabad | ... .. | *2,409 .. |
| | No. 3 PARTY.—In the Jeypore State of the Vizagapatam Agency, Madras Presidency, and Bustar State of the Central Provinces | ... .. | 1,966 .. |
| | No. 4 PARTY.—In Sirgooja Korea, and Chang Bhokar of the Chota Nagpore Division | ... .. | 2,755 .. |
| | No. 5 PARTY.—In Rewah, Churkaree, Punnah, Kotee and Adjgurh | ... .. | 1,838 .. |
| † 4900 sq. miles on $\frac{1}{2}$ inch. 540 " " on 1 " " | No. 6 PARTY.—In North Cachar, Khasia and Jynteah Hills | ... .. | †5,140 .. |
| Sqr. ms. 6,140; of this 1652 sq. miles belong to the previous season's survey. | No. 7 PARTY.—In the Native State of Jeypore | ... .. | 3,077 .. |

19. The total out-turn of fair mapping by the seven surveys, *viz.*, 18,265 square miles of standards on 1 inch and $\frac{1}{2}$ inch scales, and 20,901 square miles of exaggerated mapping, is exceedingly good, and indeed has kept every one employed to the latest day of the recess.

20. Relatively taken, the following opinion has been formed of the maps received. The fair standard maps of No. 1 party are well drawn in the usual good style of this party. In the exaggerated maps there is great room still for improvement, and for better generalization of details for reduction to $\frac{1}{4}$ th scale, and this has had careful attention.

In No. 2 party, there is a marked improvement in the drawing of the standard as well as of the exaggerated maps. These latter have not yet been tried, owing to complete degrees not being squared up. The style of the topographical details on this survey has always been of an inferior character.

Of No. 3 party, the standard maps describe the ground very clearly and are decidedly progressing in improvement, but they are not as yet sufficiently suited to reproduction by photo-zincography, owing to the horizontal line shading for the hills and some of the lower slopes being very broken and rough. The exaggerated maps are in some instances wanting in relief. This description of drawing is peculiar, and requires much practice, as well as competent assistants to do it. None have been reduced this season, for the same reason as stated in No. 2 party.

The standard maps of No. 4 party, and also the exaggerated maps, are very effective and artistic drawings, and have reproduced and reduced excellently by photo-zincography. They reflect the highest credit on Lieutenant Sale and his assistants. Specimen sheets of this officer's own drawing have been circulated to the department as good guides for imitation.

The standard maps of No. 5 party delineate the ground well and are beautifully drawn, the writing on some of the sheets is somewhat defective, but as a whole are satisfactory and creditable records. The exaggerated maps are in some instances wanting in relief.

The $\frac{1}{2}$ inch standard maps of No. 6 party are well executed delineations of extremely difficult ground, and some have reproduced well by photo-zincography. The writing on most of the sheets is very indifferent, requiring careful attention on the part of the Deputy Superintendent. The exaggerated maps are very effective, but somewhat too closely drawn for satisfactory reductions.

The standard maps of No. 7 party are mostly of a very easy character, they have all been very fairly reproduced by photo-zincography. In some of the exaggerated sheets the hill shading is a little too closely drawn for reduction, but this will soon adjust itself.

21. PROFESSIONAL RESULTS, GENERAL REPORTS, &c.—The professional reports, computations and field books lodged in this office by the different surveys are as follows :—

| | |
|---|-----------------|
| No. 2 PARTY.—Duplicate angle books Nos. 1 to 10 of 1866-67. | |
| Ditto Nos. 1 to 10 of 1867-68. | |
| Ditto Nos. 1 and 2 of 1868-69. | |
| General report vol. (fair copy) | 1868-69. |
| Original Computations, 2 vols. | for 1866-67. |
| Ditto 1 vol. | for 1867-68. |
| Ditto 1 vol. | for 1868-69. |
| No. 3 PARTY.—Original set of computations (bound) | for 1868-69. |
| No. 4 PARTY.—Horizontal angle books, 2 vols. | for 1868-69. |
| Vertical ditto 1 vol. | for 1868-69. |
| General report, vol. (fair copy) | for 1868-69. |
| Original computations | for 1868-69. |
| No. 5 PARTY.—General report, vol. I. | for 1864 to 68. |
| No. 6 PARTY.—General report, vol. | for 1868-69. |
| No. 7 PARTY.—Original computations | for 1866 to 69. |
| General report (degree sheet II) | for 1866-67. |
| Ditto (ditto IV) | for 1864 to 69. |
| Ditto (ditto VIII) | for 1866-67. |

22. The entire out-turn of work by the seven parties, both in the field and recess, is

Opinion on the general results of topographical surveys and services of officers in charge of parties.

perfectly satisfactory, because the diminished area reported arises from no cause over which any of the executive officers had any control. The labors and

endeavours of the Deputy Superintendents, and their assistants, both in the senior and junior departments, have been highly praiseworthy and creditable, the aim and object having been a high standard of accuracy and perfection of the professional details and maps, combined with the largest practicable area consistent with the above conditions. Those executive officers more specially named in the body of this report are particularly deserving the notice and approbation of the Government, as a proper incentive to further exertions.

23. INSPECTION OF PARTIES.—With one exception only (that of the Khasia Hill Survey), all the parties were personally inspected by myself during the year, the results of which will be found recorded under the proper head of the executive surveys. I have derived the highest satisfaction from the close communication thus held this year with the several Deputy Superintendents of Surveys, and from the opportunities I thus derived of discussing professional details, and the progress of departmental improvements, with both officers and their assistants, as well as of witnessing the actual mode of working in each office. I can bear special testimony to the value of the labors bestowed, and am well assured that the best impetus is being given to a steady perseverance in overcoming all obstacles and difficulties which generally beset survey operations in the more intricate parts of this country, and also that the style and character of the survey will go on gradually improving by the very laudable and successful efforts of the officers engaged in the work.

24. OBJECTS AND RESULTS OF TOUR OF INSPECTION.—My tour of inspection embraced the following objects :—In May and June I visited Madras and Ootacamund, where I met Colonel Saxton's party, and had also an opportunity of deriving full information regarding the Madras Revenue Surveys from Colonel Priestley and Major Hesse at Coimbatore. After returning to Calcutta early in July, I proceeded in August to Chota Nagpore for the purpose of inspecting that division survey now under Lieutenant Sale at Dorundah, and also had the opportunity of examining the topographical work now being carried out by the revenue

survey party of the Hazareebaugh District under Captain Sconce of that branch of the department. Immediately after that I repaired to Dehra Dhoon and Mussooree, where I inspected three topographical parties of the Rajpootana and Central India Agencies, and the revenue survey party of Oudh under Major Adrian Vanrenen. On the completion of which duty I proceeded to Jubbulpore, where I spent several days in examining the offices of the Central Provinces' Topographical Survey, under Mr. Girdlestone (late Mr. Mulheran's), as well as the revenue survey party under Major Oakes.

25. **MADRAS GEOGRAPHY.**—The result of my enquiries regarding the Madras Revenue Surveys, and my propositions for turning them to good account for geographical purposes, under the direction of a Deputy Surveyor General to be re-appointed for that presidency, were embodied in the letter marginally cited, and submitted for the consideration of the Government of India, and for reference to the Government of Madras. Many of the old sheets of the Indian Atlas of the Southern Peninsula, published half a century ago, from the Military Institution surveys on a small scale, are quite obsolete, and urgently require to be revised by the results of the more recent surveys in that presidency.

26. **BOMBAY GEOGRAPHY.**—From Jubbulpore I repaired to Nagpore, where the revenue surveys in Raipore were discussed with Mr. Smart, Deputy Superintendent of Survey, and the opinion of the Chief Commissioner also taken on the general operations, and particularly as to the definition between topographical and revenue surveys in the Central Provinces. From thence I reached Bombay with the view of consulting the Bombay government as to the state of the geographical records of that Presidency, and to ascertain the exact value of the materials now existing there, as well as the nature of the records of the fiscal or cadastral survey, or rather measurement of fields, which has for so many years been under progress in that presidency. The non-receipt of any contribution whatever to the geography of the northern portion of Bombay during the last 40 years, and the absolute blanks which have prevented the publication of the Atlas sheets specified on the margin, and the subject having attracted the attention of the Bombay Government, I was invited by His Excellency the Governor to consider and report on the question, and to visit Bombay for that purpose.

Atlas sheets, blank, Nos. 11, 12, 13, 21, 22, 23, 35, 36, 37.

27. The existing state of the geographical materials connected with the Bombay Presidency is described in a memorandum which I drew up and submitted to the Government of Bombay as per margin.

Dated 7th August 1869, to the Secretary to the Government of Bombay.

28. **REMEDIAL MEASURES FOR BOMBAY.**—In this paper three very important questions had consideration :—

First.—The collection and compilation into convenient sheets, on a reduced scale, by a competent departmental officer, for immediate publication to serve temporary purposes, of such of the old existing materials now scattered in different offices, as well as the utilisation of the maps of the Bombay revenue measurements of fields wherever practicable, and susceptible of combination and connection with the great triangulation, now so greatly extended, all over this part of India.

Secondly.—The acceleration of the topographical survey of the northern portion and Native States of the Bombay Presidency above the parallel of 20° North Latitude, so long and unaccountably neglected, by a gradual introduction and increase of the number of topographical survey establishments.

Thirdly.—The revival of the old appointment of Deputy Surveyor General (abolished in 1833) to meet the above objects, and to provide for the extension of surveys shown to be so urgently needed in this long neglected presidency.

29. This subject is still under the consideration of the Government of Bombay, and the result of my enquiries at that presidency will be brought forward with distinct propositions on a fitting opportunity. After a careful examination of the old Deputy Surveyor General's office records, now under charge of the Chief Engineer, as well as of the geographical materials existing in the Quarter Master General's Office at Poona, and having made my representations to His Excellency the Governor, I returned to Calcutta on the 6th of December, availing myself of the opportunity of inspecting the Chanda Revenue Survey Office under Captain Coddington, as well as the photo-zincograph office at Poona,—from all of which I derived very considerable satisfaction and profit.

30. **CONTEMPLATED REDUCTION OF THE SURVEY DEPARTMENT.**—The state of my department has now grown eminently efficient, and the effect of the reorganisation, obtained after so many years' labor, is beginning to tell, so that the existing machinery is capable of producing work of a high order at the most reasonable cost, and the area added annually to our stock of geographical knowledge of territories hitherto absolutely unknown is very considerable. The necessities for the completion of the first survey of India are every day presenting themselves with greater force, and the absence of maps is felt, most particularly by the Geological Department, whose important investigations in the coal-bearing districts, and on those parts of the country where metallic deposits are known to exist, cannot be carried out in consequence. The demands from the Irrigation and Railway Departments are equally strong; it is therefore really a matter of the most vital importance that the sphere of usefulness and efficiency of the Survey Department should not be lessened, and its agency, which has cost so much to rear, set aside or reduced on financial grounds, as it is intimated to be the intention of the Government to do.

31. **SURVEYS AND RE-PRODUCTION OF MAPS REMUNERATIVE.**—There is so much of a remunerative character in the operations of this department, that the reduction of its powers and capabilities in dealing with the existing wants of India must prove highly detrimental to the real interests of the State, and to the absolute necessities of the public service. So far from any economy arising from such a course, it is believed that the dispersion and discardment of such trained professional agency, obtained at such a cost, and perfected with so much labor and time, will prove ruinously expensive. It has to be borne in mind that the qualifications of survey agency capable of conducting important operations of a professional character, in so specially a difficult country as India, are not to be met with when wanted, and if once disbanded, the expense of re-establishing and re-organising a staff of this nature will be very serious. Reductions in the survey budget can only be met by the stoppage of the field surveys and by the discharge of establishments.

32. Whether, therefore, we look at the interests of the Government alone, or of the individuals who have deserved so well of the State, by risking their lives in its service in so arduous a profession, the economy or policy of reduction, and withdrawing the means of meeting the certain and ever-increasing exigencies of every local administration in this time of great transition in which India is now involved, is open to grave doubt, and I trust that the subject in all its bearings may receive the fullest and most careful attention which it deserves.

33. The causes of the increase in the expenditure of the department during the past five years, and the effects likely to be produced by any material financial reductions, have been reported on in my memorandum cited in the margin.

34. In addition to the area effected by the topographical branch of the department

| | Combined total results. | | Rate. | |
|---------------|-------------------------|--------------|---------------------------|-----|
| | Square Miles. | Cost. Rs. | Rs. | As. |
| Topographical | 16,801 | 3,68,609 | 21 | 15 |
| Revenue | 19,369 | 8,90,314 | 45 | 15 |
| Total | 36,170 | 12,58,922 | 34 14 General average. | |

as above given, there is the out-turn of the revenue surveys for the same period, as reported by the Deputies Surveyor General, to be considered. Combined, the two branches aggregate a total area of 36,170 square miles of four inch, and one inch survey respectively, at a cost of Rs. 12,58,922, yielding a mean

average rate of Rs. 34-13 per square mile.

35. Placing these figures in juxtaposition with the areas previously reported, we obtain the following results as the total amount of survey executed in the Nizam's territories, and in the revenues, from the date of my own superintendance of these operations in 1847.

| | Period over which the Survey extended. | Total area accomplished. Square Miles. | Total cost. Rupees | Average rate of survey per square mile. | |
|--|--|--|--------------------|---|--|
| Topographical Surveys, vide paragraph 24 of general report for season 1866-67... | 1836 to 1867 | 1,60,026 | 27,81,462 | Rs. A. | |
| Topographical Surveys, vide Surveyor General's letter to the Secretary to the Government of India, Home Department, dated 5th February 1869, submitting general report for 1867-68 ... | 1867-68 | 20,201 | 3,64,211 | | |
| Topographical Surveys season under review | 1868-69 | 16,801 | 3,68,608 | | |
| Total of Topographical Surveys | 1836 to 1869 | 1,97,028 | 35,14,281 | 17-13 | General average rate per square mile for the Topographical Surveys. |
| Revenue Surveys (vide general report of 1866-67) | 1846 to 1867 | 3,64,177 | 97,39,129 | | |
| Revenue Surveys | 1867-68 | 16,616 | 8,84,928 | | |
| Ditto, season under review | 1868-69 | 19,369 | 8,90,314 | | |
| Total of Revenue Surveys | 1846 to 1869 | 4,00,162 | 115,14,371 | 28-12 | General average rate per square mile for Revenue Surveys. |
| Total of Topographical and Revenue Surveys up to | 1869 | 5,97,190 | 150,28,652 | 25-2 | General average rate of survey per square mile for topographical and revenue work. |

36. In the above-mentioned period, or it may be said in the last quarter of a century (without considering the old Hyderabad and Ganjam areas effected prior to 1844), the enormous area of nearly six hundred thousand square miles of country, much of which was of a difficult and insalubrious character, peculiarly hostile to European life, have been accomplished, all based on undeniable triangulation, and rendered in a proper state for incorporation in the general Atlas of India, at a cost of only Rs. 25-2 or £2 10s. 3d. per square mile. This does not include the Topographical Surveys conducted under the Trigonometrical Branch, either in the Himalayas or in the Bombay Presidency which are reported on separately—

37. This area is very nearly five times larger than that of the whole of the British Islands; more than twice and a half larger than that of France; upwards of five times the area of Prussia, more than double that of Austria, and three times that of Spain. It may fairly be said to be an achievement of no ordinary character, and of which those officers who have steadily assisted in the operations may well be proud. The survey of India is a national work worthy of comparison with similar undertakings in other European countries.

38. In order to show more precisely the disposition of the several survey parties now employed, and the respective fields of survey since 1862, when the last index map was published, I annex a new index map of India, showing at a glance the tracts under topographical treatment (green), and those being dealt with by the Revenue Survey establishments (pink), whilst the older surveys previously reported or executed are shown with a grey tint. Although it will be observed very great progress has been made, and a marked impression

effected on the total area of India, both British and Native States, yet much remains to be accomplished still, and it is to be hoped that nothing may arise to prevent this most desirable end from being carried out to completion within a reasonable time. To fill up the blank spaces is a most essential object, and until the whole of India is covered by a first and cheap survey, the pressing necessities of the public service, and the requirements for good administration, will not be attained.

39. The results and details of the revenue surveys are shown in the separate printed reports of the Deputies Surveyor General, and Superintendents of the Revenue Branch of the Department, which are furnished to the several Administrations under which these particular operations are going on, as well as submitted to the Supreme Government by myself. The revenue surveys of the Upper Circle of Superintendence are about to lose the valuable services

Military Department, Order No. 1289, dated of Colonel Gastrell, who has for so many years been the 28th December 1869. connected with this department, by the recent orders granting him furlough to Europe. The absence of this able officer will be severely felt, but it is highly essential he should enjoy respite from work for a time, after so many years uninterrupted service in India, and I desire to record the obligations I feel under to Colonel Gastrell for the uniform support and co-operation he has invariably rendered to me in the discharge of his duties, both as an executive and superintending officer.

40. In the drawing and compiling office, a large amount of mapping of various descriptions has been completed (as detailed in Statement A in Appendix). Some of the most important maps which have been compiled and published, which await publication, or which are in course of completion, will be briefly referred to here, to illustrate the progress which is being made in the geography of India.

CARTOGRAPHY.

Geographical Drawing and Compiling Branch.

INDIA (SMALL SCALE MAP).—To illustrate reports, routes of travellers, &c., small scale maps of India have been in great demand. A small map (No. 1, scale 256 miles to the inch) has been engraved with all such details as the scale will admit of. It is revised up to date. A second map (hand map of India No. 2, scale 128 miles to the inch) has also been prepared and engraved, forming a most useful publication for various purposes. The hills for this map have still to be engraved. Skeleton editions of both these maps, containing only a few names, are available to meet requisitions for special reports, and illustrations of particular subjects.

A new edition of several hundred impressions of the 6 sheet sketch map of India, showing revenue and political divisions (scale 32 miles to the inch), revised up to 1869, has been issued. This map is in great demand, and has been prepared with the object specified in the note, as given on the map, quoted on the margin.

NOTE.—This map is based on Mr. John Walker's sketch map of India in 6 sheets engraved in England. The additional information on it has been obtained from various sources, and it is only to be considered as a preliminary sketch map, published with the object of collecting the latest and most trustworthy information regarding orthography; new territorial limits and divisions; boundaries of districts; new towns of importance; roads; canals; railways; &c.; with a view to the compilation of a complete and accurate map of British India from the results of the various actual surveys completed up to date.

INDIA.—An entirely new standard map, scale 32 miles=1 inch, is in progress of construction, showing the results of actual surveys only, and based on the Great Triangulation of India. An accurate map of our Indian possessions on a convenient scale being still a very great desideratum, owing to all the English maps being filled up with obsolete names, and being otherwise seriously defective and inaccurate, and three editions of the lithographed preliminary map having been exhausted, I have been induced to undertake this new map, which will be in six sheets, the same size as the former one on the above basis; and from local information as to the correct names of places, their orthography, relative importance, &c., which I have collected with great labor from every part of India, its limits have been extended beyond British possessions, so as to represent on it all the geographical information we possess, or can hereafter obtain, of the various surrounding independent States. This compilation will occupy some time.

INDIA.—An entirely new standard map, scale 32 miles=1 inch, is in progress of construction, showing the results of actual surveys only, and based on the Great Triangulation of India. An accurate map of our Indian possessions on a convenient scale being still a very great desideratum, owing to all the English maps being filled up with obsolete names, and being otherwise seriously defective and inaccurate, and three editions of the lithographed preliminary map having been exhausted, I have been induced to undertake this new map, which will be in six sheets, the same size as the former one on the above basis; and from local information as to the correct names of places, their orthography, relative importance, &c., which I have collected with great labor from every part of India, its limits have been extended beyond British possessions, so as to represent on it all the geographical information we possess, or can hereafter obtain, of the various surrounding independent States. This compilation will occupy some time.

INDIA—Scale 10 miles=1 inch.—Eastern Bengal section between the parallels of 20° and 25°, North Latitude, and the Meridians of 90° and 94° East Longitude, has been well advanced towards completion.

The Central Bengal section between Latitude 20° to 25° and Longitude 86° to 90°, containing Calcutta and the surrounding districts, the mouth of the Hooghly river and the Soonderbunds, has been completed and is being photozincographed prior to the despatch of the original to Sir Henry James, Director of the Ordnance Survey of Great Britain, for incorporation and publication with his Universal Atlas of the World on this scale. The remainder of the sheets will be taken up as the survey materials will permit.

41. PUNJAB.—Lithographed in 8 sheets,—scale 8 miles=1 inch; sheets 6 and 8, containing portions of Jamoo, Kashmir, the Delhi, Hissar and Umballah divisions, have been published, only sheet 5, containing Sirinagar, Skardo and Leh, remains to complete the entire map.

PUNJAB AND DEPENDENCIES 16—miles=1 inch, lithographed in 4 sections.—The final proofs have been revised and the map is on the point of being issued.

42. BENGAL (LOWER PROVINCES).—Atlas sheets, $\frac{1}{4}$ -sheets 125 south-west and south-east containing portions of the districts of Sylhet, Mymensing and Cachar, have been compiled and made over to the engraver. One quarter-sheet 125 south-east has been engraved, and $\frac{1}{4}$ -sheet south-west well advanced. I hope very soon to publish copies of these specimens of the first, engraving executed in India. The Lower Provinces district maps, on the scale of 4 miles=1 inch, of Manbhoom, Chittagong, Sylhet, Tipperah and Noacolly with Tipperah Hills, from the results of the revenue survey, have been lithographed and issued.

43. OUDH.—A map to illustrate the census report of the province has been specially compiled on a scale of 16 miles=1 inch, from the results of the revenue survey, and will be immediately reproduced by the photozincographic process. This map has been compiled and based on the Great Trigonometrical Survey operations, and will be most useful as an index or hand

| | | |
|-----------------------------|-------------|---|
| * Published in 1869 | 29 sheets. | map. Thirty-six sectional maps* of the Province of |
| Previously published | 7 „ | Oudh, on the scale of one inch to the mile, showing |
| TOTAL | <u>36 „</u> | village boundaries, have been lithographed and |
| | | issued. |

The $\frac{1}{4}$ -sheets of the Indian Atlas No. 87, containing the greater portion of the northern and north-eastern districts of the Province of Oudh (scale 4 miles to the inch) have been compiled in outline from the recent revenue survey details, and are now in the engraver's hands.

The old sheets 68 and 88 (full plates double elephant size) of the Indian Atlas, containing the western and southern portions of Oudh, with parts of the North-West Provinces, are under compilation in outline, and will soon be ready for the engraver, as a second edition of the above plates as regards the whole of the Oudh portion.

| | |
|---------------------------------|-------------|
| * Published in 1869. 17 sheets. | |
| ditto previously, 4 „ | |
| Total | <u>21 „</u> |

44. SINDH.—Twenty-one sheets* of the one-inch maps of the Province of Sindh Revenue Survey have been lithographed and issued; others are in course of drawing for transfer to stone.

The $\frac{1}{4}$ inch general map of Sindh (in 10 sections) without hills is ready for publication; sheet 7 has been transferred to stone; sheet 8 is being drawn for transfer and is half finished.

45. CENTRAL PROVINCES.—District Hooshungabad.—3 sheets, 1 inch to 1 mile; and District Seonce.—3 sheets, 1 inch to 1 mile, have been issued.

46. Of the several topographical surveys in British and Native States, on the 1 inch, $\frac{1}{2}$ inch and $\frac{1}{4}$ inch scales, the out-turn of published materials, and the state of the publications up to date, is as follows :—

| | Published in 1869. | Published previously. | Total 1 inch to 1 mile sheets. |
|--|-----------------------|---------------------------|--------------------------------------|
| BENGAL, CHOTA-NAGPORE DIVISION.—1 inch sheets containing portions of Chota-Nagpore, Sirgoojah and Jushpoor | 11 | 17 | 28 |
| Ditto Ditto Degree sheet | 1 | $\frac{1}{4}$ inch scale. | |
| BENGAL, KHASIA AND GARROW HILLS.—1 inch and $\frac{1}{2}$ inch sheets containing the Khasia and Jynteah and North Cachar Hills | 8 | 2 | 10 |
| REWAH AND BUNDELCUND.—1 inch sheets containing portions of Rewah, Punnah, Nagode, Chirkaree, Myhere and Adjygarh | 9 | 11 | 20 |
| Ditto Ditto Half degree sheets | 2 | $\frac{1}{4}$ inch scale. | |
| GWALIOR AND CENTRAL INDIA.—1 inch sheets containing the States of Gwalior, Dholepoor, Kerowlee, Ulwur, Jeypoor and Dattiah | 11 | 23 | 34 |
| Ditto Ditto Degree sheets | 2 | $\frac{1}{4}$ inch scale. | |
| RAJPOOTANA.—1 inch sheets containing portions of the Native States of Jeypoor, Shekawuttee and Bikaner | 20 | 10 | 30 |
| Ditto Ditto Degree sheets | 3 | $\frac{1}{4}$ inch scale. | |
| CENTRAL PROVINCES.—1 inch sheets containing portions of the Districts of Belaspore, and Rypore, and portions of the dependant States of Bustar, &c. | 5 | 18 | 23 |

47. TOTAL AREA OF MAPS PUBLISHED IN 1869.—Roughly calculated, the maps published during the season under review, from the results of topographical and revenue surveys in progress, and omitting all small scale compilations, index maps and miscellaneous maps, represent an area of no less than 77,000 square miles. This calculation is made in order to show the difference between the area mapped and actually received into the office, and the area returned by executive officers. Fuller details regarding the extent and nature of the mapping executed and published will be found in the Appendix.

48. ENGRAVING BRANCH.—In my letter No. 180, dated the 5th February 1869, para. 10, forwarding the printed General Report of the Topographical Surveys and Surveyor General's Offices for 1867-68, I reported that the staff of European engravers sanctioned by the

Mr. C. W. Coard, Supdt.
 .. F. J. T. Walsh, Hill Etcher.
 .. J. M. Dalziel, Engraver.
 .. W. Donaldson, "
 .. M. H. West "
 .. E. Best "
 .. J. Wilkie, Plate Printer.

Right Hon'ble the Secretary of State, as per margin, who came out from England with me in January 1869, for the purpose of undertaking the publication of the final maps of the Atlas of India in this country under departmental supervision, instead of in England as heretofore, had commenced work in this office, and in my letter as per margin, I submitted proposals to

supplement the above European skilled nucleus, with a proportionate establishment of native engravers and apprentices, plate printers and pressmen, sufficient to make a fair beginning in an entirely new process hitherto unpractised in Calcutta, with the object of making tolerable progress, and reducing the cost of each engraved sheet, or general map.

49. This having met the approval of Government, in the Financial Resolution noted on the margin, the work, which advanced from various causes but slowly at first, has now assumed fair proportions, and a considerable number of maps of a most useful character, and of a style of execution hitherto unknown in Calcutta, are now being turned out, and the new establishment promises most fairly. Under the able superintendence of Mr. Coard, this new branch of my department has made a good beginning, and the native hands and apprentices are making excellent progress in learning the first steps in engraving on copper, and hill etching, for which they show great aptitude. The results already attained in the training of native agency is highly encouraging for the very short time spent on it, and I anticipate the greatest advantages from this important and necessary addition to my department in this country.

Formation of new establishment,
 No. 1133, dated 18th June 1869.

50. The transfer of this duty therefore from England to the personal supervision of the Survey Department in this country is already proved to be most satisfactory, and as the engraving of the final geographical materials is further developed, and the native establishment becomes more competent and experienced, I am satisfied that the economy of the measure, setting aside its other obvious advantages, will be sufficiently demonstrated in each succeeding annual report. The description and amount of work performed by the engraving branch during the year, which is fully up to my expectations, and creditable to the exertions of the European establishment, will be found detailed in Appendix D.

51. Owing to the very severe season we have had in Calcutta during the year under review, I am sorry to have to record that considerable sickness has taken place amongst the European engravers, in this the first season of their sojourn in India, resulting in the death of two promising individuals as per margin. The former, however, appears to have succumbed to latent disease which manifested itself before he even reached Calcutta, and he died at sea on his return home, whilst the latter was carried off most suddenly from heat apoplexy and was a great loss. It is to be hoped that as the European constitution becomes more acclimatised, the amount of sickness in the hot weather may decrease, and I have left nothing undone to provide for, and watch over the comforts of this new establishment entrusted to my charge. The question of the removal of a portion, or of the whole, of my offices to a better climate having been under discussion with the Government,* a Committee is now sitting to enquire into the whole question, and will report thereon in due course.

52. On my application, the Secretary of State was good enough to send out the two persons as per margin to supply the casualties above noted, and I am happy to say the whole establishment is in a state of perfect convalescence, and in full working order.

53. The copper-plate presses sent out on my indent have been only recently received, and the very serious defects caused in transit having been repaired at the Cossipore Gun Foundry, they are now put up and in full working order, enabling me to execute any description or amount of copper-plate printing.

54. LITHOGRAPHIC BRANCH.—The work performed in the lithographic, drawing and printing branches has been of the usual kind, and as extensive and important as heretofore. The amount of business executed in this branch is briefly described in the following abstract of the detailed statement given in the Appendix B.

| | | |
|--|----------|--|
| New drawings on transfer paper and on stone of various maps and plans | 271 | completed. |
| Departmental professional forms, circulars and orders ... | 1,24,105 | printed. |
| Maps of various sizes, plans, diagrams, sketches, &c., ... | 355 | subjects, 97,647 copies complete, or 111,684 pulls or impressions. |

55. The remunerative character of this branch of the office may be thus estimated. The value of the work performed, taken at the lowest rates of selling prices for the maps, and at the usual rates for the smaller diagrams, plans, sketches, &c., is as follows:—

| | Subjects. | No. of Copies. | Value. Rs. |
|---|-----------|----------------|---------------|
| Large and small scale maps from survey results drawn and printed ... | 158 | 17,465 | 24,486 |
| Plans of cantonments, cities, forts, &c. | 4 | 127 | 191 |
| Miscellaneous maps, plans, diagrams, &c., executed for other departments | 136 | 71,130 | 16,670 |
| Reprints of old general maps | 60 | 2,925 | 11,889 |
| Total work performed—Total value, Rs. ... | | | <u>53,136</u> |

Cost of the Lithographic Branch—

| | |
|--|-------------------|
| Establishment | Rs. 36,596 |
| Contingencies | „ 3,145 |
| Estimated cost of paper | „ 4,688 |
| | <u>44,429</u> |
| Balance on mapping alone in favor of the office | Rs. 8,707 |
| Add value of printing 124,105 copies of departmental orders, circulars, professional forms for topographical and revenue branches, &c., which, if not printed in this office, would certainly have to be paid for elsewhere... | Rs. 21,814 |
| | <u>Rs. 30,521</u> |

56. There has been great improvement in the drawings on transfer paper, as well as direct on stone during the year.

57. The art of drawing and writing backwards, or reversed, on stone, is now being persevered in by all the younger hands. Direct drawing and writing on stone is very superior to the system of transfer drawing on paper. Impressions from the former style are much sharper and clearer, and a larger number of copies can be obtained from the stone than from the ordinary method of transfers. This method, in almost universal practice in England, has peculiar advantages in this country, where from the great atmospheric changes and hygrometrical state of the seasons, great danger is caused with transfer drawings if not put on the stone within a short period, but it is more tedious and difficult to execute.

58. **DEATH OF HEAD ASSISTANT.**—The health of the head assistant of this department, Mr. H. A. D. Lawrence, had been for some months in a very precarious state, and I regret to have to record his demise on the 31st December last, as reported to Government in my letter marginally noted. Mr. Lawrence having been brought out from England by myself in January 1867, had brought much practical knowledge and experience to bear on the duties of the office, and his laudable and indefatigable exertions for a period of three years told with good effect in improving the style of the work produced. His loss is much felt, the more so, as his place cannot easily be filled up at present.

59. The duties of this office are very heavy, and in addition to the regular work of the Survey Department, there are incessant calls made on it for job work by all branches of the service, all of an urgent nature, which interferes materially with the systematic progress of the publication of the survey maps, of which there is a superabundance, but the utility of the press is thus greatly enhanced, and if cash payments were enforced, as they ought to be, for all extra geographical non-departmental issues, the great economy and advantage of this establishment would be better defined. A detailed report on the working, out-turn and cost of the office by Captain Murray, Assistant Surveyor General, in temporary charge, will be found in the Appendix. Mr. H. Niven, Lithographic and Chromo Printer, merits my encomium, for the general improvement of the printing, for the great zeal and energy he brings to bear in instructing the native printers, and in performing multifarious and onerous duties.

60. **PHOTOGRAPHIC AND PHOTOZINCOGRAPHIC BRANCH.**—This recently formed branch of my office has made great and most satisfactory progress, as regards the general style and execution of the photozineographed maps, during the past calendar year of 1869. In consequence of Captain A. B. Melville, previously in charge, having entirely broken down in health, he was compelled to obtain leave to Europe on medical certificate from the 10th of February 1869, and it was extremely fortunate that just at that moment Lieutenant J. Waterhouse, Assistant Surveyor General, returned from two years' leave to Europe, and he was accordingly by the orders of Government, marginally noted, placed in charge to take Captain Melville's place.

Home Department No. 547,
dated 2nd June 1868.

61. This officer had previously superintended the first commencement working of this branch of my office for a short time, and during his leave to Europe, with the sanction of the Secretary of State, employed his leisure in visiting the various photographic establishments in England as well as on the Continent, and gleaned much valuable practical information which has been turned to good account in this country. He has drawn up a report describing the various cartographic reproduction and reduction systems pursued in the national surveys of France, Prussia, Austria and Bavaria which was submitted to the Secretary of State in England, by whom it was sent out to the Government of India, and ordered to be printed here. During its progress through the press, chapters on the processes especially adapted to the Indian climate, as well as on the constitution of the Indian Survey Department have been added with my approval, and copies of the report have very recently been submitted to Government and circulated to the department at large.

62. The subjoined abstract statement shows the nature of the work which has passed through this office, and the total out-turn of some of the maps dealt with; only silver prints were taken, but for the most part they were transferred to zinc or stone. For convenience of future record, the statement has been brought up to the end of the calendar year.

| | Subjects received. | Negatives. | Silver prints. | Photo-transfer prints or sections. | Transfers to zinc or stone entire. | Number of pulls or sections. | Number of complete copies. | REMARKS. |
|--|--------------------|------------|----------------|------------------------------------|------------------------------------|------------------------------|----------------------------|---|
| From 1st December 1868 to 31st December 1869 | 673 | 1,784 | 3,773 | 2,273 | 487 | 51,069 | 44,982 | Cost of the establishment, inclusive of contingencies and all other charges— Rs. 42,163-11-4 |

63. With improved photographic apparatus which was specially constructed under Lieutenant Waterhouse's direction in England, better accommodation in a separate building, new and improved processes for the transfer of photo-carbon prints to zinc, as well as new presses obtained by myself in England last year, together with considerable improvement in the style and finish of the drawing of original maps and subjects for reproduction by the executive officers, the quality of the work performed has greatly improved and will well bear the test of comparison with similar work produced in any other country.

64. The advantages secured to the public service of this country by the immediate publication and dissemination of the original scale sheets of the topographical surveys of the Native and British States, which never before saw the light or were turned to any practical use, can scarcely be over-rated.

65. The remunerative character of this office is shown by Lieutenant Waterhouse as follows, total cost of establishment Rs. 42,163; value of the work performed Rs. 47,439, balance in favor of Government 5,276. This is susceptible of very considerable expansion, and will doubtless be more lucrative annually, as our arrangements improve. In the present year's expenses, house-rent for a new office, and the Superintendent's salary have been included.

| | Maps. | Profit. |
|---------------------|----------|---------|
| Lithographic | 91,617 | 30,521 |
| Photographic | 44,092 | 5,275 |
| Total | 1,35,741 | 35,796 |

66. The combined out-turn of the two printing establishments, lithographic and photozincographic, amounts to 135,741 maps or plans, and the profit to Government Rs. 35,796 as per margin.

67. Lieutenant Waterhouse's abilities as a photographer are of a high order, and his industry and special scientific attainments have enabled him to develop several useful processes in photography and photozincography, and he is now making experiments in the new process of photo-engraving.

68. The European staff of photographers and zinc printers as per margin have worked exceedingly well, and by their steady conduct and close attention to duty merited my entire approbation. A detailed account of the working of the photographic branch by Lieutenant Waterhouse, for the calendar

* Serjeant James Mackenzie.
Mr. W. Crosley.
Serjeant Bruce Muckeuzie.
Serjeant Watson.
Mr. W. Mulhor.

year 1869, is given in Appendix C.

69. During my temporary absence from the presidency on my annual tour of inspection of survey parties, Captain W. G. Murray, Deputy Superintendent of Survey, who returned from medical leave to Europe on the 24th March 1869, conducted the current duties of my Head Quarter Office, and I have to record my appreciation of this officer's valuable assistance, whose professional knowledge and experience have been utilized in various ways. His special attention was directed to bringing up of the professional report of the Hyderabad Survey, arranging and collating the computations of many years' work, writing the introductory remarks, as well as gathering from various sources statistical and geographical information for the same, to which he has devoted much extra or leisure time.

70. He has likewise under preparation a tabulated document, long most urgently needed, viz., a list from various official returns and documents, obtained by myself from all parts of India with much difficulty, showing the most important places in each district in India, the correct orthography of names, and the minor sub-divisions of the districts and provinces, according to existing territorial arrangements and jurisdictions, to which is being added the absolute geographical positions or co-ordinates of latitude and longitude for each place from the Great Trigonometrical Survey data in all practicable instances, thus forming a complete geographical index for all India up to the present date, which after being carefully checked and revised I propose, to publish.

71. The want of such a work for general purposes and ready reference has long been felt, and in this office it will be most useful for all description of maps, which have frequently to be projected and compiled for various purposes, and the more particularly for aiding and assisting the Gazetteers, which are now so universally under preparation in this country, and for which the most accurate and authentic data is absolutely essential. The rapid progress of the executive surveys, and the employment of every available qualified officer in the field hitherto, has prevented many useful and even necessary objects of this nature, which I have had in view, from being carried out.

72. PREPARATION OF GAZETTEERS.—This subject has been peculiarly felt and brought home to me during the past year, when from every local jurisdiction in India, the most urgent and pressing demands have been made on this office for geographical information of all descriptions, and to a very large extent, on account of the Gazetteers ordered by the Government of India to be undertaken, with the view to the publication of one uniform series of histories of provinces and districts to be edited by a single officer.

73. DEFINITE PLAN OF THE GAZETTEERS REQUIRED.—Having the deepest interest in the dissemination of true and authentic geographical information and numerical data as derivable only from the records of the survey of India, I have responded cordially to the wants of the local officers engaged in the preparatory Gazetteers of districts and provinces, but the absence of any defined system or plan of the work, or of any authoritative decision as to the orthography of native names, has been a great drawback to the real object in view, and I fear will render such maps as have been compiled, with considerable labor and research, unfitted for incorporation in the final work which will be published no doubt under the auspices and sanction of the Government of India.

74. UNIFORM SYSTEM OF ORTHOGRAPHY OF NATIVE NAMES.—Gazetteers without good maps will be but of little avail, it is therefore essential that the latter should correspond with the

text of the former, and to ensure this most important, but equally difficult end, a proper understanding must be arrived at on the part of all who are engaged in the duty, and until this is done, it will be useless to expect uniformity of system in the rendering of the equivalent of the vernacular names of this country. The more so as everybody seems to have both a theory and practice of his own, and the subject generally is beset with many difficulties, which it will not be easy to get over.

75. **STEREOTYPED GEOGRAPHICAL NAMES SHOULD NOT BE ALTERED.**—Whatever system maybe adopted or directed by competent authority to be carried out, it appears to me of vital importance not to create such a complete revolution in the mode of spelling as will altogether upset the existing geography of the country and the labor of years. The names of capitals and of important well known places, understood and appreciated by Europeans, and familiar to the ear of everybody for upwards of a century cannot, I submit, be altered in the present day with any degree of reason or propriety. Such a course of altering long established orthography to such a degree as to render the identification of the name impracticable to ordinary understanding, as some persons would like to carry out, appears to me pedantic and unsafe in the extreme. The entire subject is one involving too many considerations to be enlarged on in this place, but as it so materially affects this department, and our daily work with the publication of the maps of the Survey of India, I have deemed it necessary to place it briefly on record. I had occasion to report on it to the Bengal and Bombay Governments in letter marginally quoted.

No. 256, dated 23rd March 1867.

76. **PRINTED MAPS SENT TO ENGLAND.**—During the past year, very large quantities of the published maps and plans of the Survey of India have been transmitted to the India Office to complete the records of the Geographical Department there, and likewise for sale in England, to supply a desideratum long felt there. All the available maps of older date, contained in the most recent edition of our printed catalogue, have now been furnished, whilst the current publications are likewise periodically transmitted, so that the results of the Indian Surveys may be procurable in England with as great ease and facility as they have always been in this country.

77. **ISSUE OF MAPS TO GOVERNMENT OFFICIALS AND SALES TO THE PUBLIC.**—The demand from

| | MAPS. | VALUE. |
|--|--------|------------|
| Maps supplied from the Surveyor General's Office on indent and application ... | 15,471 | Rs. 27,353 |
| Maps issued to Local Agents for supply to Government officials and sale ... | 5,577 | 11,694 |
| Total ... | 21,048 | 39,052 |

Government officials for the published results of the Survey Department continues increasing, and forms a heavy business. During the year, 15,471 lithographed, photozincographed and engraved maps have been issued *bonâ fide* on the public service by my office, and 5,577 lithographed and engraved maps have been issued to the several local agents at Allahabad, Lahore, Lucknow and Nagpore. The total number issued being 21,048 maps, and their value at the very low rates which have

now been fixed, so as to render the maps available to all classes of the community, being Rs. 39,052. If public officers had to pay for all the maps they receive from this department, it would greatly conduce to the economy of this office as well as to the interests of Government.

78. Exclusive of the maps, as above shown, which have been issued from the store or stock in hand of actual survey results, several thousands of impressions of maps, sketches, diagrams and plans have been printed and issued from the photozincographic and lithographic press branches of my office, on special requisitions from local Governments and various public offices. These in fact in no way concern my own department, but they show so much extra work done, and for which payment ought to be made and credited in my budget.

79. The sums actually realized by map sales, fees for copying maps, &c., after deducting agents' commissions, amounts to Rs. 6047. The cash account up to the 31st December 1869, since the last account rendered, viz., 1st October 1868, stands as follows:—The cash balance will be paid into the General Treasury immediately in addition to the Rs. 5,000 already paid in.

Dr. *Abstract Cash Accounts from 1st October 1868 to 31st December 1869.* Cr.

| ITEMS. | Amount. | ITEMS. | Amount. |
|---|------------|---|------------|
| To Cash Account | 10,298 0 4 | Total Rs. | 5,139 10 2 |
| Balance in the bank of Bengal as per printed Report for 1867-68 | ... | By Commissioner Account. | ... |
| Amount received from Sundries | ... | Amount paid to the Comptroller of Government | ... |
| Ditto Messrs. Thacker, Spink and Co. | 1,684 11 3 | Books, N. W. P., as commission for sale of maps not returned in his account ending 30th September 1868 | 8 9 2 |
| Ditto Messrs. Thacker, Spink and Co. | 100 0 0 | Amount paid by the Comptroller of Government to Pioneer Press Alibund, for advertisement of map and notices | 51 1 0 |
| Ditto Messrs. Bartham, Hill and Co. | 283 0 6 | Ditto by a cheque No. 311 to Colonel Handall for 100 copies of a district map of Bihar re-illustrated by Irrigation Department. | 92 8 0 |
| Ditto Messrs. Bartham, Hill and Co. | 283 0 6 | By Transfer Account. | ... |
| Ditto Secretary, School Book Society | 26 1 9 | Amount paid to Government, vide cheque No. 334, dated 4th May 1868 | 5,000 0 0 |
| Ditto Comptroller, Government Books, City | 68 12 2 | By Cash Account. | ... |
| Ditto Messrs. G. C. Hay and Co. | 43 7 0 | Balance in Bank of Bengal, on 1st Jan. 1870 | 3,430 10 9 |
| Total Rs. | 10,298 0 4 | Ditto on account of outstanding advances | 1,286 0 6 |
| | | Ditto in hand for contingencies | 260 10 6 |
| | | Ditto on account of sale of maps outstanding | 128 4 11 |

80. From the foregoing details, a tolerable idea may be gleaned as to the extent and importance of the varied work which has to be performed in the head quarters offices. For a great deal of the efficiency and rapid execution of the work devolving on the administrative establishments, in superintending such large offices here, as well as an extensive and widely dispersed executive in the field, I am indebted to the great ability and persevering industry of Mr. J. O. N. James, Assistant Surveyor General, whose indefatigable labors are beyond all praise. The addition of the engraving branch and the consequent publication of the sheets of the Atlas in this country has added very materially to the extent and importance of the geographical, compiling and examining duties of this office, and it has been found absolutely necessary to provide for the same, by the transfer of Mr. Baness, Surveyor 2nd Home Department No. 205, dated 25th June 1869. The services of this Surveyor are now being turned to excellent account, and I have great reason to be satisfied with the professional knowledge and experience he combines with first rate talents as a draftsman, and employs zealously in superintending the work entrusted to his care.

81. I have advisedly brought the good services of those officers and subordinates who have rendered me valuable aid to prominent notice, because I am well satisfied that no body of men in this country can continue to work zealously, or beyond the ordinary routine, year after year, in a profession of such risk to life and health, without some acknowledgment is rendered, when they have especially deserved well of the Government. It is to me therefore no less a pleasure, than a positive duty I owe to those excellent officers whose names are specified with approval in this report, to describe their services faithfully.

EXECUTIVE ESTABLISHMENTS.

No. 1.—TOPOGRAPHICAL PARTY.

Gwalior and Central India Survey.

82. *Kotah, Boondi, Tonk, &c.*—This party on breaking fresh ground in the Gwalior State, found some inconvenience and delay from the want of vakeels (or agents from the Maharaja) for the several detached parties, without whom it was impossible to procure provisions and assistance of any kind from the villages; owing to the scarcity of grain which prevailed throughout the country, and other difficulties, it was about the middle of December before the detail parties were fairly at work in the ground allotted to them.

PERSONNEL.

Lieut. Charles Strahan, R. E., Assistant Superintendent, Offg. in charge.
 Lieut. T. Holdich, R. E., Assistant Superintendent on duty with the Abyssinian Expedition, rejoined 24th April 1869.
 Mr. F. B. Girdlestone, Assistant Superintendent, joined 23rd January 1869.
 Mr. H. J. Bolst, 2nd Grade Surveyor.
 „ G. P. Chill, resigned on 15th April 1869.
 „ G. K. Allnutt, 3rd Grade Assistant Surveyor.
 „ G. T. Murphy, 4th „ „ „
 „ G. L. Esteve, 3rd „ „ „
 „ W. J. Cornelius, 3rd „ „ „
 and 5 Sub-Surveyors.

83. The advance triangulation lay in the vicinity of Goonah and Chandairee, within the meridians of 77° and $78^{\circ} 15'$ and parallels of $24^{\circ} 25'$ and 25° chiefly in the Gwalior State. The plane tablers occupied ground in detached portions of Jeypore, Kotah, Boondi, Gwalior, Tonk and Jhalawar, within the degree square formed by the lines of Latitude 25° to 26° and of Longitude 76° to 77° . Two parties were also employed on outlying portions of unfinished work in the vicinity of Kolarus, east of the Agra and Bombay trunk road, and near the large city of Tizara in the Ulwar State.

84. Of triangulation in advance of the details 2,607 square miles were completed, and the ground within and around the city and cantonment of Goonah was closely triangulated by Mr. F. B. Girdlestone, Assistant Superintendent (who was posted to this party on his return from medical leave to Europe and joined it in the field), for a large scale plan.

85. Of final topography 1,577 square miles were completed as per margin, and an entire

| | <i>Square Miles.</i> | |
|--|----------------------|--|
| Mr. Bolst 2nd grade Surveyor... | 143 | } Also em- ployed on triangu- lation. |
| „ G. P. Chill do. do. ... | 132 | |
| „ G. K. Allnutt, 3rd grade Assistant Surveyor ... | 270 | |
| Mr. G. T. Murphy, 4th grade Assistant Surveyor ... | 50 | |
| Mr. G. L. Esteve, 3rd grade Assistant Surveyor ... | 240 | |
| Mr. W. J. Cornelius, 3rd grade Assistant Surveyor ... | 177 | |
| Jonalpersaud Sub-Surveyor ... | 150 | |
| Abdool Samud Khan ditto. ... | 84 | |
| Abdool Subhan ditto. ... | 63 | |
| Ghulam Mahomed ditto. ... | 180 | |
| Churaman Lall ditto. ... | 88 | |
| TOTAL ... | 1,577 | |

new survey of the city, fort, cantonments and environs of Agra on the large scale of 12 inches to the mile being urgently required, was commenced and finished. These materials have been carefully collated, and fair drawn in my head quarters' office, and a very valuable plan will soon be published for general use.

86. The total cost of the season's operations amounts to Rs. 48,632, of which Rs. 3,917 is due to the large scale survey of the Agra city. Observations were taken at 54 stations, fixing 300 points, and the elevations of 234 points were trigonometrically determined.

87. Lieutenant Charles Strahan, Deputy Superintendent in charge, states that while triangulating he visited the city of Chandairee, formerly the capital of the British district of the same name, which was transferred to Scindiah with the territory east of the Betwah river in 1858. This city, which under British rule was very populous and famed for its manufacture of fine muslins, is now in a ruinous state, and the trade which was formerly carried on in delicate cotton fabrics has fallen considerably. Ishagurh, another large town, was also visited; it is at present the residence of a Soubah of the Gwalior State, and evidently was in former times a place of importance and considerable size.

88. The country from the Betwa river rises in steps from 1,200 feet until it attains an altitude of 1,650 feet above sea level. The hills are low, covered with jungle, and very flat at top. As soon as the high table land is reached, the jungle ceases and the ground is open and undulating, with small isolated hills scattered here and there, and the entire country is well

cultivated and thickly inhabited, presenting a very marked contrast with the ground along the steps and lower lands to the north.

89. Lieutenant T. Holdich, R. E., Assistant Superintendent, who in October 1867 was under the orders of Government transferred for employment with the survey party attached to the Abyssinian Field Force, returned to India in February 1869, and was posted to this party, joining it after return to recess quarters; as the field work for the season closed in the middle of March he was unable to share in any field duties.

90. The season's out-turn of triangulation and topography contrasts somewhat unfavorably with that of previous seasons, and is below the usual average, but owing to the drought which prevailed throughout Central India and Rajpootana the duration of the field or working season was reduced considerably, as provisions could not be easily obtained for the several detached parties, and it was considered desirable to relieve the country under survey from the strain on its resources caused by the presence of large and scattered camps.

91. The strength of the party was also reduced by the transfer of Mr. Horst, Assistant Superintendent, to the charge of No. 7 party, Rajpootana Topographical Survey—a measure which could not be avoided owing to the paucity of executive officers then available. The survey of the city and cantonments of Agra also occupied one Assistant and two Sub-Surveyors for a good part of the most favorable season. These circumstances combined, have materially affected the season's out-turn, which is neither so large or so well disposed as usual, and due allowance must consequently be made in comparing the work of prior seasons, or with that of other parties.

92. This party was inspected by myself at Mussoorie on the 14th, 22nd and 27th September. All the records, *viz.*, the angle books, computations, field sections, and fair maps were carefully examined and commented on, and the past and future proceedings of the survey fully discussed and determined on. The squaring up of the sections in the field season by season, as far as practicable, appeared a desideratum on this survey, and other minor points had consideration, which will no doubt be fully attended to in future. The results of my inspection this year were on the whole satisfactory, and I have every reason to anticipate a more compact and better return during the current field season.

93. During the recess, the following computations and fair maps have been completed:—

- 741 Triangles computed.
- 103 Latitudes and longitudes.
- 318 Heights.
- 137 Pages of horizontal angle books.
- 63 Do. of vertical do.
- 2 Fair standard maps completed.
- 3 Do. do. finished in part.
- 8 Exaggerated maps completed.
- 3 Do do. finished in part.
- 1 Chart of triangulation.

No arrears of any kind exist in this Surveyor's Office, which is satisfactory.

94. The officer in charge reports in very commendatory terms of the good and valuable aid rendered to him, both in the field and recess duties, by Mr. H. J. Bolst, 2nd Grade Surveyor, whose excellent services, extending over 17 years, have always merited approval. Mr. Bolst has been employed on the triangulation during the past year, as well as in laying down the topographical details, and he has merited my entire satisfaction and commendation in all parts of his duty.

95. During the ensuing season, the triangulation will be advanced southwards from Latitude $24^{\circ} 30'$ between the meridians of 77° and 78° , and the plane tablers will take up the unfinished sections required to complete the degree square bounded by the parallels of 25° and

26°, and the meridians of 76° and 77°; after completing this, ground between the meridians of 77° and 78° below the parallel of 25° will be occupied in continuation of the topography completed in previous years.

96. The health of the establishment is good, the party has been strengthened by the addition of a Military Assistant Superintendent (Lieutenant T. Holdich, R. E.), and it is expected that the return of work for the season now commenced will compensate for the diminished out-turn of the past year.

97. Lieutenant Charles Strahan reports that, in the States of Gwalior and Tonk, he and his party were rendered very hearty aid, and met with the greatest attention and civility from the several chieftains and their subordinates, but in Kotah, Booudi and Jeypote similar help and attention to the wants of the party was not rendered.

98. The services of Mr. Girdlestone, 1st Grade Assistant Superintendent, who was posted to this party in January last, having been urgently required, he was transferred to officiate in charge of No. 2 party, Central Provinces Topographical Survey, from the 12th of July last, in consequence of the demise of Mr. Mulheran.

No. 2—TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES SURVEY.

99. *Baitool and Chindwarra Districts.*—Owing to the unhealthy nature of the country

PERSONNEL.

J. Mulheran, Esq., Depy. Supdt., 2nd grade,
died 25th March 1869.

F. B. Girdlestone, Esq., Asst. Supt., 1st grade,
Offg. in charge from 12th July 1869.

Mr. C. Neale, 1st grade, Surveyor, in temporary
charge from 29th March to 11th July 1869.

Mr. R. Farrell, 1st grade, Assistant Surveyor.

„ C. Scanlan, 2nd „ ditto ditto.

„ B. Maine, 3rd „ ditto ditto.

„ J. Chennell, 2nd „ ditto ditto.

„ A. Chennell, 4th „ ditto ditto.

and five Sub-Surveyors.

in which the field of operations lay, along the eastern portions of the Sauthpoora and Deogurh ranges of hills which skirt the Baitool and Chindwarra plateaus on the north and south, this party was obliged to remain in recess quarters at Ellichpoor later than usual, and was employed in completing the mapping and computations. They did not therefore commence field work till about the middle of December.

Even at this late period of the year fever prevailed to an alarming extent, and more than half the strength of the party was prostrated on entering the hills.

100. The triangulation in advance of topography was carried through the southern portion of the Chindwara District and the south-eastern portion of Seonee, along the Deogurh Ghauts, or between the parallels of 21°30' and 22° and the meridians of 78°45' and 79°45', and it was while engaged on this duty, I regret to record that the executive officer in charge of the party, Mr. James Mulheran, was attacked with the disease which terminated in his death at Seonee on the 25th March 1869, as was reported to Government in my letter No. 582, dated 16th April 1869. The services of this old and valuable public officer, and the estimation in which his character was held, were described in my departmental order of the 28th March 1869, copy of which will be found in the Appendix. The loss to the department has been severely felt.

101. The topographical details completed during the season lay in portions of the Baitool, Hooshungabad and Chindwara Districts, the main portions being situated between the parallels of 22°15' and 22°45' and Longitude 78°15' to 79°.

102. The total out-turn of the season's work amounts to 1,563 square miles of triangulation, by which 140 points have been trigonometrically determined, and 47 heights obtained from observations at 88 stations, and 1,912 square miles of final topography, at a cost for the entire season of Rs. 49,554-12.

103. The amount of final work completed by each member of the party is given on the margin. The country surveyed was of a most intricate and difficult nature, heavily covered with forest.

| | Square Miles. |
|---|---------------|
| Mr. C. Neale, 1st grade, Surveyor ... | 214 |
| „ R. Farrell, 1st ditto, Asst. Surveyor | 148 |
| „ C. Scanlan, 2nd ditto, ditto ... | 322 |
| „ J. Chennell, Senior, 2nd ditto ... | 61 |
| employed also on triangulation. | |
| A. Chennell, Jr. 4th grade Asst. Suvr. | 183 |
| Ram Chunder, Sub-Surveyor... | 277 |
| Pandarao | 236 |
| Baparao | 236 |
| Janardanrao | 235 |
| TOTAL ... | 1,912 |

104. On the death of the officer in charge, I directed Mr. C. Neale, Surveyor, 2nd grade, the senior assistant with the party, to assume temporary charge, and after closing the field work of the season to make arrangements for removing the entire party from their old station at Ellichpore in the Berars, the survey of which had been concluded up to Jubbulpore, the nearest station at which sufficient accommodation was obtainable. It was especially desirable to bring this establishment away from Ellichpore, where it had been located so many years, up to a more central position, where it was likely a good effect might be derived on the health of all the members of the party, and where also it might be within easier reach of inspection. It will also be very necessary to bring this survey establishment in contact with others, with the view of obtaining uniformity of practice and that emulation which stimulates to exertion.

105. Mr. Neale performed these duties to my entire satisfaction, and displayed great zeal and judgment in carrying out all my instructions. I am much indebted to this Surveyor for the hearty aid he has rendered under very trying and difficult circumstances, at a time when his own health was greatly impaired from repeated attacks of jungle fever, and I have been glad of the opportunity of his length of service to reward him for his services by promotion to a vacancy in a higher grade.

106. Mr. F. B. Girdlestone, 1st grade Assistant Superintendent, who returned from medical leave in December 1868, and was temporarily attached to No. 1 Topographical party, being the senior executive officer available for charge of a party, was by departmental order No. 174, dated 7th May 1869, placed in charge and relieved Mr. Neale at Jubbulpore on the 12th July last.

107. The recess duties, *viz.*, fair mapping and computations, were conducted under Mr. Girdlestone's supervision, and towards the close of the recess, the party was inspected by myself at Jubbulpore (November 8th to 12th inclusive), when I had full opportunities for reviewing the labors of every individual, and of comparing the results and the system pursued with that of other survey parties. The Berar survey had never before been inspected, and it therefore afforded me satisfaction to become better acquainted with the party, and to be able personally to discuss principles and progress, and the training of subordinates, which is of the first importance. The general state of the instrumental and camp equipment and of the records and other details was such as to justify expectations, and I believe the future efficiency of the establishment is well and most satisfactorily provided for. The entire personnel is very promising.

108. Owing to the unexpected and serious loss which the party had met with by the death of the officer in charge, in the midst of the field season, and while all his assistants were at a distance from him on detached survey work, considerable labor fell on both Mr. Neale in the first instance, and on Mr. Girdlestone on his taking charge, in acquiring an insight into the records of the survey of past years, and in arranging a large mass of computations and field surveys, but he has worked most assiduously and methodically, and by great energy and perseverance having overcome all difficulties, has brought the records of the party into a satisfactory and intelligible shape. All arrears which existed on his assuming charge have now, by the joint efforts of the two officers, been cleared off.

109. Owing to the heavy amount of work which existed in the computations and fair mapping of the past season, and the heavy demands on the new incumbent, the final report of the old Hyderabad Topographical Survey, which had been left in a very unfinished state by the late Mr. Mulheran, who intended writing the narrative account of the past year's operations during

the current recess, I directed to be sent down for completion to my head quarters' office, where it has been entrusted to Captain W. G. Murray, and I am glad to report that the Assistant Surveyor General having devoted much time and care in collecting the required information from various sources, this voluminous document has been nearly perfected and arranged for final record, and it will prove a very creditable production.

110. During the recess, 11 standard, 14 exaggerated fair maps for reduction to $\frac{1}{4}$ th scale, and 2 charts of triangulation have been completed. These were carefully examined by myself in the Surveyor's Office, and all defects pointed out; although there is decided improvement in the style and finish of these records over those of previous seasons, there is still room for better results, which I trust will be realized under the present management. The computations completed are as follows:—

- 1 General report volume (142 pages)
- 2 Volumes of original computations (108 pages)
- 14 Duplicate angle books (788 pages)

No arrears exist, and great credit is due to Mr. Girdlestone and his assistants for the large amount of work which has been completed during the recess.

111. The triangulation during the ensuing field season, emanating from the principal series of the Great Trigonometrical Survey in Seonec, will be extended over the Balaghat District, and portions of Bhundara and Raipore; the detail parties will operate in the hills immediately north of Chindwara, of which about 800 to 1,000 square miles remain for survey, and if time admits, will, after completing this, enter the Balaghat District, should the state of the triangulation in advance allow of detail survey being taken up. The Seonec District, which intervenes between the Chindwara and the Balaghat District, having been entirely surveyed by the revenue branch of the department, it was necessary to break off the minor triangulation in Chindwara, and to start again from the Jubbulpore meridional series for the prosecution of the remainder of the topographical work in the Central Provinces.

112. In the Appendix are given extracts from the narrative report of the Officiating Deputy Superintendent of Survey, containing a description of the country visited, and a memorandum by Mr. Scanlan, Assistant Surveyor, on the Gonds, which is creditable to that young assistant.

No. 3.—TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES AND VIZAGAPATAM AGENCY SURVEY.

113. *Jugdulpore or Bustar, and Jeypore (Madras) States.*—The field of operations for this party, under Colonel Saxton, lay in the Native States of Jeypore of the Vizagapatam Agency, and Bustar or Jugdulpore of the Central Provinces jurisdiction, between the lines of Latitude $18^{\circ}30'$ and $19^{\circ}15'$ and Longitude $81^{\circ}15'$ and $82^{\circ}30'$. The officer in charge was employed.

PERSONNEL.

Colonel G. H. Saxton, 1st grade, Deputy Superintendent in charge.

- Mr. R. W. Chew, 4th grade, Surveyor.
- “ J. A. May, 1st Assistant ditto.
- “ F. Adams, ditto ditto.
- “ T. E. Claudius, 2nd ditto ditto.
- “ W. S. Barnett, 3rd ditto ditto.
- “ W. F. Pettigrew, 3rd grade ditto.
- “ A. Cooper, 4th ditto ditto.
- “ R. Trewman, Sub-Surveyor.
- “ E. Atkins, ditto.
- “ F. Atkins, ditto.
- “ J. McCay, ditto.

in conjunction with two other Civil Settlement Commissioners, throughout the field season on the settlement, demarcation and survey of the disputed boundary between Jeypore and Bustar, which was urgently called for by the Foreign Department, and in laying down additional points and determining heights within the area triangulated in previous seasons, which is about 10,000 square miles in advance of the detail operations.

114. The boundary work was completed on the 11th March 1869, and Colonel Saxton submitted his report direct to the Foreign Department

115. An area of 1,966 square miles of topographical details, as specified marginally, and about 1,500 square miles of secondary triangulation were completed. Observations were taken at 38 stations, by which 141 fixed points were obtained, and 137 elevations were determined.

| | Square Miles. |
|-------------------------------------|---------------|
| Mr. R. W. Chow, 4th grade, Surveyor | 246 |
| .. J. A. May, 1st Assistant | ditto 125 |
| .. F. Adams, | ditto 200 |
| .. T. E. Claudius, 2nd | ditto 344 |
| .. W. S. Barnett, 3rd | ditto 160 |
| .. W. F. Pettigrew, 3rd | ditto 214 |
| .. A. Cooper, 4th | ditto 106 |
| .. R. Trewman, Sub-Surveyor | 187 |
| .. E. Atkins, | ditto 265 |
| .. F. Atkins, | ditto 94 |
| .. J. McCay, | ditto 25 |
| TOTAL | <u>1,966</u> |

116. The country, of which the topography has been completed, filling up sheet No. 93 of the Indian Atlas, is described as extremely wild and unhealthy and most thinly inhabited; there are no roads through it, and no means of carriage. Vast tracts are almost exclusively

occupied by wild beasts, but the jungle is too dense and extended for the sportsman. The principal towns (which are but bare villages) met with, were Kotpar, Jugdulpore, Bustar (old), Salmi and Dantawara. An interesting account of these places is given in Colonel Saxton's narrative report, from which extracts will be found in the Appendix.

117. The out-turn of topography, 1,966 square miles, is in excess of the area completed last season by 439 square miles, which is very satisfactory for such a country. The party had been strengthened by the addition of one Assistant and two Sub-Surveyors, who had to undergo training, and the best qualified and most experienced Topographical Surveyor (Mr. May) was employed with the Special Commissioners on the Jeypore and Bustar boundary in mapping the ground along which the line ran, while a second Assistant (Mr. Cooper) was engaged in traverse surveys of the boundary. The officer in charge expresses his confidence in the final topography, derived under great privations and difficulties. Three of the assistants suffered severely from malarious fever, and have been in a very precarious state of health for some time. Mr. F. W. Atkins, Sub-Surveyor, I regret to state, died at Madras on the 1st December 1869.

118. The total cost of the season's operations amounts to Rs. 66,833, this sum includes all charges connected with the survey of the Jeypore and Bustar boundary.

119. Owing to the distance at which this party has worked in the field and also recessed from head quarters for many years past, it had never been inspected, and I was therefore particularly anxious to confer with Colonel Saxton, and personally examine the internal economy of his office and establishment. I therefore proceeded to Madras and the Neilgherries for this purpose, and spent several days, from the 31st May to the 16th June, in examining the results of these operations and settling with the Deputy Superintendent of Survey many matters which had long formed the subjects of official discussion.

120. The state of the records, computation and angle books I found in satisfactory order, and the several assistants evinced much zeal and good spirit in carrying on the duties entrusted to them. I was especially gratified at the marked change and improvement in the health and appearance of all the members of the party, in consequence of the three seasons' great advantage of recessing at Ootacamund.

121. From the terrible effects of so many years' employment in the region above described, and from the depressing atmosphere of the plains in Vizagapatam and Cuttack for the recess, the strength and stamina of the assistants had been reduced to such a degree as to render a really good field season's out-turn a matter of physical impossibility, but now, by resorting to the hills, the fever is shaken off, men take the field invigorated and refreshed, and the efficiency of every individual is so much increased as to afford grounds for congratulation. The gain to Government in every way is manifest, whilst the mortality, which has always been heavy in this survey, has been considerably reduced.

122. Finding a very elaborate survey of the station or sanitarium of Ootacamund far advanced on a large scale, for fiscal purposes, under the Madras Revenue Surveyors, I directed Colonel Saxton to adopt measures next recess, on his return from the field, to execute some minor triangulations by which the Neilgherry Hills may be duly connected with the great triangulation of the G. T. Survey now passing down the meridian of 78° on the great arc of India. It is very important that the old survey of the Neilgherry Mountains by the late

Captain Ouchterlony should be identified and connected with the principal triangulation and by incorporating all these surveys in one standard of comparison and connecting them together, great advantages will accrue, and facilities be afforded for filling up the sheets of the Atlas of India with rigorous accuracy, which cannot be done at present. This duty is of a very trifling character, and can easily be performed by the Deputy Superintendent during the recess months without additional expense.

123. All the computations were duly completed in triplicate, and duplicates were made of the field and angle books. Of fair mapping, the following sheets have been completed and rendered to this office :—

1—inch standard sheets Nos. 17, 19, 41, 42, and 43.—

1—inch exaggerated sheets Nos. 17, 19, 41, 42 and 43. A map of a portion of the Jeypore and Bustar boundary was also completed and reproduced at my head quarters' office by the photo-zincographic process, and copies were furnished to the Government of India, Foreign Department, with my letter cited on the margin.

No. 184, dated 11th November 1869.

124. Colonel Saxton reports in favorable terms of the zeal and energy of all his assistants. Mr. Chew, 4th grade Surveyor, rendered excellent service during the season, both in the field and recess, and Messrs. Claudius and E. Atkins completed the largest amount of final detail work.

125. I have derived much satisfaction from my insight into this party and their labors, and I anticipate the best results from the same. The state I found everything in, both as to equipment and execution of details, is creditable alike to the officer in charge and to his assistants.

126. Mr. Harper, 4th grade Surveyor, returned from medical leave to Europe on the 23rd March 1869, and was re-posted to this party, which he joined on its return from the field.

127. During the current field-season the party is again employed in the Jugdulpore or Bustar and Jeypore territory, south of the area just completed, between the parallels of 18° 30' and 19° 30', and within the meridians of 81° 30' and 83° 30'. A small gap in the Saora Hills, in Goomipoorum, long left blank in the old maps, and situated on the north of Atlas Sheet No. 108, which has defied many attempts to delineate, is also now being provided for on the requisition of the local authorities. The Deputy Superintendent will triangulate this ground this season, and pave the way for the topographical detail surveyors next year, by which means all political and other difficulties will, it is fully expected, be overcome.

128. Colonel Saxton has for many years past, while in charge of this party, labored perseveringly in conducting survey operations through some of the most difficult, inhospitable and unhealthy tracts in India, and it is to his judgment and energy, as well as physical capacity and endurance for such a climate, that we owe all the geographical information we now possess of the untrodden and little known tracts in the Orissa and Kond Hills and the Goomsoor country, ground so notoriously insalubrious and unprofitable that portions have never yet been visited by Europeans, except Colonel Saxton himself and his assistants.

129. There is still much to be accomplished to fill up the remaining unsurveyed tracts of this Agency and of the petty States in the Central Provinces, extending westwards up to Chanda and down to the limits of the regular Madras Presidency Districts of Rajamundry and Godavery River, as taken up by the revenue survey operations, and represented in sheets Nos. 91, 92, 93 of the Atlas. A good index map of all this survey, both completed and remaining, has been prepared and published.

NO. 4.—TOPOGRAPHICAL PARTY.

CHOTA NAGPORE DIVISION SURVEY.

130. *Sirgoojah, Oodeypore, &c.*—On the 7th November 1868, Lieutenant M. T. Sale, R. E., Assistant Superintendent from No. 7 party, relieved Captain G. C. Depree, Deputy Superintendent of this Survey, who proceeded to Europe on furlough on the 5th December 1868.

Personnel.

| | |
|---|--------------|
| Lieutenant M. T. Sale, 1st grade Assistant Superintendent, Officiating in charge. | |
| Mr. G. A. McGill, 3rd grade Surveyor. | |
| .. J. Vanderputt, 4th grade Surveyor. | |
| .. A. G. Wyatt, 2nd grade Assistant Surveyor. | |
| .. A. James 3rd, | .. .. |
| .. J. A. Barker 3rd | .. .. |
| .. R. G. Rue, 4th | Proby. |
| .. J. H. Wilson, 4th | .. .. |
| .. S. R. Owen, | .. .. |
| Bahoo M. S. Dutt, Sub-Surveyor. | |
| .. H. S. Dutt | |
| .. Eusuf Sharif | |

131. The triangulation for the season lay in portions of Sirgoojah and Oodeypore of the Chota Nagpore Division, and also in the northern zemindares of the contiguous Belaspore District of the Central Provinces, or between the parallels of 22° and 23°, and the meridians of 82°15', and 83°15'.

Lieutenant Sale, with an Assistant Surveyor (Mr. James), undertook the triangulation.

132. The country topographically surveyed embraced the portions of Sirgoojah, Korea and Chang Bokhar, situated on the extreme north-west frontier of the Chota Nagpore Division, touching upon the southern limit of the Mirzapore District and the south-eastern boundary of the Rewah State, within Latitude 23° to 24°, and Longitude 81° 40' to 83°, and is embraced in Atlas Sheets, Nos. 89 and 90.

133. The country triangulated, as well as the tract through which the topographical delineation progressed, presented many obstacles to rapid progress. Provisions were very difficult to procure owing to the scarcity caused by the past season's drought. In many places the inhabitants were living on wild fruit and roots, and some of the detail parties were put to great straits for want of requisite food and supplies of every description.

134. Notwithstanding these difficulties, an excellent season's work was completed, amounting to 3,239 square miles of triangulation, and 2,873 square miles of topography, by the joint efforts of the several assistants as per margin.

| | Square Miles. |
|---------------------------------|---------------|
| Mr. McGill, Surveyor, 3rd Grade | 383 |
| .. Vanderputt, " 4th " | 362 |
| .. Wyatt, Asst. " 2nd " | 275 |
| .. Barker, " 3rd " | 305 |
| .. Rue, " 4th " Proby. | 305 |
| .. Wilson, " 4th " | 355 |
| .. Owen, " 4th " | 98 |
| M. S. Dutt, Sub-Surveyor | 251 |
| H. D. Dutt " " | 275 |
| Eusuf Sharif " " | 264 |
| Total | 2,873 |

135. Observations were taken at 68 stations, laying down 266 points, and the heights of 202 points were determined trigonometrically. Check routes were run through the field sections of nearly all the Assistant and Sub-Surveyors, in addition to examination and test *in situ*.

136. The total cost of the season's operations, including all contingent charges, is Rs. 49,950.

| | Square Miles. |
|-----------------------------------|---------------|
| Triangulation by Lieutenant Sale, | |
| assisted by | 3,239, |
| Mr. A. James. | |

137. During the recess the entire computations of the season were completed in triplicate, and 3 angle books were copied in duplicate; of fair mapping, the following was completed—

- 1 Inch standards, 6 sheets.
- .. Ditto, exaggerated 6 "
- 1 Chart of triangulation, scale 4 miles=inch.
- 1 Chart of check routes " "

All these records have been lodged in this office. The standard maps for reproduction to scale are finished in very superior style, while the exaggerated sheets for reduction by photo-zincography are second to none rendered by other parties. The very marked improvement in the mapping of the party during this season I attribute entirely to the skill of Lieutenant Sale, who is an artistic draftsman and delineates ground in a very masterly and correct style.

138. This party, from its extreme isolation, I had long endeavoured to visit, but owing to various other more pressing calls on my time, had been prevented from doing. I was glad however, to be able to effect my object this year, when I repaired to Dorundah in the height of the rainy season, and inspected the establishment on the several dates from the 18th to the 21st of August last. The office records, instrumental equipment, and camp equipage, were in excellent order and well and carefully kept. The entire establishment was, I have much satisfaction in stating, in a state of perfect efficiency. The Surveyors and assistants showed a most praiseworthy spirit of emulation and were very zealous in their efforts to complete and perfect the work entrusted to them.

139. Credit is due to Lieutenant Sale for having ably conducted the season's operations to a successful and creditable termination under many difficulties, and for the manifest improvement he has effected in the style of the hill drawing. Under this officer's management the efficiency of the party is not likely to suffer, while the special aptitude he possesses for the work of a Surveyor and Topographer, his high professional qualifications, and the active share he takes in both the field and recess duties, will have the most salutary effect and prove very beneficial to all under his orders. Credit is also due, and has been awarded, to the former Deputy Superintendent, Major Depree, now on furlough, who conducted the operations for many years, and took a large share in the training of the subordinates and bringing them to their present state of efficiency.

140. The future operations of this party and the extension of the survey (on the completion of the Chota Nagpore Division, a small portion of which only remains) into the districts of Mandlah and Belaspore of the Central Provinces, were fully discussed by myself with the officer in charge during my inspection, as well as determined in communication with the Chief Commissioner of the Central Provinces. The plan laid down for the current season's work is as follows:—Lieutenant Sale, assisted by Mr. Vanderputt, is extending the triangulation due west from its present limit through the northern portion of Belaspore, and across Sohagpore and Ramghur of the Mandlah District. This officer will likewise visit and report on Ummurkuntuk, with reference to the former orders of Government cited on the margin, which the direction of the topographical operations hitherto have not permitted the officer in charge of the Rewah Survey from carrying out, as originally contemplated.

No. 152, dated 23rd January 1862, from the Secretary to Government of India, Foreign Department, and No. 902, dated 29th April 1862.

141. The detail parties will be employed in completing the unfinished portions of the Chota Nagpore Division in Korea, Chang, Bokhar, Oodeypore, and Ganpoor, and delineating this hitherto totally unknown region, almost unvisited by Europeans, which provides for sheets Nos. 105 and 90 of the Atlas. The completion of this division or commissionership will be a matter for great congratulation, it has been a most arduous undertaking, and only accomplished by the unflinching zeal and perseverance of the officers and assistants who have been employed on its execution for the past ten years.

142. Messrs McGill, Vanderputt and James have rendered excellent service during the season. Lieutenant Sale reports of them in the most favorable terms, and having witnessed their attention to their duties, I am able to endorse his opinion.

143. The health of the party, I am happy to state, was generally good during the field season, but on return to recess quarters at Dorunda, every assistant suffered from intermittent fever of an obstinate type. The country under survey is of a most peculiarly inhospitable and bad character, and it would be very advantageous, if after such exposure and privations, the establishment could be transposed to a hill climate for the recess, where the baneful effects of the malarious atmosphere imbibed for five or six months might be possibly eradicated, and the European agency restored to vigor for commencing a new season's field operations.

No. 5.—TOPOGRAPHICAL PARTY.

REWAH AND BUNDELCUND SURVEY.

144. *Rewah, south of Soane, Punnah, &c.*—This party, under Lieutenant Riddell's charge, started from recess quarters on the 20th October, and commenced work in Rewah and Bundelcund early in November.

Personnel.

| | |
|--|--|
| Lieutenant R. V. Riddell, R. S., 3rd grade Deputy Superintendent, in charge. | |
| Lieutenant W. F. Badgley, 1st grade Assistant Superintendent, on leave to Europe from 23rd January 1869. | |
| Lieutenant J. R. Wilmor, Proby. Assistant Superintendent, appointed on 24th August 1869. | |
| Mr. A. Chamarett, 2nd grade Surveyor, on leave up to 3rd March 1869. | |
| Mr. A. J. Wilson, 1st grade Assistant Surveyor, transferred from No. 4 party, joined in November 1868. | |
| Mr. C. F. Hamer, 2nd grade Asst. Surveyor. | |
| .. C. Kirk, 3rd | |
| .. E. A. Wainright, 3rd | |
| .. T. D. Ryan, 4th Proby. | |
| .. H. T. Kitchen, | |
| .. W. H. Lilley, | |
| Sheik Nubbi Bux, Sub-Surveyor. | |
| Prem Raj, ditto. | |
| Sheik Abdur Rahim, ditto. | |
| .. Abdul Ruhman, ditto. | |
| .. Ali Ahmed, ditto. | |

145. The Assistant Superintendent attached to this party, Lieutenant W. Badgley, who joined the department in May 1865, obtained furlough to Europe from the 23rd December 1868, and did not take any part in the season's field operations. Mr. A. Chamarett, the senior Surveyor with the party, who was quite incapacitated from field duty, also obtained leave for six months, from the 3rd September 1868, to remain at Dehra, and took no share in the field work, but rejoined the party on its return to recess quarters.

146. The ground to be triangulated in advance was situated in the Native States of Punnah, Adjyghurh, Chutterpore and Bijawar, all in Bundelcund. The stations of observation were selected by Lieutenant Riddell, and Mr. A. J. Wilson observed the angles.

147. The country for final survey lay partly in Rewah, south of the Soane river, in a narrow slip between the tehseel of Bijeragougurh of District Jubbulpore and the northern limit of Mandlah, and partly in the States of Punnah and Churkaree, south of the Banda District. This will fill up sheet No 89 of the Atlas, and completes the whole of the Rewah State, with the exception of the transferred talooka of Sohagpore, which will have to be dealt with now by another party whose operations are immediately connected with it.

148. Of triangulation, 1,215 square miles were completed, and 750 square miles were partially covered with points. Of details, 1,838 square miles were completed, and all the field sections were checked by test routes. The amount of topography completed by each Surveyor is given on the margin. The cost of the entire season's operations amounted to Rs. 51,653-6-0, including all contingent charges.

| | | | |
|---|-----|------------------|--------------------------------|
| Lieut. Riddell, 3rd grade Deputy Superintendent in charge | ... | 145 sq. miles. | } employed also on topography. |
| Mr. A. J. Wilson, 1st grade Assistant Surveyor | ... | 43 .. | |
| Mr. C. F. Hamer, 2nd grade Assistant Surveyor | ... | 215 .. | |
| Mr. C. Kirk, 3rd grade Assistant Surveyor | ... | 188 .. | |
| Mr. E. A. Wainright, 3rd grade Assistant Surveyor | ... | 184 .. | |
| Mr. T. D. Ryan, 4th grade Assistant (Proby.) | ... | 124 .. | |
| Mr. H. T. Kitchen, 4th grade Assistant (Proby.) | ... | 154 .. | |
| Mr. H. Lilley, 4th grade Assistant (Proby.) | ... | 172 .. | |
| Sheik Nubbi Bux, Sub-Surveyor | ... | 47 .. | |
| Prem Raj, Sub-Surveyor | ... | 200 .. | |
| Sheik Abdur Rahim, ditto | ... | 173 .. | |
| .. Abdul Ruhman, ditto | ... | 193 .. | |
| Total | ... | 1,838 sq. miles. | |

tially covered with points. Of details, 1,838 square miles were completed, and all the field sections were checked by test routes. The amount of topography completed by each Surveyor is given on the margin. The cost of the entire season's operations amounted to Rs. 51,653-6-0, including all contingent charges.

149. The season's out-turn is moderate, but this is accounted for by, 1st, the reduction in the strength of the party, owing to the Assistant Superintendent and senior Surveyor being absent on leave; 2nd, the duration of the field season having been reduced to five months consequent on the scarcity which prevailed throughout the country; and 3rd, owing to the detached nature of the work in two distinct parts, one south of the Soane river, and the other in the Bundela States, north of Nagode and Punnah, as well as from the inexperience of several of the junior Assistant Surveyors, who had not been long enough in the department to acquire any great facility in delineating difficult hilly ground.

150. The party was much divided, and the several detachments were at long distances apart; this could not well be avoided, as it was absolutely necessary to complete the small unfinished portion of the Rewah State in a notoriously unhealthy locality, and it was also most desirable to square up the work of previous seasons in Northern Rewah and Bundelcund, for publication of complete sheet maps. Lieutenant Riddell's exertions in the

field were most praiseworthy, and he shared with some of his subordinates in completing the topography of some very intricate and unhealthy ground, south of the Soane river, in the extreme limit of the Rewah State; thus, by his presence and example encouraging and assisting his Surveyors in a very difficult and trying duty.

151. In the appendix to this report, extracts will be found from Lieutenant Riddell's narrative report, descriptive of the country through which the season's operations have been carried.

152. On the return of the party to recess quarters at Mussoorie, the usual office duties commenced on the 26th April 1869, and the following computations and maps were completed.

Computations.

| | | |
|-----|---|--|
| 36 | 1st and 2nd class triangles. | |
| 258 | Minor and 2nd class secondary triangles. | |
| 96 | Computations of principal and secondary lats. and long. | |
| 340 | Computations of heights. | |
| 22 | Do. of barometrical observations. | |
| 204 | Pages of horizontal angle books. | |
| 112 | Pages of vertical angle books. | |

In addition to the above, all the computations and alphabetical lists of villages connected with the general report of the Rewah Survey were completed. This was a laborious task, consisting of several seasons' work, much of which was performed by another officer, Captain Murray, and its completion in the style I found it is very creditable to Lieutenant Riddell. Fair copies were made of some of the papers, and all the computations were arranged and compared with the originals. Mr. A. Chamarett rendered very able assistance in these duties, and Lieutenant Riddell reports in high terms of this Surveyor's ability and zeal, which I was well able to observe was well merited.

153. The fair mapping completed is as follows :—

| | |
|---|---------------------------|
| 1 Inch sheets, standards, of Rewah and Bundelcund, for reproduction | ... 7 sheets. |
| 1 Inch exaggerated maps ditto ditto for reduction to $\frac{1}{4}$ th scale | ... 7 sheets. |
| Charts of triangulation examined and finished, scale, 4 miles = 1 inch | ... 4 half degree sheets. |

No arrears of computations and mapping exist in the office.

154. This party was inspected by myself at Mussoorie on the 15th and 23rd September 1869, and I had every reason to be satisfied with the state in which I found Lieutenant Riddell's office, and the order and method with which all the recess duties were conducted. Most of the junior members of the party are in need of more professional training, and during my inspection I impressed on the officer in charge, and his assistants, the necessity for efficient training of all the younger hands. This subject will have Lieutenant Riddell's attention in future.

155. The mapping of this season shows a marked improvement in many respect on that of the previous year. The standard maps are very clear, express the ground well, and are good subjects for reproduction by photo-zincography. The exaggerated sheets for reduction to $\frac{1}{4}$ th scale are boldly drawn, and seemingly well suited for reduction. Probably the only defect in these maps is, that the style of hill delineation is somewhat stiff and regular, imparting a want of relief to some of the most prominent features of the ground; but the delineation is as good as can be expected for the time and money expended on the work.

156. The health of the party was generally good throughout the year. Some mild cases of small-pox and cholera occurred amongst the native establishment towards the close of the field-season, but the effect of recessing in the hills has had the best results, and the programme of operations for the ensuing season was discussed and arranged with Lieutenant Riddell during my inspection, and is as follows :—The triangulation will be extended westwards from about the meridian of 80° to that of 79° , so as to embrace all the unsurveyed portion of the Bundela States, in sheets 89 and 70 of the Indian Atlas, and the topography will be taken up for all the tract of country situated between lines of Latitude $23^\circ 50'$ and 25° , and Longitude 80° and $80^\circ 30'$.

157. Lieutenant J. R. Wilmer, R. A., Probationary Assistant Superintendent, was appointed to this party on the 24th August 1869,* and joined at Mussoorie prior to the party proceeding to the field.

* *Vide* Government of India, Home Department Notification No. 276, dated 24th August 1869.

158. Captain Murray, Deputy Superintendent, the permanent executive officer of this party, returned from furlough on the 23rd March last, and was directed to do duty at head quarters, in the room of Captain Melville.

No. 6.—TOPOGRAPHICAL PARTY.

KHASIA AND GARROW HILLS SURVEY.

159. *North Cachar and Naga Hills.*—The season's detail operations lay chiefly in the hills of North Cachar and the eastern and northern portions of Jynteah and Khasia. To square up portions of the work of previous seasons, skirting the southern side of the valley of the Brahmaputra river, some of the plane tablers were employed at long distances from the main portion of the party, which worked diagonally across (from north-west to south-east) a parallelogram formed by the lines of Latitude 25° and 26°, and of Longitude 92°30' and 93°30'.

Personnel.

| | |
|--|--|
| Major H. H. Godwin-Austen, Deputy Superintendent, in charge | |
| Lieutenant R. Beavan, Assistant Superintendent. | |
| Mr. N. Belletty, Surveyor, 1st grade. | |
| „ M. J. Ogle, Assistant Surveyor, 2nd grade. | |
| „ P. C. Gilhooly, „ 3rd „ | |
| „ W. A. Stratford, „ 4th „ | |
| „ P. J. Doran, „ 4th „ | |
| Sub-Surveyors { Nnsiruddin, Gourchandra and Abdur Rahim. | |

160. The topography completed covers an area of 3,288 square miles, of which 327 square miles were on the scale of 1 inch to the mile, and the remainder, 2,961 square miles, on the smaller scale of $\frac{1}{2}$ inch to the mile, to which this difficult survey was obliged to be reduced in consequence of the heavy expense attending the operations.

| | Square Miles. |
|--|---------------|
| Major Godwin—Austen, Deputy Superintendent. ... | 98 |
| Lieutenant Beavan, Assistant Superintendent. ... | 298 |
| Mr. Ogle, Assistant Surveyor ... | 526 |
| „ Gilhooly, „ „ ... | 780 |
| „ Stratford, „ „ ... | 126 |
| „ Doran, „ „ ... | 390 |
| Nasiruddin, Sub-Surveyor ... | 840 |
| Gourchandra, „ „ ... | 230 |
| TOTAL ... | 3,288 |

161. The triangulation in advance for future detail survey was extended into the western portion of the Naga Hills District, and along the northern portion of the Munnipoor State under considerable obstructions and

difficulties, covering in all an area of 1,300 square miles. Observations were taken at 46 stations by which the positions of 162 secondary points were determined, together with 71 heights.

162. The total cost of the season's work amounts to Rs. 60,508, of which Rs. 14,050 were on account of contingent charges, caused by the excessive cost of labor in these hills, and the local allowances to assistants incurred in consequence.

163. The out-turn of topographical details (3,288 square miles) is very satisfactory, and fully double what it would have been had not the scale been reduced. The natural and political difficulties of the country increase to the east in the Jynteah and Naga Hills, and very little assistance can be obtained in procuring supplies and labor for clearing hill tops for stations of observation, or for the conveyance of instruments and the smallest possible amount of baggage. The inhabitants are in a state of semi-civilization, and no facilities exist for traversing the country in any direction. In fact, survey operations in such a country, with the means and appliances allowed to the Surveyors as described in the Appendix, are out of place. With coolly labor at such excessive prices, and with such independent notions of what they will carry and do for the high remuneration given, the cost becomes prohibitory.

164. The triangulation in advance was much impeded from the want of local labor to clear sites, and the angular measurements could not, in consequence, be completed at many of the stations selected and visited.

165. Major Godwin-Austen was deputed to accompany the military force under Major-General Nuthall, which proceeded into the hills south of Cachar against the Looshai tribes towards the end of February last. After having fairly started all his field parties, the Deputy Superintendent followed the column on this duty. But, owing to the sudden return of the expedition, in consequence of the state of the country from the early rain, he met the force at Jalna Cheera on its way back to Cachar, and was therefore unable to do much towards exploring the unknown country beyond the limits of the reconnoissance made by the Revenue Surveyor of Cachar, and a few positions only of prominent hills were fixed on the general map, which had been compiled and furnished for his special guidance.

166. The loss of this opportunity which might have been afforded to so able an explorer, by the unexpected return of the military expedition, is greatly to be regretted, as the tract of country still undefined and unpenetrated on the eastern frontier between the tea gardens or hill portions of the Cachar and Chittagong Districts, respectively, is of great interest and importance, and some extended knowledge of it, beyond what we now possess, seems absolutely essential for the real interest of the Government, and for due administration on that frontier.

167. The Deputy Superintendent then returned into the hills of North Cachar and completed the angular measurements on some of the peaks of the Burail range, and the topography of the country in the vicinity of the Upper Jhirri river.

168. Major Godwin-Austen reports in favorable terms of the exertions of his military assistant, Lieutenant R. Beavan, who completed 298 square miles of topography in a very accurate and satisfactory manner, and would have completed a larger area had he not, towards the close of the season, been prostrated by a stroke of the sun, which incapacitated him from remaining longer in the field.

169. Lieutenant Beavan having completed his period of probation, and successfully passed To Home Department, No. 2262, dated the 15th December 1869. the required examination before me at head quarters in the tests laid down, was recommended for confirmation in the department by my letter marginally cited.

170. During the recess, all the computations connected with the season's triangulation were completed; 12 fair standard sheet maps, on the $\frac{1}{2}$ inch scale, were finished and rendered to this office, together with two exaggerated maps for reduction to the $\frac{1}{4}$ inch scale, and 2 charts of triangulation were prepared for record in this office.

171. The share taken by Major Godwin-Austen in the duties of the field and recess are deserving of much commendation, and it is mainly due to his individual exertions and admirable qualities as a draftsman and delineator of difficult ground that all the fair standard maps of the season have been completed. Mr. Ogle, Assistant Surveyor, rendered good aid in the field, and Sub-Surveyor Shah Nusirrudin's zeal and energy, both in field-work and recess duties, has been very conspicuous. The Sub-Surveyor excels as a draftsman.

172. It was arranged that during the current season the operations of this party should have extended eastward into the Naga Hills District, where the approximate triangulation had been laid out and a good deal of expense incurred in clearing rays, and along the northern frontier of the Munnipoor State, in conformity with the orders of the Government of India to take up that State in due succession. Also, in communication with Lieutenant Williamson, the Assistant Political Agent in the Garrow Hills, to explore and sketch the southern and western face of the Garrows, on the Mymensing and Goalpara District frontier, round to Tura, in order to endeavour to reduce the insignificant blank composing that tract, which appears hitherto to have baffled all attempts to describe or delineate on any map, and I was therefore particularly anxious to seize the opportunity which the local political authority placed at my disposal.

173. On the close of the recess, and when the establishment was ready to take the field, the orders of the Government of Bengal were received to the effect detailed on the margin, which prevented the intended programme from being carried out.

Bengal Government to Home Department, No. 703, dated the 18th October 1869, with Home Department docket No. 381, dated the 29th October 1869.

"Neither in the Naga Hills, nor in South Cachar, nor in the Garrow Hills is any survey to be undertaken in the ensuing season. If a survey party proceeds into Munnipoor, it will do so under the orders of the Government of India, and the Lieutenant-Governor is of opinion that it will be a proper precaution to send an armed guard with the party in question."

174. From the tenor of these instructions prohibiting any survey at all, in all the three quarters where alone the operations could be continued or prosecuted with professional system in regular order, considerable embarrassment has been felt in putting the establishment on any work during the last month, or in directing their movements from recess quarters; and the more so, in consequence of an intimation from the Financial Department, directing severe retrenchment from the survey budget to be carried out with immediate effect, and which can only be complied with by the entire stoppage of the survey operations in these hills, which, from their great expense, cause a great strain on the resources of this department.

175. I had no alternative, therefore, but reluctantly to submit a proposition to the Bengal Government to suspend this survey altogether, in the letter marginally cited. His Honor the Lieutenant-Governor, on a further reference being made by myself personally, waived his previous objections to undertaking the reconnoissance or exploration of the Garrow Hills, with the consent and co-operation of the Political Officer, and this duty is now being actively carried out, and will, I trust, be permitted to go on to completion for the current season at least, under reduced establishment, to meet, in some measure, the financial exigencies for the present official year.

176. In a previous communication,* the Bengal Government expressed an opinion that merely a reconnoissance would be sufficient for the Naga Hills, and likewise directed that a sub-party should be detached to accompany the Deputy Commissioner, Lieutenant Butler, and the Political Agent for Munnipoor, for the purpose of settling the boundary between that State and the Naga Hills. The latter duty has been directed to be carried out, but the former awaits the further decision of Government on the general question of the financial deficit.

* No. 699T, dated 13th October 1869.

NO. 7.—TOPOGRAPHICAL PARTY.

RAJPOOTANA SURVEY.

177. *Jeypoor, Native State.*—In the month of October 1868, Lieutenant A. E. Downing, 1st grade Assistant Superintendent, officiating in charge of this party, applied for furlough to Europe on private affairs, and on obtaining which, was, on the 16th October 1868, relieved by Mr. H. Horst, 2nd grade Assistant Superintendent, the only available officer for such duty, who carried the party into the field, and conducted the operations until its return to recess quarters at Mussoorie, when he again delivered over charge on the 14th July 1869 to Lieutenant George Strahan R. E., 3rd grade Deputy Superintendent, on his return from medical leave to Europe.

Personnel.

Lieutenant Geo. Strahan, R. E., Deputy Superintendent, 3rd grade, on leave to Europe, rejoined 11th July 1869.
 Lieutenant A. E. Downing, 1st grade Assistant Superintendent on leave from 16th October 1868.
 H. Horst, Esq., 1st grade Assistant Superintendent, officiating in charge, from 16th October 1868.
 Mr. J. P. Bucess, 2nd grade Surveyor.
 .. E. S. P. Atkinson, 1st grade Asst. Survr.
 .. R. Todd, 2nd ditto
 .. Taprell, 2nd ditto
 .. Kitchen, 3rd ditto
 .. Stotesbury, 3rd ditto
 .. McNair, 4th ditto (Proby.)
 Kalkapershad, Sub-Surveyor.
 Harlall, ditto.

178. Thus, in consequence of Lieutenant Downing quitting his officiating charge, before the return of Lieutenant Strahan (for whom he was acting) from furlough, another change in the executive administration of this party became necessary, which was exceedingly inconvenient in many ways, but it was fortunate that so qualified an assistant was found in Mr. Horst, who has performed his task with great success.

179. The plan laid down for the season's operations, was to carry on the advance triangulation southwards from the parallel of 26° to that of 24° , and to complete the detail survey for the degree square bounded by Latitudes 26° and 27° and Longitudes 75° and 76° . This was accomplished in a very satisfactory manner, though under great difficulties, owing to the famine which was more severe in Rajpootana than in the eastern states of Central India.

180. The triangulation completed covers an area of 4,168* square miles. Observations were taken at 54 stations, by which 303 points were fixed, and the altitude of 193 points were trigonometrically determined.

* By Mr. Horst and Mr. Bunes.

181. The final topography completed, is embraced in atlas sheets Nos. 33 and 34, and covers an area of 3,347† square miles, all of which was tested in the field, and a large scale plan (12 inches to the mile) of the City of Tonk and its environs extending over about 120 square miles.

| | | | |
|----------------|-----|--------------|---|
| † Mr. Atkinson | ... | 487 | Square mile. |
| " Todd | ... | 390 | " " |
| " Tapsell | ... | 435 | " " |
| " Kitchen | ... | 551 | " " |
| " Stotesbury | ... | 392 | } Also large scale survey of city of Tonk. |
| " McNair | ... | 465 | |
| Kalkapershad | ... | 157 | |
| Harlall | ... | 470 | |
| TOTAL | ... | <u>3,347</u> | square miles. |

182. The total cost of the season's operations amounts to Rs. 41,477.

183. The season's triangulation was carried through portions of the Native States of Kotah, Boondi, Oodeypoor or Meywar and Gwalior (Neemuch). The state of Boondi is very hilly, and two-thirds of it is covered over by dense jungle, in which tigers, leopards, samber deer, and nilgai, with smaller game, abound. The Chief is said to be very hospitable and to have rendered good assistance.

184. In Oodeypoor large tracts are covered with forests, principally of sâl, tendoo (ebony), babool, mowah, plum, wood-apple, khair and malkarai. The last named, is the only tree which attains any height. The tendoo or ebony is of stunted growth, and the sâl unfit for timber.

185. The cultivation of opium is on the increase in Rajpootana, and the people (rich and poor) are greatly addicted to its use. In Jeypoor, at Rajmahal, Latitude $26^{\circ} 3' 44''$ and in Kishengurh, at Sarwar, Latitude $26^{\circ} 53' 35''$, Longitude $75^{\circ} 30' 28''$ quarries of garnet exist, and large stones of the size of pigeon's eggs are sometimes found, which are valued at from Rs. 500 to 600.

186. The party retired early from the field about the middle of March as the famine was daily increasing. Villages were found entirely deserted, the cattle were perishing in thousands, and it was found impracticable to keep the establishments out longer, or to add to the difficulties of the people by marching through the country at a later period.

187. The country topographically surveyed was chiefly in the Jeypoor State (atlas sheet No. 50), of which only about 400 square miles remain for completion. Owing to the open nature of the ground, the plane tabling progressed rapidly, and a large out-turn is the result. Small portions of Tonk, Boondi, Oodeypoor, and Kishengurh were also taken up.

188. Recess quarters at Mussoorie were reached by the 15th April, and the following computations and maps were completed :—

Computations—Latitudes, longitudes, and azimuths of 58 points.

Secondary and minor secondary triangles—117.

Triangles for intersected points. —461.

Heights computed. —287.

Horizontal and vertical angle books—258 pages.

Alphabetical lists of villages.

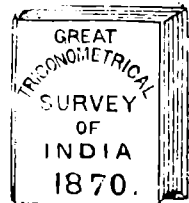
Fair mapping.

1 Inch standard sheets for reproduction. —6. sheets.

1 Inch exaggerated maps for reduction to $\frac{1}{2}$ scale—8 sheets.

Charts of triangulation for general report, Vols. —4 ..

Charts to illustrate the season's operations —2 ..



In addition to the above, the fair copies of professional papers for the general reports of 3 square degrees were compared and arranged.

189. Great credit is due to Mr. H. Horst, 1st grade Assistant Superintendent, for the ability and energy with which he pushed on and brought to a successful termination the field operations of the season. His personal example and exertions throughout the season have been very conspicuous, and have had a most salutary effect on all his assistants and subordinates.

190. Mr. Baness, the Senior Surveyor attached to this party, was, on the 1st May 1869, transferred to my head quarters office, and now fills the post of chief draftsman, in which his professional knowledge and special qualifications as a draftsman are being turned to good account, and I have every reason to believe that his services at head quarters, where important additional geographical duties have recently been transferred from England, will be of great advantage.

191. Messrs. Atkinson, Tapsell and McNair, are specially mentioned by Mr. Horst in commendatory terms. Mr. Atkinson's exertions in the field and recess were very praiseworthy.

192. In recess quarters, on the 14th July 1869, Mr. Horst delivered over charge of the party to Lieutenant George Strahan, R. E., who reports in most favorable terms of the state of discipline and generally efficiency in which the party has been kept up by the Assistant Superintendent, an opinion in which I entirely concur.

193. The party was inspected by myself on the dates marginally noted, and I have much pleasure in recording that the past results of the Survey, the method and system pursued in the office work, and the progress and qualifications of the several members of the establishment merit my full approval.

194. Under Lieutenant George Strahan's subsequent able direction, and Mr. Horst's previous industry and management, all the recess duties have been well performed and no arrears exist. General report, vols. of 3 degree squares have been completed, and all the records, charts, and field sections have been well kept and systematically arranged. Mr. Horst received promotion to 1st grade Assistant Superintendent, by the orders of Government cited on the margin.

195. I personally discussed with Lieutenant George Strahan (whose return to the department I gladly hail) the programme for the ensuing field-season's work, and the future extension of the operations into the Western States of Rajpootana, and have been guided by Colonel Keatinge's advice in deputing the establishment this season into parts of the country least affected by former scarcity.

196. The Deputy Superintendent has been directed to arrange for and start a large scale survey of the station of Mount Aboo, which has been very urgently applied for by the Agent to the Governor General for the States of Rajpootana, and the progress of the general survey now enables me to detach competent hands for this purpose without inconvenience. The advance triangulation will be extended westwards from the meridian of 75° into the Oodeypoor State; the topography for the square limited by the meridians of 75° and 76°, and the parallels of 25° and 26° will be taken up, and large scale surveys made of the cities of Kotah and Boondi.

197. I found this party weak in native agency for employment in open easy ground with the compass and chain, where high paid European assistants would waste their energy to but little purpose, and have therefore instructed the officer in charge to increase to full strength his staff of sub-surveyors, who can also be easily trained to the merely mechanical portions of map drawing.

198. Much yet remains to be achieved in these Rajpootana States, comprising such an immense area, but the survey has made visible strides, and the results being now published as soon as received in this office, the greatest benefits are derived, and not the least so by the Government officials now prosecuting new projects for lines of railway in these parts.

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

SURVEYOR GENERAL'S OFFICE, }
Calcutta, 15th January 1870. }

REMARKS PROFESSIONAL, GEOGRAPHICAL, AND STATISTICAL,

BY EXECUTIVE OFFICERS.

Extract from the Narrative Report of LIEUT. CHARLES STRAHAN, R. E., Offg. in charge No. 1 Topographical Party, Gwalior and Central India Survey, No. 38A, dated 1st October 1869;—Season 1868-69.

I commenced my triangulation from Nimdant Station, Great Trigonometrical Survey, and worked eastwards and southwards to the Betwa river, which forms our eastern boundary. The country then rises in steps from the river, which is about 1,200 feet above the sea until it attains an altitude of 1,650 feet.

GWALIOR TERRITORY.
Country through which the triangulation was carried.

These hills are covered with jungle, and being very flat at the top, it is not an easy matter to fix points amongst them.

Chandairi is the only place of note that I came across amongst them. It has all the signs of having been of much greater importance in former years, but now the greater portion of it is in ruins. The city itself is enclosed by a wall, but outside the wall are remains of many temples and houses; over the city, on a hill about 300 feet above it, are the remains of a fort; this was taken by assault by Colonel Keatinge during the mutiny, and the whole fort was destroyed with the exception of the Killadar's house, which is now however in a ruinous condition. *Chandairi* is famous for its weavers, who still carry on their trade of making fine muslins, but to nothing like the extent that they used to do in former days.

On reaching the table land the jungle ceases, and the ground becomes open and undulating, with small isolated hills scattered about, which makes it remarkably suitable for survey purposes. It is well cultivated and thickly inhabited, with several very large villages at no great distances apart. At *Isagarh*, which is close to the western edge of the jungle, a *Subah* resides, but this town also seems to have been much larger and of more importance in by-gone days, as is apparently the case with almost all the towns in Central India that we have as yet met with. Working my way westwards across the *Sind* river I came to the *Agra* and *Bombay* road not far from *Goonah*; on the north I found there was still a little of the immense jungle which we have had to work through ever since leaving the southern banks of the *River Chambal*. On account of the want of rain during the previous monsoon there was a great scarcity of water, and after leaving the *Koonoo* river, which takes its rise a little to the north of *Goonah*, I found that the few villages there were in the jungle were deserted, and I was obliged to leave a great portion of one table to be triangulated next year.

On the extreme west I came to the *Parbutty* river, which I crossed, and carried the work on to *Chupra*, the capital of a portion of the *Tonk* State. I cannot speak too highly of the civility we invariably experienced in this State. The head man of each district will always do his utmost to assist you in every way. In *Gwalior* too we have always been well treated, but I cannot say the same for *Kotah*, *Boondi* or *Jeypore*, this last State being by far the worst we have worked in as yet.

The strip of jungle west of the *Betwa* river round about *Chandairi* seems to be if any thing more desolate than the larger jungle south of the *Chambal*, but it is of comparatively small extent. The whole time I was working through it I scarcely saw any game, and the villages are small and scarce. I attribute this to the want of water. The forest about the source of the *Koonoo* is very much more picturesque, and there is a fair amount of large game amongst the hills over the river, which rises in high ground but rapidly descends into a large valley with rocky and precipitous hills on either side of it; about this valley and in the

adjoining "khos" the tigers become very numerous during the hot weather, when the water elsewhere has dried up. Mr. Bolst's triangulation was carried over the open ground to the south of Goonah.

18. For next season I propose that the blanks left this season in degree sheet No. VI be first filled up, and that then the plane tablers should take up the Proposed plan of operations for 1869-70. ground over which I have triangulated this season. I shall at the beginning of the season complete the triangulation of degree sheet No. IX, leaving that on the west blank for the present. This will keep the work as much as possible square, and enable me to send in the work in degree sheets according to the present orders without having any great accumulation of records in the office.

19. This year we have no general report of computations to send in, as none are as yet ready for transmission. They are however arranged in order, and a Computations and mapping. fair copy commenced so as to save work next season. I am glad to say we have worked off all arrears of exaggerated maps, and have finished all the standard maps as far as our data will allow us.

Extract from the Narrative Report of F. B. GIRDLESTONE, Esq., Officiating in charge of No. 2 Topographical Party, Central Provinces Survey, No. 1, dated 1st October 1869;—for the Season 1868-69.

The plan of operations (as per para. 51 of the late executive officer's last narrative report, and also his No. 406 of 6th November 1868) for the field CENTRAL PROVINCES, SATHPOORA RANGE. season was as follows: 1st—Mr. Mulheran himself, with Sheikh Omer, as recorder, to extend the former season's triangulation Plan of operations and arrangements. area untriangulated in *Chindwara* and *Seonee*. 2nd.—Mr. Neale, with the party as per margin, to take up the detail survey of the Hill Jagheers in the Mahadeo range, and as much of the adjoining ground as was practicable in the Hooshangabad and Chindwara Districts, or plane tables Nos. 21, 23, 24, 32, 33, 34 and 35 in the accompanying sketch map; distribution and superintendence being left to Mr. Neale's discretion. 3rd.—Mr. Scanlan and Janardanrao to resurvey plane table No. 5 and parts of Nos. 15 and 16, executed in season 1867-68 by Mr. Smith, and condemned subsequently by your orders. 4th.—Mr. A. Chennell first of all to triangulate the slip of country lying along the boundary of Berar and Baitool from near Ellichpooor at the west to the Wurdah river in the east, on which to base a topographical resurvey of that portion of ground, and enable the old Berar survey maps to be properly united with the recent ones of No. 2 party; and having completed this duty to march eastwards and assist the executive officer in charge to carry on the triangulation of the tract south of Umarpathar, extending east from Deogar to the boundary of the Seonee District. 5th.—Mr. Maine to complete the survey of the forest reserve boundaries of Saoligurh and Rajabarari in Baitool, and then take up that of Jamgarh or other reserve.

Owing to severe sickness which occurred in camp en-route, Mr. Neale's detachment did not reach their ground and commence work until the 15th to Party breaking ground in the field. 31st December, Mr. Scanlan's party on the 10th December, Mr. A. Chennell's on the 3rd November, and Mr. Maine's on the 8th December.

The programme as described in para. 3 was followed as closely as was possible. The Plan of triangulation carried out by executive officer. intention of the late executive officer was to start with a base from the principal triangulation of season 1866-67 a few miles south-west of Deogar in the Chindwara District, and with a 14" theodolite to carry a secondary series in a north-easterly direction, so as to furnish sufficient points for the plane tablers in the remaining area of Chindwara; and also another secondary series in an easterly direction through the Khamarpani Tehseel of Chindwara into Seonee District, so as to provide the revenue survey

now working there with points also. Both of those series were intended to be so extended to north and north-east as finally to join on to Mr. Shelverton's Jubbulpore meridional series and thereby get a check on the work.

To carry out these intentions the late Mr. J. Mulheran left Ellichpoor with head

Illness and subsequent death of executive officer.

quarter's camp on the 30th November, but in order to reach his ground was obliged to march through an unhealthy tract, and in doing so contracted near Nimdana village an obstinate kind of malarious fever. He had been observing on Heti H. S. when the attack came on him, and remained under that hill for three days, under the care of the Native Doctor attached to head quarter's camp, but not getting better he crossed over the Wurdah river, and went up on to the Mooltye plateau about the 13th December. Having derived some benefit from this change, he resumed observing on Jam H. S. On December 21st, although in a very enfeebled state he carried on for some time the triangulation in the notoriously unhealthy tract called Khamarpani, but was again prostrated at Bichua village by fever on the 6th February, and had to go into Chindwara station for medical treatment. Having halted there for a week only, he (against the advice of the Civil Surgeon, and indeed warning, that his life would be endangered if he did so), with his usual energy and zeal for his work, again resumed observing on Banadai H. S. near Seonee on the 22nd of February, intending to try and carry on a series to south, so as to meet that which he had commenced bringing up from near Deogar. He had only however worked for five days when he was again taken ill and marched into Seonee station in a very bad state on the 28th February. Although everything that care and science could do were done for the late Mr. J. Mulheran at Seonee by Dr. Barter and the Assistant Commissioner, Lieutenant Thomas, he rapidly got worse and succumbed to his disease on the night of 25th March: his wife had been sent for and had arrived from Ellichpoor the previous evening, but only to find her husband in an unconscious and dying state.

I estimate the total area of country triangulated, exclusive of the "connecting slip"

Area of whole triangulation of season exclusive of that done in "connecting slip."

reported on separately in paragraphs 8, 9, 10 and 11, to be 1,126 square miles. It all lies in the south and south-east portion of Chindwara and south-west corner of Seonee Districts. This triangulation is based on the sides.

Haira H. S. to Dokerjila H. S.—112,168 feet,

Rangrikapa H. S. to Daramtekri H. S.—28,589 feet,

got from triangles numbers 29 and 3 of the secondary triangulation of this party, season 1867-68. Observations were made from 60 stations, and 87 points, chiefly poles, have been determined, giving an average of 1 to every 13 square miles.

The heights of 47 points have also been determined, giving an area of 1 to every 24 square miles.

All the secondary angles were observed on two zeros, twice on L0°, and twice on R 180°

Method of observation.

The tertiary angles were observed once only on each face. The secondary and tertiary heights were observed in rounds once on each face.

The average linear error of Mr. Mulheran's secondary triangulation

Errors of triangulation derived from 11 values of common sides ... =0.11 feet per mile.

The average linear error of Mr. Mulheran's tertiary triangulation

derived from 33 values of common sides =0.48 " "

The average linear error of Mr. Neale's secondary and tertiary

triangulation derived from 16 values of common sides ... =0.53 " "

The average linear error of Mr. A. Chennell's secondary triangulation

derived from 16 values of common sides =0.42 " "

The average linear error of Mr. A. Chennell's tertiary triangulation

derived from 11 values of common sides =0.42 " "

The mean difference obtained from 27 deductions of heights of secondary stations by the late Mr. J. Mulheran ... =4.3 feet.

The mean difference obtained from 14 deductions of heights of tertiary stations by the late Mr. J. Mulheran ... =4.4 "

The average difference obtained from 11 deductions of heights of secondary stations by Mr. A. Chennell ... =3.0 "

The average difference obtained from 4 deductions of heights of secondary stations by Mr. C. Neale ... =2.4 "

These heights are all based on the revised and latest values of Sironj, one of the great are stations. No junction having been made with any Great Trigonometrical Survey points, no idea can be given of the real errors generated in the above triangulation.

The accompanying table shows the number of square miles of detail done, together with the number of plane table stations made and the nature of the ground surveyed by each plane tabler :—

| SURVEYED BY | Area surveyed in square miles. | No. of plane table fixings | Remarks on nature of ground. |
|-------------------------------------|--------------------------------|----------------------------|--|
| Mr. C. Neale, Surveyor ... | 214.0 | 2.0 | Rugged precipitous sandstone hills, very difficult of access and to delineate. |
| Mr. R. Farrell, Asstt. Surveyor ... | 148.4 | 4.0 | Wild, forest-clad, hilly country and difficult to survey on account of dense jungle for $\frac{1}{3}$ of work, remaining $\frac{2}{3}$ fair, open country in which more plane table stations might have been made. |
| Mr. C. Scanlan, ditto ... | 322.0 | 3.2 | Hilly but not difficult country to survey; more plane table stations might have been made. |
| Mr. A. Chennell, ditto ... | 61.0 | 6.7 | Easy open ground, ditto ditto. |
| Mr. J. Chennell, ditto ... | 183.6 | 3.7 | Very rugged precipitous ground, very difficult of survey on account of dense bamboo jungle. |
| Ramchunder, Sub-Surveyor ... | 270.8 | 2.4 | Jungle clad, very hilly ground, but not very difficult of survey; more plane table stations wanted. |
| Janardanrao, ditto .. | 235.0 | 8.5 | Easy hilly, interspersed with easy open ground; more plane table stations wanted. |
| Pandarno, ditto ... | 236.0 | 2.0 | Jungly hilly country, but not very difficult of survey; more plane table stations wanted. |
| Baparao, ditto ... | 235.5 | 6.3 | Jungly hilly country, but not very difficult of survey; more plane table stations wanted. |
| | 1812.3 | m = 41 | |

The character of the ground under detail survey during the last season varied much, from

the rugged sandstone precipices near the Pachmari plateau in board 23, and the wild, forest-clad tracts in boards 14, 32, 34, &c., to the fine open fertile plains in the "connecting slip" between Baitool and Berar. In the former tract the hills were simply a

Remarks on the country. Triangulated and plane tabled as regards hills, rivers, temples, and scenery met with.

chaotic mass piled one on another in strange and fantastic forms, which rendered their delineation no easy task. In all the springs of water thereabouts a sulphurate of mercury exists in large quantities, often discoloring the water and probably giving to it its unenviable notoriety. The highest point in the Pachmari Hills is Dhokgarh H S. 4,454 feet above the sea level, and a village station in the middle of the plateau gives its height as 3,481 feet above sea level. The survey round this plateau, consisting as it does of well-wooded park-like glades, is very beautiful, in many places grand and imposing, more especially at the head of the Denwa river, the Hurrakho, the sacred grotto in the Jambudip river, the Buddhist remains on a natural bridge over the Denwa river, and the waterfall to the eastward. These are all worthy of a visit. The plateau itself, has, I believe, been selected as a site for a sanitarium for the Central Provinces, and large quantities of the Cinchona tree have been planted as an experimental measure up there. As I shall be probably in its neighbourhood during the next

field season, I shall probably visit it myself, and then be able to report, if others have not done so already, further on its merits. Twenty miles to the eastward of Pachmari is the far famed Patál Kho, a singularly beautiful bit of scenery. This Kho is formed by overhanging precipices of 400 to 500 feet in height. Its rugged wild look, and its total separation from all civilised haunts, coupled with the silence which always reigns inside, cannot but strike a spectator with wonder and admiration. Few places I am told can surpass it in wild, bold and picturesque beauty. This Kho was long the refuge of Appa Sabib, the fugitive Rajah of Nagpore.

To its south the sandstone ranges become rich in coal, constant loud reports like those of heavy ordnance, coupled with vibrations of the ground, seem to denote either the explosion of pent-up gas or disturbance of a volcanic nature in those wild tracts. Such noises were constantly heard by Mr. Neale while surveying them. The only road about there, is a track from Bunkheri village to Pachmari, and another from Sohagpore to Pugara, the residence of the Jagheerdar of those parts. This gentleman does not appear to have assisted the survey much in the way of supplies, as, except kootki, a coarse kind of grain patronised by the Gonds, he declined to give anything to Mr. Chennell's camp. Water was very scarce all over this tract in March, April and May. Twenty five miles to south-west of the Pachmari plateau lie the hot springs called by the natives "Anoniki garampani." Once a year, about March, a large fair is held at this spot, at which time people from the surrounding districts come to bathe in them. They contain a large amount of sulphur, and preserve a high temperature. Another set of hot springs was met with this season near the village of Salbaldi on the banks of the Maroo, a large stream taking its rise in the Baitool District, and which forms the eastern boundary of Berar. A fair is held yearly at these temples in honor of Mahadeo. Pilgrims to it having bathed in the hot springs come on to worship in the temples in this village. The scenery round this spot is said to be peculiarly beautiful, the vegetation on the surrounding hills being particularly rich and verdant.

To the north again of these temples, some 25 miles in board 14, the country is mostly drained by the Tapti river, which, running as it does often in deep narrow gorges, affords many a lovely bit of scenery. To the south of this river the hills are much broken up, and rise in regular steps to some 3,000 feet above sea level, from whence their summits stretch away to the south and south-east in fertile undulating plains dotted with hills of all sizes. To the north-east of the Tapti river the hills retain their broken nature far into the Ganga country, and are a constant series of ups and downs; to the north-west they become more bluff and bold, and are often surmounted by high peaks. Ten miles due north of the river, running from west to east, is a long valley in which small strips of wheat and sugar cultivation were seen growing. They look like an oasis among the wild waste of hills, which are so thickly covered with heavy jungle in these parts. Here and there among these hills are small patches of dry cultivation sown among the ashes of dried burnt trees, the only method of cultivation in vogue among the Gonds.

The Gonds inhabit those tracts throughout. They were always found truthful, obliging and honest; they were all, as is generally the case with the aboriginal tribes of India, very poor, and living indeed in an almost barbarous state. Their peculiar customs have been so often described, especially by the late Reverend Hislop, that I am doubtful if much new can be gathered now about them, I have, though, annexed to this report an interesting memo. drawn up by Mr. Scanlan, Assistant Surveyor, from his own observations of this interesting race, which you may think worthy of a place in your annual report to Government.

Almost all that tract of Chindwara, Baitool, and Hoshungabad surveyed and triangulated this last season is wretchedly cultivated. Here and there only are patches, round the villages, of wheat, grain, rice, moong and mussoor. Wild honey abounds all over the hills, and is much prized by the Gonds. All supplies

for the detail surveyors were got only with the greatest difficulty, and then only by sending long distances for them.

The regular forests are almost all now reserved by Government, and contain chiefly teak, ebony, sattu wood and mangoe trees. The villages within them are rapidly being deserted.

Forest.

Antelope, bears, bison, wild dogs, panthers, tigers, hyenas, sambar, &c., abound, and are very destructive to human life. One man-eating-tiger only was heard of near Gogri village of Chindwara.

Wild animals.

The only regular roads met with were in the tract triangulated, viz., the grand trunk road from Nagpore to Jubbulpore, and two large district roads from Khamarpani and Sonser in Chindwara to Korai, and Korai to Mandlah. Large quantities of grain, salt and other traffic are constantly passing to and fro along these on bullocks from Chindwara, Seonee and Mudlah to Nagpore and Berar.

Roads.

Regular office has been held from 9 A. M. to 4 P. M. for five days in the week since May 28th last. Four members of the party were absent on privilege leave as per margin. The awful heat in June, and the constant sickness of all, and of Messrs. Neale, Scaulan and Chennell especially, has retarded the recess work greatly. Mr. Neale continued to hold temporary charge of the party till July 12th, on

Recess duties.

| | | |
|--------------|-----|----------|
| Baparao. | ... | 30 days. |
| Jannardarrao | ... | 30 " |
| Sheik Oomer | ... | 40 " |
| Beccum Sing | ... | 30 " |

which date, having been appointed in D. O. No. 174 of May 7th, I relieved him of the same. Much of my time at first had to be spent in getting a thorough insight into the working of the party, in looking over and arranging voluminous records, the accumulations of 15 years in this office, in drawing up reports on the various subjects connected with the survey for your orders, and in superintending the computations and mapping, and carrying on correspondence, which, owing to Mr. Neale's constant sickness, had all fallen into arrears. A large amount of work of all kinds still remains to be done; but I hope and trust to be able to clear off all arrears, and start clear on next taking the field about November 15th. On taking over charge of the party, I took with Mr. Neale a complete inventory of all records, instruments and other Government stores, which agreed well with the office lists. I found these all nicely labelled and arranged, which duty had taken up much of Mr. Neale's time, as records of Major Brown's, the Hyderabad Survey, and Central Provinces Survey were all, he says, in great confusion and disorder before he separated and classified them.

There being no chance of the Hyderabad Survey General Report from 1855 to 1866 ever being finished by this party, I obtained your sanction and Hyderabad Survey General Report. have since despatched to your office such portion of it as I found finished, together with all records connected with it, with a memo. from myself on the best method of finishing off this lengthy document.

The forest reserve boundary surveys done by Mr. Maine, having not in any way been looked into since their commencement, I next proceeded to Forest Reserve Boundary Computations. arrange and compute these results out with Mr. Maine. Owing to my report on them, you have since ordered all this work to be rejected. The records connected with this work will remain in this office, but are in my opinion quite useless for any re-survey of the same.

The arrangement and computation of the secondary and tertiary triangulations, as well as latitudes, longitudes and heights, has been done principally by Mr. Triangulation Computations. A. Chennell, Sheik Oomer, Ramchunder and myself. The alphabetical lists, synopsis and general report by Sheik Oomer, Mr. Maine, Mr. A. Chennell and Ramchunder. These are all nearly finished, also 2 triangulation charts of connecting slip and season's triangulation by Messrs. Chennell and Maine respectively.

Amount of computations and maps to be sent in.

The computations which will shortly be sent into your office will consist as follows :—

| No. | | Pages. |
|-----|---|----------|
| | | Regular. |
| 1 | Volume of the connecting slip and season's triangulation containing 187 secondary triangulations, 106 tertiary triangulations. | 108 |
| 94 | Secondary latitudes and longitudes, double deductions. | |
| 50 | Tertiary ditto ditto single ditto and pages. | |
| 93 | Heights, computations. | |
| 1 | Volume, general report of connecting slip and regular season's triangulation containing | 45 |
| 255 | Introduction and skeleton triangulations. | |
| 93 | Ditto computation of heights. | |
| | Ditto synopsis | |
| | Ditto alphabetical list of latitudes, longitudes and heights. | |
| | Ditto ditto of villages. | |
| | Ditto abstract of horizontal angles. | 32 |
| 1 | Triangulation chart of connecting slip, scale 4 miles = 1 inch | |
| 1 | Triangulation chart of regular season's triangulation, scale 4 miles = 1 inch | |
| 17 | Original horizontal and vertical angle books, season 1866-67, 1867-68 and 1868-69 | |
| 14 | Duplicate horizontal and vertical angle books, season 1866-67, 1867-68 and 1868-69 | 788 |
| 26 | Field section 15' by 15' (11), season 1866-67, 1867-68 (15) | |
| 10 | Standard maps 30' by 15', Nos. 8, 9, 10, 11, 12, 13, 15, 16, 17, 17 and 18... | |
| 13 | Exaggerated maps 30' by 15', Nos. 2, 3, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 17 and 18 | |

The duplicate bound up copy of this volume will remain in this office.

As stated all through the above report, this party has suffered much, and for long, from the effects of fever and exposure in the malarious tracts in which the Health and efficiency of the party. it has been employed constantly for the last 15 years. This last year has been specially a most unhealthy and trying one, and all members of the party have been, for days and weeks at a time, down with fever. In the field Mr. Mulberan died and Messrs. Neale, Chennell and Scanlan suffered severely, and, since they came into quarters, have been absent many working days from office. It is impossible to expect greater efficiency till the health of the party is better, and this will not be the case so long as they continue to recess in the plains. I earnestly recommend, therefore, that it be allowed to recess in future at Mussoorie or other hill climate, when fever engendered in the field can be shaken off and a fresh stock of health and energy laid in. Increased efficiency will amply repay the Government for the extra expense of moving to and from recess quarters; moreover, recessing in a good climate is a privilege which this party, after so many years' field work in malarious tracts, and recess work in stations on the plains, is justly entitled to.

Notes on the "Gonds" met with in the "Sathpoora Hills," Central Provinces, by
MR. A. SCANLAN, Assistant Surveyor.

The *Sathpooras* extend to a mean breadth of about seventy miles. They are inhabited by the Gonds and Kirkus who are a shy, ignorant, and very primitive race of men; their predilec-

tion for hilly and forest ridden tracts is so great, that I think nothing could induce them to leave their abodes. The Kirku is a perfect Hindu, though he indulges in fowls : while the Gond who styles himself a Hindu is a hybrid between him and a Mussulman, for he appreciates his beef. The Gond claims his descent from a deity. It is said that while a Rajput Prince was once out hunting, he espied a goddess perched on a rock enjoying the wild scenery

The origin of the Gonds. of the country. They became enamoured of each other, and were blessed with a son, whom they called a Gond, a wild man of the woods ; from this man the Gonds are supposed to be descended, and since he claimed his origin from a goddess and a Rajput Prince, they style themselves Raj-Gonds and Gonds-Thakurs. Both the men and women, especially the latter, have a peculiar caste of countenance, which is broad and high cheeked with oblique eyes and a rather flattish nose. They appear to be of a very lively disposition, and are honest and well behaved to us. During the Holi-festival the women throw off all reserve and do not scruple to detain for bakshish any one going through their villages or encamped near them. They will surround him and keep dancing and singing in a ring till their claims are complied with. On a moon-light night both men and women assemble round their village fires and enjoy themselves by discoursing music.

The Bhumkas are the constituted priests of the Gonds and Kirkus, and preside at all their religious ceremonies. Each village has its Bhumka. These men have their especial Lares and Penates which are called the Bhumka and Phatak Deos, the latter being the gods they place in a road over which visitors to shrines pass, and through these tutelar deities they levy a sort of black mail on all who go that way. The chief gods of the people appear to be Bara Deo, Maha Deo, Narain Deo,

The gods of the people. Mata and Khanderao ; in fact, almost every hill-top has on it the stone individuality of some one of the many mythological powers ; to them are offered up the narial, khajur, sendur, patch-khaja, chandal, incense, eggs, limes and fowls. The latter god plays a prominent part during the Holi-festival. He is to be seen almost in every village represented by a long red-colored pole, which is driven vertically into the ground. A ladder leads to the top of the pole, a few feet below which is a platform made of bamboo work, on which two men can take their places. On the extremity of the pole is placed a cross-piece which revolves round, to the ends of it men and women allow themselves to be attached and swung round, fanatics submitting to the hook. This is what they call the " Gâl. " At the foot of this pole are placed stone or earthen images, which are called Kham and Khami, the former being the male, and the latter the female representation. As I said before, it is during the Holi this god calls his votaries in large numbers, when they bring their offerings, which are always cocks and hens, men presenting the former, and women the latter. The Bhumka decapitates them, the offerer takes the trunk and sprinkles the posts and stones with the warm blood, when from a basket little pieces of cake are broken and put before the deities. On the Gal-day, each village sends out its young men and women in procession, the men ahead beating their drums and the women behind singing ; the former lustily carolling totally different airs ; when they reach Khanderao and his wife, the men sit down in a ring and keep chanting on, while the women form their usual arc of a circle and gyrate round the pole.

The death ceremonies of the Gonds. The birth ceremonies of the Gonds and Kirkus are alike, both give a dinner ; but in their death ceremonies they differ. I can best draw the distinction by describing each. The Gonds burn their adults and bury their children. After a few days they offer up to their memory a bull or cow, which they place right over the threshold and knock over with a blow from the blunt end of the hatchet. This they call the Pat. The widows are not allowed to marry without the consent of the Patia, who is the High Priest of the Bara Deo, and one is attached to every Got, which I shall hereafter describe. The Patia, in technical language, sells the widow for 5 rupees to the man seeking her hand, in other words, 5 rupees are used in the ceremony.

The Kirkus like the Gonds burn their adults and bury their children. They offer goats and fowls to their Gata-Peris, which are their Lares and are made of wood, supposed representations of the deceased, who are thus incorporated into their polytheistic category. The ceremony itself is called the Sidoli or Phuljhari. On the day appointed, friends are invited, a great deal of eating, drinking, dancing, and merry making is gone through. From the cross beam of the roof a thread is suspended, and its lower end hangs directly over a small cup of brass or clay, and to the upper end a finger-ring is attached so as to run down at the slightest oscillation ; after a short time it begins to move and drops into the receptacle below, with a clanging sound, then the waudering spirit is supposed to have returned to his former haunts and ceases to molest any one. For so long as his relations do not propitiate him, the restless spirit, they say, will annoy them ; either sickness, want, or ravages by wild animals on their cattle will keep afflicting them.

When Gonds marry, a dinner is given, and the food consists of dal and kutki. The bride gets as a present a cloth and a pair of anklets. When a man makes his overtures and is accepted, if able, he gives the bride's parents 9 rupees, 160 seers kutki, 40 seers dal, 160 seers kodo ; not able to supply these, he makes terms of servitude for a period of 5, 7, or 12 years, and though he may soon get married afterwards, still he goes on working at his father-in-law's house. This is called " Lamjhanaa."

When among the Kirkus a marriage is settled on, the asker gives a good supply of liquor to the bride-elect's father ; this binds the contract. If he cannot give 20 rupees or its value (if he be a widower 40 rupees or its equivalent), he is obliged also to do Lamjhana. At the marriage the bridegroom gives the paternal aunt and the mother of the bride a cloth each, and the paternal uncle a pagri. Amongst both, the Gonds and Kirkus, the money is not given to defray the expenses of the marriage cheer and paraphernalia of the bride, but for the marriage contract.

The Kirkus are divided into four chief divisions of caste. The Bapcha, Baoria, Rumba, and Boudoi, the last being the highest. These castes do not intermarry, eat, drink, nor smoke the hooka amongst themselves.

The Gonds divide into two sections, which call themselves Raj-Gonds and Khatola Wala Gonds, the latter wearing the Brahminical thread or janeo across the shoulder. These two divisions hold nothing common among them.

The Gots which I have alluded to above, I find to be clans, something after the manner of those among our Scottish brethren, and in no instance is inters marriage permitted between men and women of the same Got, but cousins are permitted to marry each other. How this finds sanction I shall explain : I shall instance a brother and sister of the Wika Got. The sister marries, say, a Dhurwa. She accordingly becomes of the Dhurwa clan, while her brother, of course, still retains his clanship ; thus the sister's children being Dhurwas and the brother's Wikas, they can intermarry. From this precise explanation, it will at once be seen that the marriage of two brothers' children is interdicted, because they are of the same clan. I was not successful in collecting the names of many of the Gondi Gots worth recording, but I think I have got a good number of the Kirku clans, which are as follows :—Kasda, Betha, Chuthar, Maosi, Busum, Darma, Sakoma, Ataker, Akhundi, Tota, Bhendra, Tandil, Kolsa, Suvati, Selu, and Atkom.

This year I met with no archaeological remains which invited my attention ; there is only one place which has its local tradition. I have remarked on it in my village book.

I have briefly attempted to enter into the chief points of interest regarding these wild tribes, without detailing the many other munitæ which relate to them, such as their dancing, their dress, their villages, and many of their customs, but I trust what I have written on will prove useful to you.

Extract from the Narrative Report of COLONEL G. H. SAXTON, in charge No. 3 Topographical Party, Central Provinces and Vizagapatam Agency Survey, No. 117, dated 28th September 1869 :—Field Season 1868-69.

Fixing and demarcating the Bustar and Jeypore boundary was not completed until 11th March. The tedious delay in this duty was entirely owing to the impossibility of reconciling the opinions of my colleagues, and a final decision in some instances was only effected by my arbitration. The whole proceedings have been printed, and the sanction of the Government of India has confirmed my decision as final and binding on both States. I was able to execute a large quantity of secondary triangulation which has all been computed.

The amount of detail survey executed during the season is very small. The party, though strong in number, was in several instances weak in experience. Also the object of completing to a considerable extent the survey of the boundary required to illustrate and make final and satisfactory the proceedings of the boundary commission caused great hindrance to the steady and systematic progress of some of the Surveyors. Then, again, very much of the country surveyed is of extreme difficulty. Giving credit for these several causes, the out-turn could not be expected to be much larger. The maps are well executed, and the number of stations per square mile is fully up to the required standard. I have made many severe tests, particularly in computing the positions of points after their being laid down by the plane table, and the accuracy has in all instances been quite satisfactory. My Surveyors always evince the greatest confidence in their work, and the results of these tests corroborate that confidence. The sketch map gives the extent of each Surveyor's work, and for reference it is here marginally given.

| | Sq. Ms. |
|--|----------------|
| Mr. Chew, Surveyor ... | 246·0 |
| „ May, Asst. do. ... | 125·0 |
| „ Adams, do. ... | 200·0 |
| „ Claudius, do. ... | 343·6 |
| „ Barnett, do. ... | 160·0 |
| „ Pettigrew, do. ... | 214·0 |
| „ Cooper, do. ... | 106·0 |
| „ Trewman, Sub-Sur. ... | 187·4 |
| „ E. Atkins, do. ... | 265·0 |
| „ F. Atkins, do. ... | 93·7 |
| „ J. McCay, do. ... | 25·0 |
| TOTAL ... | 1,965·7 |
| Average of stations per square mile, 6 for the whole. | |

The more important items of the present season's survey are, *first*, the completion of all the boundary between Bustar and Jeypore, which, for so long a period has, from its unsettled state, been the cause of much trouble and annoyance to the Rajahs, the people of the country, and the officers of the Civil Administration and Police; *secondly*, the River Koolab, which forms the boundary now, fixed for a considerable distance, and its course for many miles where it does not form the boundary, has been surveyed this season; next to the Indrabati River, the Koolab is the most important stream; *thirdly*, of the Indrabati about 50 miles from East to West is given in the maps now under preparation; *fourthly*, on its left or South bank in No. 17, Fair Standard Sheet which is being sent in, in complete form, stands the fort and town of Jugdalpur, the residence of the feudatory Maharajah of Bustar, and *fifthly*, the Tulsi Dongaree Hills, which form a very prominent feature in the country. My principal station named Tulsi is in the middle of the mass at nearly 4,000 feet elevation, and the hills extend from the station on all sides to a radial distance of nearly six miles; within that area there are only two small villages occupied on the north side. These hills are completely surveyed, but only a small portion will be sent in this season in No. 19 Standard Sheet.

The following remarks on the country surveyed in detail last season are chiefly supplied by my Civil Assistant, Mr. Chew. In the country surveyed, there are a few places worthy of notice, *viz.*, "Kotpar," "Jugdalpur," old "Bustar," "Salmi," and Dantawara. Kotpar, a village of 542 houses,

situate about 30 miles from the town of Jeypore, to which it appertains, is the principal place in the zemindary of that name. It was once well fortified, as the ruins show, and belonged formerly to Bustar, but was given many years ago under certain stipulations, and, probably, under some political pressure from the Jeypore Rajah. The ownership of a large portion of this zemindary was contested between Bustar and Jeypore in the late boundary dispute. *Kotpar* is under the management of a Nigaman, a very intelligent man. *Jugdulpur*, the residence of the Bustar Rajah, is on the left bank of the Indrabati River, an important tributary of the Godavery. It is composed of detached blocks of mud huts, the only instance of masonry being the Rajah's house, which, however, is a very rude edifice. Some attempts to improve the place have lately been made. It contains a fort so badly constructed as to offer scarcely any difficulty to an assailant.

Old Bustar was formerly the capital of the district, and bears marks of having been strongly fortified, but is at present in ruins and the resort of wild beasts. The walls surrounding the fort are built of huge blocks of stone, cemented together with lime. They afforded protection to a palace, built of the same material, and from which subterranean passages lead to several large deep wells of good water, situated within the walls, but hidden from view, and covered by domes of masonry. During the mutiny of 1857, the Bustar Rajah, it is said, took refuge here, and partially repaired the defences. The moat around the fort is at present dry, but could easily be filled with water from a neighbouring tank.

Dantawara, the principal place of a Taluq of that name, is situated between the "Sankani" and "Dankani" streams, and belongs to Bustar. The headman called "Jee-ali" who resides here has a court consisting of men more civilized than those at *Jugdulpur*. The languages most generally in use are a rude Hindustani (here called *Narriah*) and *Ooria*; and *Telugu* is not unfamiliar to many. At this place is a temple made of brick, but having a thatched roof, dedicated to a goddess called "Dantesra Mai," whose image is considered extremely sacred, and possessing great power. A story is rife among the inhabitants of this part that, on a certain occasion, a bairagee (devotee) attracted by the ornaments of the idol, which are of considerable value, determined upon stealing them. For this purpose having placed an accomplice on the watch, he ascended the roof, through which alone he could gain access to the interior, but on removing some of the grass and putting his arm through, he found it so effectually secured, that all attempts to withdraw it proved futile, although there was apparently nothing to prevent his doing so. The excruciating pain he suffered made him lose all fear of detection, and giving vent to his feelings in the most pitiful cries for succour he soon aroused the neighbourhood, when, with the assistance of the officiating priests, who invoked the goddess, he obtained her pardon and was released. The rites of this temple are maintained at a great deal of expense, and it is nightly illuminated by 33 lamps, which are fed with ghee obtained from a herd of upwards of 500 buffaloes, belonging exclusively to the temple. These animals are held in some measure sacred, and a feast is annually given to them, on which occasion they are driven to the front of the temple and fed. Once a year a covered litter containing, as is supposed, *Dantesra Mai* herself, but in fact empty, is carried in great state to *Jugdulpur*, and the Rajah, being informed of its approach, goes to a distance of one mile from his palace on foot to meet the procession. This is by no means a slight matter, as the Rajah being a very corpulent personage, the exertion of a two miles' walk is extremely fatiguing to him.

Salmi is a mootah under a *Nagi*, belonging to Jeypore, and adjoining the Bustar frontier. The settlement of the boundary between this and that of *Sunkom*, a zemindary of Bustar, formed a chief duty of the special Boundary Commission last field season. The use of opium is very prevalent in *Salmi*; cases have come to the knowledge of Surveyors where common coolies have sought it at the end of a march, and were incapable of exertion until supplied with it. The population is *Ooria*. Their staple food is rice, which, together with a few other grains, is cultivated in the open country, and tobacco is extensively grown on the banks of the *Koolab*. The inhabitants of the hills subsist almost entirely on raggy, a small round grain resembling mustard seed.

There is nothing worthy the name of commerce in Bustar and Jeypore. Their resources have yet to be developed. I imagine that in no part of India religion, &c. has so little been done. I see no reason why these provinces should not advance to the same standard of productiveness and healthiness as other districts. There are no roads, and no means of carriage. There are fewer indications of religion than are seen in any country within my experience. The people are all Hindoos. The few Mus-sulmans met with, are merely visitors or temporary employés. Vast tracts of country are almost exclusively occupied by wild beasts. The jungles and cover, are too dense, and extended for the sportsman.

Since writing this report, I have received information, which will, I fear, prevent the survey of the Saora gap at present. All my preparations were completed, and my usual requisitions sent in to the Madras Government, and special provisions for that work applied for, when I casually heard, that the Saora tribes had recently been unruly. I immediately wrote to the Madras Government reporting, that my previous letter had been written in ignorance of anything of the kind having occurred. I have no reply from the Government, but I also wrote to Mr. Robinson, now in the Board of Revenue, and lately Inspector General of Police, for information. He replied that, he was not informed as to anything of the kind, but referred my note to the Inspector General of Police, who writes me, that there were some symptoms of opposition, and that some of the ill-disposed people remain out in the hills, holding aloof from communication; he thinks, "that the introduction of a survey party (the object of which is frequently misunderstood) into that part of the country at present might possibly kindle an excitement which otherwise there is no reason to anticipate. If, therefore, as you say, you can concentrate your work with equal usefulness upon Jeypore, I would strongly advise that the survey of the Saora country should be deferred." The subject will certainly be referred by the Madras Government to the same officer, and no doubt, I shall be officially requested to defer [the work. The consequence will be, that the survey in the neighbourhood of Jeypore will be considerably extended instead, and the rest of my programme will remain unchanged.

Extract from the Narrative Report of LIEUTENANT M. T. SALE, R. E., Offg. in charge of No. 4, Topographical Survey Party, Chota Nagpore Division Survey:—Field Season 1868-69.

On taking over charge of this party from Captain Depree on 7th November 1868, I found
 NATIVE STATES. that all preparations for the field season had been made, the
 CHOTA NAGPORE. work had been allotted to the several plane tablers, they had
 Sirgoojah, Jushpore, Korea, &c. been started for their ground, and in fact that there was nothing to delay me in recess quarters.

Having thus provided for the satisfactory completion of the triangulation, I marched towards the ground under survey by the plane tablers. The boundary of the Chota Nagpore Division was at this time under settlement by Boundary Commissioners, who met at the tri-junction point of Chota Nagpore (Korea), Rewah (Sohagpore), and the Central Provinces (Belaspore), and continued the work of settlement from that point; one party (Captains Samuels and Tottenham) working towards the North and West and settling the boundary of Korea Rewah, and another party (Captains Garbett and Bowie) working to the South and East settling the boundary of Korea and Sirguja with Belaspore and the Central Provinces.

As I hope to be able to record a good portion of this settled boundary in the current season's maps, and as the Commissioners were then engaged in the vicinity of my line of march, I visited both camps and arranged to send tracings, &c., of such ground near the boundary as might be surveyed during the current season, so as to procure with as little delay as possible the results of their settlement work.

After visiting the Boundary Commissioner's camp, I at once proceeded to run pertain lines through the boards of the detail Surveyors, visiting them and inspecting their work, &c.

I commenced with the work of Esuf Sharif, Native Surveyor, and ran a pental line diagonally across it, then marched through M. S. Dutt's board and entered Esuf Sharif's second board, inspecting that Native Surveyor's work, meeting that Native Surveyor at the village of Pīnour, near the Rewah portion of Chang Bhokar.

Running check lines.

I then marched back through Baboo M. S. Dutt's board, meeting him and running check lines in his work, then into Mr. J. H. Wilson's plane table, in which I ran check lines and made an inspection *in situ*, from a commanding point.

Having done this, I marched across the South-West corner of Mr. Vanderputt's board into Mr. Wyatt's work, and ran a pental line completely across it, starting from one trigonometrical point and closing on another, and checking by others. The remaining of this pental line brought me into Mr. Rae's board, into which I continued the check line until stopped by country unfavorable to linear measurements. Mr. Rae was met with at the village of Ghugra, and tested his board by the projection of the pental line on his board, and by the *in situ* test.

I subsequently ran check lines through Baboo H. D. Dutt's board and met that Surveyor on the *situ* of his work, then marched to Mr. Barker's 2nd board, and inspected his work from a hill (Choura H. S.) which gave a view over the whole of his work.

I then proceeded through Mr. McGill's Northern board to Mr. Barker's first, a Northern board, and inspected it from a high hill (Mackra Duari H. S.)

As by this time it was late in the season, and as it was especially necessary to check with great care the work of Mr. Owen (this being his first season's work), I gave up all idea of inspecting the work of Messrs. McGill and Vanderputt (of which indeed there was no great need), and marching through the former Surveyor's board, made straight for Mr. Owen's camp, having satisfied myself that his was good and accurate. I ran some more test lines in H. D. Dutt's board, as I had not been altogether satisfied with the result of my first inspection. This furnished the season's work, and having remained a few days at Jhilmili to satisfy myself that there would be no delay or hitch in the completion of the work, I marched towards recess quarters on 18th April and arrived at Dorundah on 2nd May.

The areas completed by each Surveyor are as given below :—

| Name of Surveyor. | No. of Board. | Square miles area. | No. of planetable fixings. | Average per square mile |
|--------------------------------|---------------|--------------------|----------------------------|-------------------------|
| Mr. G. A. McGill, Surveyor | 63 E. | 203.4 | 1021 | 5.0 |
| Ditto | 64 W. | 180 | 616 | 3.4 |
| J. Vanderputt ditto | 76 E. | 270 | 1111 | 4.1 |
| Ditto | 64 W. | 92 | 311 | 3.4 |
| A. G. Wyatt, Asst. Surveyor | 71 E. | 275 | 1121 | 4.1 |
| J. A. Barker, ditto | 63 W. | 120 | 650 | 5.4 |
| Ditto | 64 E. | 185 | 865 | 4.8 |
| R. G. Rae, ditto Probationary | 65 W. | 275 | 790 | 2.9 |
| Ditto | 64 E. | 30 | 66 | 2.2 |
| J. H. Wilson, ditto | 69 E. | 85 | 345 | 4.1 |
| Ditto | 70 W. | 270 | 860 | 3.1 |
| L. R. Owen, ditto | 65 E. | 97.5 | 758 | 7.8 |
| Baboo M. S. Dutt, Sub-Surveyor | 74 E. | 251 | 1412 | 5.5 |
| H. D. Dutt, ditto | 65 E. | 180 | 918 | 5.1 |
| Ditto | 64 E. | 60 | 341 | 5.7 |
| Ditto | 66 E. | 35 | 166 | 4.5 |
| Shaik Esuf Sharif, ditto | 71 W. | 152.1 | 1367 | 8.9 |
| Ditto | 74 W. | 112 | 890 | 7.9 |

The computation and mapping during the recess have been much more laborious than usually the case in survey parties.

General remarks on recess duties.

It will be seen by a reference to the following list of computations and mapping how very largely they exceed the previous year's work. I had for a long time feared, that we should have been unable to avoid getting into arrears, but I am happy to say, that this is not the case.

I attribute the successful completion of the computation mainly to the care and attention given to them by Mr. McGill, who, indeed, throughout took a leading share in the horizontal computation.

The mapping was of a kind involving very much more labour than usual, as most of the country mapped was intricate and hilly.

The standard sheets executed by Mr. Vanderputt are very neatly shaded, and I would especially point out the second sheet completed by Mr. Wyatt, No. 63, the hill shading of which, I think, is worthy of your favorable notice.

On the whole, I trust you will be satisfied, that due progress has been made in this most essential part of the work.

As regards the results of the junction of the series of principal triangulation with the Kolhan series, I sent you a full statement of them in my letters Nos. 35 and 44 of June last, applying the correction spoken of in the last named letter to the data derived from the Sumbulpore series, the coincidence of results is very good.

Health.—During the field season, the health of the party was, with some exceptions, very good, but on coming into recess quarters, every Surveyor suffered, more or less, from a rather obstinate kind of fever; office work was thus a good deal retarded, but at present I am glad to say, that there is an almost complete absence of fever or sickness of any kind.

The country passed through by the triangulation and by the detail Surveyors, has been of a kind offering many difficulties to the rapid progress of the work, and, in addition to the natural difficulties of the ground having been a great deal of trouble, was caused by the unprecedentedly high price of all kinds of provisions during such a season of scarcity and famine as the past year proved to be.

At one time, it was a question, if some of the plane tablers would not have to cease work, for the people of the country, who at the best, live a great deal on roots and jungle fruits, were quite unable to supply the requisite amount of food.

Hence it is, that the rate of survey is as much as Rs. 17-5-1; had circumstances been as favorable as they were in the preceding season, I do not hesitate to say that the work would have been done at Rs. 14 per square mile.

Extract from the Narrative Report of LIEUTENANT R. V. RIDDELL, R. E., Officiating in charge No. 5 Topographical Party, Rewah and Bundelcund Survey, No. 112 A, dated 4th October 1869:—Season 1868-69.

REWAH STATE.
South of Soane River.
Strength of the party and date
of leaving recess.

At that time, the strength of the party was as follows:—

Lieutenant R. V. Riddell, R. E., Deputy Superintendent, 3rd grade, in charge.

„ W. F. Badgley, Staff Corps, Assistant Superintendent, 1st grade, on leave preparatory to proceeding on furlough to Europe.

Mr. A. Chamarett, Surveyor, 2nd grade, on leave of absence on private affairs for six months, from the 3rd September 1868.

Mr. C. F. Hamer, Assistant, 2nd grade.

„ C. Kirk, „ 3rd „

„ E. A. Wainright, „ 3rd „

„ T. D. Ryan, „ 4th „

„ H. T. Kitchen, „ 4th „

„ W. H. Lilley, „ 4th „

Sub-Surveyor Sheik Nubbee Bux.

„ „ Prem Raj.

„ „ Sheik Abdur Rahim.

„ „ Abdul Rahmun.

„ „ Ali Ahmed.

The plan of operations, as stated in paragraph 36 of my last Narrative Report, was to complete the detail survey of unfinished portions of sheets 25, 38, 40, and 41 of Rewah, and 29 and 30 of Bundelcund, and to extend a network of principal triangulation Westwards from the Amua to the Rangir Meridional Series, G. T. Survey, also to complete the triangulation of sheets 25, 37, 39, and 49 of Bundelcund. This, it will be seen, was completely carried out.

The country triangulated in Bundelcund was, in my own work mostly, very favorable for triangulation, consisting chiefly of a plain, from which a number of isolated hills rise up to heights of from 100 to 600 feet above it, but between Kissengurh (Chutterpore) and Hatta (Dumoh) running in a South-West and North-Easterly direction, very nearly as far as the line of the Jubbulpore Railway, there is a strip of country terminating abruptly on the North side and sloping off gently to the South, of from 4 to 10 miles in width, which is almost entirely covered with large mohwa trees and jungle, and on which it is not easy to fix any trigonometrical points; through this, the river Cane (or Kain) cuts its way in a northerly direction, some 10 miles East of Kissengurh. This will be a troublesome piece to survey, as almost all will have to be done by chaining and traversing.

The country triangulated by Mr. Wilson in a general way somewhat resembles the ridge just described, between which, and the stations of Tikeria, Mohdra, Benra, and Dokhan, there is a strip of, generally speaking, flat, well-cultivated country, about 16 miles in width, from which there is on the South side, an abrupt rise of about 600 feet, near the top of which the above stations are situated; from these stations to the South the country is undulating, the general surface falling towards the South, but the streams taking their course Northwards. This portion of the country is almost all covered with heavy jungle, and is very slightly populated.

Of the country plane tabled, sheet 29 in Bundelcund was the most favorable, being in general a well-cultivated tract, and amply supplied with isolated hills, most of which had been determined trigonometrically. Sheet No. 30 of Bundelcund presented greater difficulties, more than half the sheet being covered with jungle and broken up into scarps forming a succession of steps, facing the North; sheet 38 of Rewah presented fewer difficulties to a Surveyor than almost any of the previous season's work in the same neighbourhood, the country is generally slightly undulating, not very much cut up by nullahs, nor covered by heavy jungle, except towards the Southern edge of the sheet.

Sheet 40 in the North-Western portion contained very similar ground to that in sheet 38, but towards the Southern edge, the country becomes mountainous; on one of the hills, "Panchi," a principal station of the Calcutta Longitudinal Series is situated; this hill stands 900 feet above the plains at its base, and the Eastern part of the sheet presents a number of slight plateaus and undulating country covered with jungle. Sheet 41 was a difficult tract of country to survey, being very hilly and covered with jungle, in the Eastern half of which, water was found in scarcity, and then, not of good quality. The portion of sheet No. 25 which came under survey, consisted of undulating ground and low hills, chiefly covered with jungle. The highest hills, with the exception of Panchi H. S., were on the Southern edge of sheet 41. The Dandia hill or "Bainsadadar" rises to a height of 2,751, or 1,200 feet above the plain at its Northern base, Panchi H. S. or "Bangraj" to 2,271, some of the peaks on the Southern edge of sheet 41 to 2,650, and over. I discovered one fact which was previously unknown to me, *viz.*, the elevation of the ground on the South side of the pass across the Kymore Range between Meyhere and Badanpore, is higher than the elevation on the North side, so that, the fall from Badanpore to the Sone River, must be much greater than would be usually estimated, no instruments being used to assist the eye.

The only river of any size met with in the Rewah Territory during this season's work was the "Mahanudy," which forms the Western boundary of the Pergunnah Chandia of Rewah, and is where it first touched Mr. Rivers. Wainright's work, a stream in width about 60 yards from bank to bank, at the usual level of the water running between high and rocky banks, sometimes in a narrow channel, sometimes forming deep and wide pools in which fish abound in large quantities; where this river leaves the Rewah Territory, its banks are from 150 to 200 yards apart; there are plenty of fords across this river, two practicable for carts in sheet 40, one between Kouria and Paharwa at "Sardaghat" about $\frac{1}{2}$ a mile North of the village of Gura on the right bank of the river, the other at Barbata on the road from the Thannah of Nadawan to Sleemanabad. In the Bundelcund work, the Cane or Kain, as the natives call it, runs in a Northerly direction through sheet No. 29 between steep clay banks much broken by nullahs and ravines; its average width at this part, is about 550 yards from bank to bank. There are fords across this river at the following places: at "Harai" is a very fair ford generally practicable for camels by the middle of November, but in the year 1867 all the baggage had to be sent across the river on canoes in the same month, the water being too high to admit of a laden camel crossing. "Sunjighat" between Barsara on the right bank and Dhowrana on the left bank, there is also a fair ford. "Barband Ghât," between Barband on the left bank and Loureta on the right bank, is a fair ford and numerous ferries, at which small canoes ply. Ghât between Hatawa on the left bank and Bira on the right bank is a fair ford, but that at Harai is the best of all these, in sheet 29.

The inhabitants of the Pergunnah Chandia, and of the neighbouring Pergunnah Sleemanabad of the Jubbulpore Division, were suffering a great deal from the effects of the previous drought, and a large number of the poorer classes had left the districts. Although, about the beginning of March, cholera was prevailing in the district, and "smallpox" had been so for a month or more previous, I fortunately escaped with only 3 cases of "smallpox" in my camps, and marching up through the district of Bijeragoogurh, we had 6 or 7 cases of cholera; none, however, proved fatal; Native Surveyor Nubbee Bux was about the second worst case.

The portion of Bijeragoogurh through which we marched, is surrounded on three sides by native states, from which the poor and starved inhabitants flocked to receive the relief distributed at many places in Bijeragoogurh District; when this is considered, I think we were very fortunate not to have suffered worse, for, with only a Native Doctor in camp and a large camp of natives, the disease might have proved very disastrous.

Seven sheets of the general maps, viz., 4 in Rewah, Nos. 25, 38, 40, 41, and 3 in Bundelcund, Nos. 26, 29, and 30, have been begun and completed this season, and the same sheets have also been prepared for reduction to the quarter inch scale.

Triangulation Charts, to scale 4 miles-1 inch of half degree Sheets Nos. VIII, IX, and XII, so far as the Rewah work in this last is concerned, were prepared and nearly finished by Lieutenant Badgley during the recess season of 1868; these have been finished and examined this season, and the chart of half degree Sheet No. XIII has been commenced and completed.

| Computations. | The computations completed are — | |
|--|----------------------------------|---|
| 9 | 1st Class | Triangles. |
| 27 | Secondary | ditto. |
| 37 | Minor ditto | ditto. |
| 221 | 2nd Class secondary | ditto. |
| 16 Computations of Lats. and Longs. of principal Stations. | | |
| 80 | Ditto | ditto of secondary Stations. |
| 340 | Ditto | Heights from observations with Theodolites. |
| 22 | Ditto | ditto from Barometrical Observations. |

The average triangular error of 1st Class triangles is 6.6 seconds.

" " " " " secondary triangles is 13.5 "

" " " " " minor " " " 15.2 "

The linear error of the principal triangles is 0.98 inches per mile, taking into account values obtained from the triangles emanating from the Amua as well as the Rangir Series.

Of the secondary triangles is 15.3 inches per mile.

„ second class secondary triangles is 27.7 inches per mile.

In addition to this, the whole of the computations, alphabetical lists of poles and villages

REWAH.
General Report.

for the professional report of the Rewah survey, embracing records, &c., extending over seven years' work, of which about two-

thirds has been completely prepared during this season, and all those previously prepared, sorted, compared, and corrected. In this duty I have received the greatest assistance from Mr. Chamarett, Civil Assistant, 2nd grade, who has worked incessantly at this uninteresting task during the whole season, assisted always by two, and sometimes by three, sub-assistants, but the sub-assistants have been employed on other office duties as well; all have had their share in working off this mass of arrears. As the charts of triangulation had been submitted for half degree sheets, so have the villages been placed in corresponding lists. I thought this plan preferable to submitting them in one general list for the whole of Rewah, even though it entailed an increase of labor, the lists previously prepared becoming useless.

Also the general report of operations in Bundelcund, which was finished last season up

BUNDELCUND.

to date, has been made to contain the whole of the finished work in half degree sheet No. IX, of which the contents of Sheet No.

XXIX were not ready for submission last season, so that, by the end of the season I hope to have forwarded to your office maps of every portion of Rewah and Bundelcund which has been plane tabled, both on the one inch and quarter inch scales. The final report of the Rewah survey with all charts, &c., connected with it, and the report of half degree Sheet No. IX, Bundelcund, leaving no arrears of any kind to be brought up hereafter, and the work in such a state that the final survey of Bundelcund as far as West as the Meridian of 80° 0' East Longitude should be completed next season.

I hope that the maps will show some improvement on previous seasons, as the remarks on our last season's maps has been carefully impressed on all

Remarks on maps.

printing and outlining, has in consequence been necessary. All the sub-assistants have

Programme for ensuing season.

been practising printing, and if time will admit, I intend that each shall do a small piece of a map on the same scale as our general maps.

During the ensuing season I propose to extend the triangulation over the whole of the remaining portion of Bundelcund at present allotted to No. 5 party, and to complete the detail survey of sheets 31, 33, 35, 37, and 39, and thus square the work up to the Meridian of 80° East Longitude, and if the assistants work, as their general steadiness and good will warrant me to expect, I have no doubt but that the above programme will be carried out in full.

In conclusion, I wish to place on record my satisfaction at the manner in which all my subordinates have assisted me both in the field and quarters, and I trust that their exertions will meet with your approbation.

Extract from the Narrative Report of MAJOR H. H. GODWIN-AUSTEN, in charge of No. 6 Topographical Party, Khasia and Garrow Hills Survey, No. 105A, dated 1st October 1869:—Season 1868-69.

The operations were mainly carried on, in the *North Cachar Hills*, in the Eastern and Northern parts of *Jyntiah* and *Khasia* with some portions, near Cherra-Poonjec.

KHASIA, JYNTIAH, AND NAGA HILLS.

It was expected that the whole of the Khasia and Jyntiah Hills would be completed in its entirety; this was accomplished with the exception of the re-survey of the portions rejected in Sheet XVI, and was due partly

Special objects to be carried out.

to the inefficiency of the sub-assistant detailed to do it, and partly to the obstruction he met with from the Khasias near Chela. The greater part of North Cachar was to be taken up, and but for Lieutenant Beavan unfortunately getting a touch of *coup de soleil* in the early part of the month of March, this district would have been completed up to the Manipur Frontier. The triangulation was to extend Eastward along the Burail into Manipur on the South-East and Naga Hills on the North-East. Some minor secondary work was to be completed near Cherra-Poonjee, and a further extension of the secondary triangulation in Jyntiah to the base of Assam Hills on the North.

Proceeded *via* Juwai for the North Cachar Hills, visiting and observing from the principal station of Tiniang, with the object of fixing the positions of far distant peaks on the Patkoi Range, &c., visible during the generally clear weather in November. Detained in a most vexatious unnecessary manner in the Jyntiah District for 7 days, owing to the want of attention paid by the native officials to the purwannahs of the Civil Authorities; crossed the Kopili into North Cachar on the 5th December, and proceeded to the principal station of Thangnansip for further observations to distant points, preparatory to an inspection of the country on the North bordering the course of the Diyung River. In this area, Messrs. Ogle and Doran were to commence their season's work; I marched with these assistants, giving daily instruction in plane tabling to the latter *en route*, until the principal station of Langroo Haja was reached. After observing some angles there myself, and having seen the nature of the ground and the work that lay before them, (which, it was very necessary to do, to fully realize the difficulties to be encountered from the dense jungle and malarious nature of the country), I left Seka on the Diyung to return to Head Quarters Camp near Khangnansip on the 19th December. Continuing march to Asalu, I met by appointment Lieutenant Beavan and was enabled to sketch the country with him for some miles along the line of route, and to thus start him fairly working alone. Asalu was reached on the 3rd of January, and a permanent Head Quarters' Camp established and arrangements made for the supply of provisions from Cachar, by placing a relay of coolies upon the road. Many things conspired to keep me in Asalu until the 16th February, during which time I made no less than 6 ascents to the summit of Mohadeo, often remaining there the night, in order to observe the Angle Sherfaisip. Thangnansip, the former station from its great elevation immediately above the low valley of the Kayeng, and the plains of Cachar, was, soon after sunrise, daily crowned with cloud, which never moved from it all day or until the evening, when the heliotrope could never be seen from its lying due West of my position. The Deputy Commissioner was also expected, but the great earthquake of the 10th and the Lushai raid that followed soon after, prevented this. The observations having been completed at Mohadeo, I marched on the 16th February for the Eastward, with the intention of clearing a peak on the Burial range, named Hengdan at the head of the Jhiri, and thence, to either proceed direct or *via* Simagutting to Manipur, and make arrangements with the Rajah and Political Agent regarding the prosecution of our work in that country. On the 23rd February, when observing at, and clearing the peak of Hinruitinoh, I received instructions to join the column under Brigadier-General Nuthall, proceeding into the hills of South Cachar; camp was immediately struck, and I descended to Nenglo, reaching Asalu on the 24th February; the 25th was occupied in arrangements for the new work, the preparation and projection of a plane table for the survey of the Southern hills on the scale of 4 miles=1 inch. Leaving Asalu on the 26th, Silchar was reached on the 1st in 4 days. Visited and observed at Salama Tila, G. T. S. the hills visible on the South, but the weather was most unpropitious with pouring rain at intervals up to the 4th, when I left Silchar for Hylakandy and the Dullessur, in which valley General Nuthall's Division of the force lay. Reached Jalnah-Cherra in 4 days, the 8th; on the 9th started for the camp at Pakwa Mookh, but after proceeding a short distance, heard that they were on their return, General Nuthall arriving at Jalnah Cherra that evening; I therefore on the 11th returned again to Cachar by boat, having effected little, save the fixing of some of the distant peaks in the Lushai Hills, seen from Tilas in the Dullessur valley, &c., and Salama Tila, G. T. Station, which I

visited again on the 14th March. In the evening of the same day, Lieutenant Beavan came in from Barkhola, suffering from a touch of sunstroke, and this delayed my departure until the 17th, when finding he was better I proceeded to Nemotha G. T. Station with him, in case that should he eventually knock up, I might either finish his Plane Table section myself or make other arrangements for its completion ; so urgently required to square up Sheet No. XXVII. After 4 days on the cool site of Nemotha, Lieutenant Beavan had so far recovered, that he considered himself able to continue at his work, and I left *viâ* Phaileng for Asalu, arriving there on the 25th March, leaving again on the 27th for the head of the Jhiri. The peak at the head of this river (Hengdan) had been cleared in the previous month by Mr. Robert, (since appointed a Probationary Assistant Surveyor in the Topographical Survey), and the regular work was taken up again on the 30th March. Dense haze from the jungle fires prevented the completion of the observations until the 12th, when some squally weather with rain brought a few clear days. Leaving Hengdan, I took up the topography of the upper Jhiri, carrying it as far down as Hemeo H. S., which station was reached on the 18th April; heavy rain and dense cloud obscured everything until the 27th, when most of the angles required were completed. I then marched for Asalu and made preparations for leaving for the plains, and return *viâ* Cachar to recess quarters. Mohadeo was visited again on the 6th May, and a few extra angles observed. Marching from Asalu on the 10th May, Silchar was reached on the 17th ; with the personal assistance of Mr. J. W. Edgar, the Deputy Commissioner, I was enabled to place in more accurate position the villages of Suk-pilall, &c., in the Lushai Hills, from the bearings of peaks recognized by Mr. Edgar which had been fixed in that direction. Left Silchar on the 21st, and arrived in Cherra-Poonjee on the 29th May.

On return through Cachar, I met with a native of Samjok in the Burmese Territory, on his way to Calcutta to learn the work of a Surveyor. I proposed that he should join No. VI Topographical Party, which he accepted. He has made himself very useful in office as a writer, &c., and as soon as the weather permits, will receive instructions in Plane Tabling. A young Burmese lad who accompanied, has also received instructions in drawing, and will, I think do very well ; thus trained in the department he shows much talent for drawing.

The out-turn is satisfactory, though not so large as in preceding year. The nature of the ground must be taken into consideration and the effects of malaria upon assistants working in such jungle ; this entails occasional attacks of fever and enervates the physical strength. The country is close and difficult to travel over, grass and jungle has often to be cleared, before a Plane Table can be set up, and this is the rule, not the exception ; these and other causes combine to delay progress and are not felt by Surveyors in most other parts of India. The party was weak ; in lieu of Lieutenant Sale, R. E., a practised Surveyor, we had Lieutenant Beavan just appointed, and the place of two Assistant Surveyors removed had not been filled up.

My absence in South Cachar broke in upon the regular work, and impeded progress very much, and prevented the detail survey of many square miles of country on the Manipur Frontier.

The following table gives the individual results and the No. of Plane Table settings per square mile. The result of the year's operations deducting re-survey and marginal area is 2,793 square miles, the cost of the survey was Rs. 60,508-3-4, or, at Rs. 21-10-8 per square mile, an increase over the rate of preceding season. Upon the whole area surveyed up to date. *viz.*, 9,151 square miles, the cost is Rs. 32-3, giving a further reduction on previous year of Rs. 4-9-10

Table showing individual Results and No. of Plane Table settings per Square Mile.

| Names. | Area on 1 inch=1 mile of Resur- vey. | Area exclu- sive of mar- gins. | Margins. | Total Area. | Total No. of Plane Table Stations. | Average per Square Mile. |
|----------------------------------|---|--------------------------------------|----------|----------------|--|-----------------------------|
| Major Godwin-Austen, Dy. Supdt. | .... | 98 | ..... | 98 | 43 | 0.44 |
| Lieut. R. Beavan, Asst. Supdt | ..... | 298 | ..... | 298 | 155 | 0.52 |
| Mr. M. J. Ogle, Surveyor ... | ..... | 493 | 33 | 526 | 318 | 0.60 |
| Mr. P. C. Gilhooly, Asst. Survr. | ..... | 707 | 73 | 780 | 340 | 0.44 |
| Mr. W. A. Stratford, do do ... | 126 | ..... | ..... | 126 | ..... | ..... |
| Mr. P. J. Doran, do do ... | ..... | 328 | 62 | 390 | 177 | 0.45 |
| Sub-Surveyor, Nasirudin ... | ..... | 840 | ..... | 840 | 357 | 0.43 |
| Ditto Gourchunder ... | 201 | 29 | ..... | 230 | 820 | on inch scale. 3.90 |
| TOTAL ... | 327 | 2,793 | 168 | 3,288 | ½ inch | mean of 0.48 |
| GRAND TOTAL ... | ..... | ..... | ..... | 3,288 | | |

The computations of the preceding field season's triangulation have been completed ; Messrs. Belletty, Ogle, Gilhooly, Stratford, and Doran being employed on them. Lieutenant Beavan triangulated at close of the recess some ground in the vicinity of Cherra-Poonjee, the computation of which he has done, and added several new heights to Sheet XVI. The office charts of triangulation are projected to date, all Angle Books are complete in duplicate, leaving no arrears of any kind.

The mapping has progressed very well, all the fair copy sheets completed in detail in the field are out of hand ; the hill shading has been the work of the officer in charge, and Sub-surveyor Nasirudin and your office will now be placed in possession of the entire hill country between 91° and 93°, a great portion of which was until lately very little known, forming together a Topographical Map of much value. The accuracy of this map will, I trust, be found as accurate as such a country admits of on the ½ inch scale. The exaggerated maps of the survey for reduction to ¼ inch are much in arrears, but I do not consider this will be a matter of regret hereafter, for with the assistance of the printed fair sheets, far better copies will be produced, assimilating throughout in style and relief ; this can never be attained when such compilation is rendered piece-meal at irregular intervals, and consequently the work of different hands. To the assistants of the party, I must express my good opinion of their labors and co-operation in field and quarters ; for this, my thanks are again due at the close of another year's employ with them. There is every prospect of my present tenure in charge shortly coming to a close, but, I trust, that should such be again resumed, I may meet them again in this quarter of India, and again with their assistance add still more to the geographical knowledge of the Eastern Frontier Hills.

The health of the party, has not, on the whole, been so good as in previous year ; the assistants have suffered more from low fever during the recess, the effects no doubt of malaria still telling on them. The Native establishment cannot be said to have been sickly, only 4 deaths occurred, including servants of the assistants. In June we lost the Native Doctor Mir Khoda Buksh, but not from any cause attributable to the climate. Cherra-Poonjee, notwithstanding the extreme heaviness of its rainfall (mean 470 inches), I am convinced, is as healthy as any spot that can be selected in these hills, and possesses many advantages over Shillong, especially in being a cheaper Head Quarters, particularly for the Native establishment, whom we could not in the latter place retain on the same rates of pay. Removal to Shillong would entail both to Government and

individuals much unnecessary expenditure, while two more seasons will see, I trust, the Garrow and Naga Hills completed. I am therefore strongly opposed at present to any change of Head Quarters, which can only be effected at enhanced expense to the operations.

Extract from the Narrative Report of H. Houst, Esq., late Officiating, in charge No. 7 Topographical Party, Rajpootana Survey, dated 1st October 1869 :—Season 1868-69.

NATIVE STATES, JEYPORE,
TONK, &c.
Mr. H. Horst, Asst. Supt.,
officiating, in charge.
„ J. F. Baness, Surveyor,
2nd grade.

Our strength consisted as per margin, all of whom were trained Surveyors, except the two last mentioned Native Surveyors.

„ E. Atkinson, Assistant
Surveyor, 1st grade.
„ R. Todd, do. 2nd „
„ C. Tapsell, do. 2nd „
„ F. Kitchen, do. 3rd „
„ W. Stotesbury, do. 3rd „
„ W. McNair, do. 4th „
Kalkapershad, Sub-Surveyor.
Hur Lall Singh, ditto.
John Noah, ditto.
Mr. W. Manly, ditto.
„ P. C. Chowdry, Writer.

The following programme, as laid down by Lieutenant Downing in his Narrative Report of 1867-68, was followed out as far as possible, except that in running series from the Rahoon to the Gurlahgarh Meridional Series I found a net-work of triangulation, and for want of time, as will be shown hereafter, I was unable to observe for altitude of points embraced within Lieutenant Downing's triangulation.

Both the triangulation and the detail survey will be continued Southwards from the old work, still keeping between the meridians of 75° and 76° . The plane tabling will begin at Lat. $26^{\circ}45'$, and the triangulation at about Lat. $25^{\circ}30'$. Both the officer in charge and the Civil Assistant, Mr. Baness, will proceed at once on this duty, which will be carried out on the

Lieutenant Downing's programme for field season 1868-69.

same plan as that pursued last field season, that is, the former will run secondary series from the Rahoon Great Trigonometrical Series on the East to the Gurlahgarh Great Trigonometrical Series on the West. Mr. Baness will continue his work within the limits of the latter. About the middle or end of February they will both proceed to the inspection and testing of the plane tables. At this time I propose that one of the sub-assistants, after being instructed in the use of the theodolite, be detached to re-observe on old stations, to lay down the heights of a large number of points, whose altitudes have not yet been determined, and which can be shown in the maps of next year. In all probability, the minor triangulation of the cities of Boondi and Kotah will come within the season's work, and should, I think, be done by the officer in charge himself. The large plan of the city of Tonk will be put in hand this cold weather.

On closing my triangulation, I found that very little time remained for myself to

Examination of plane table sections and inspection.

run check lines through the completed plane table sections, and Mr. Baness being near Neemuch, closing his triangulation, I directed Mr. E. Atkinson to take up the checking of the completed plane table sections, while I inspected the plane tablers at work. Mr. Atkinson found the work accurate throughout. I checked an unfinished plane table section of Mr. McNair's, who had been sent off to assist Mr. Todd to fill up a gap likely to be left in his work, the completion of which was absolutely necessary in order to enable us to square up Degree Sheet No. IV, and found his work satisfactory. I also checked Mr. Stotesbury's large scale plan of Tonk and found it correct. Messrs. Tapsell and Todd, Sub-Surveyor Hur Lall Singh, Messrs. Stotesbury and Kitchen, and Sub-Surveyor Kalkapershad were inspected in succession, all of whom I found working correctly and in proper style.

You will be glad to hear that all the detail work has been very satisfactorily executed, and that most of it has been checked.

The portion of country which has been plane-tabled during last field season, is comprised within the parallels $25^{\circ}45'$ — $26^{\circ}45'$ and meridians 75° — 76° , completing Degree Sheet No. IV and a little more, and embraces an area of 3,284 square miles, also a plan of the city of Tonk on a scale of 500 feet = 1 inch.

Description of country plane-tabled.

The country is generally flat and well cultivated, and intersected with a few large drainage ravines, which are generally dry.

Hills cross up here and there abruptly, in some cases 800 feet above their basis. The States over which the plane table's work extended, are Jeypore, Tonk, Kishengurh, and small portions of Oodeypore and Boondi. The survey of Jeypore Proper is, I am happy to say, very nearly completed, only about 400 square miles remaining.

Four thousand and five square miles of country have been covered with a net-work of triangulation extending over portions of the States of Kotah, Boondi, Oodeypore, and Gwalior (Neemuch). Between Kotah and Boondi, the River Chumbal forms a natural boundary, the former possessing a few villages on the Boondi side of the river. Kotah is considered the granary of Rajpootana, and there are several pits containing hundreds of thousands of maunds each of grain. On the first approach of famine, the Maharaja prevented mahajuns from trading with the neighbouring States; consequently, in those States where wheat, barley, and grain were selling at 6 and 7 seers per rupee, at Kotah the rate was from 14 to 16 seers per rupee. Colonel Keatinge, the Governor General's Agent in Rajpootana, persuaded the chiefs to permit free trade, the Kotah Raja consenting very reluctantly, yielded after considerable pressure, which was the means of equalizing rates and restoring plenty within 50 miles of Kotah, although, before that, the poor were literally starving, and at Boondi, only 20 miles from Kotah, the scarcity was so great that grain was not procurable at any price.

Boondi is a small State, very hilly, and two-thirds of it covered with dense jungle, which abounds with tigers, leopards, sambar, nilgai, and game of all kinds. Nobody is allowed to shoot without the Maharaja's permission, which can easily be obtained by Europeans, as the chief is most affable and gentlemanly. He is highly respected and really liked by his subjects, being both just and honorable. The Chumbal scarp, which originates at Dholpore, and traverses the States of Dholpore, Kerowlee, and Jeypore, divides Boondi in halves, and terminates at Khenia belonging to Boondi, and near the Western boundary between that State and Oodeypore. The Mej Naddi, which takes its rise in Oodeypore, after running for many miles almost parallel to this scarp, breaks through it at Khatkar and falls into the Chumbal near Bulwun. Another scarp (Ghat it may be called), on which Mandalgarh and Bishengarh, Great Trigonometrical Stations, are situated, stretches East and West of those stations. On the Northern side, there is a slight ascent, but on the Southern, a fall of about 500 feet. The Chumbal breaks through this scarp at Bhainsrorgarh. And it is said, though I had not an opportunity of seeing it, that the cutting caused by the river may be leapt across; the water, a large body, rushes through at a great depth.

Large tracts of Boondi and Oodeypore are covered with dense forest, consisting principally of sal, tendoo (ebony), khair, malkarai, babool, mowah, beir (plum), and bel. The sal is not the same as that used for timber, but a brittle wood of very little use except for fuel. A gum exudes from it in large quantities, which Bheels and Sheriahs collect and barter for *atta*, weight for weight. Looban (incense) is sometimes made from it. The gum is procured by peeling off the thick bark, leaving only a thin shell; in a few days a handful of gum may be obtained after the tree has been so treated. The bark grows again and does not seem to injure the tree materially. The tendoo is of stunted growth and is seldom allowed to exude 6 inches in diameter, being very much used for timber or as bullees. Except in very old trees ebony is not found. The tendoo bears fruit resembling the loquat, and has an agreeable taste when ripe; the Bheels and Sheriahs dry it and use it for food. The malkarai is a splendid tree growing only near streams, attains a great height, remaining perfectly straight throughout its length, and is about 12 or 15 inches in diameter. The wood is very prettily grained, but is brittle and unfit for timber, though very neat furniture might be made of it.

The khair is a thorny tree and used chiefly for ploughs. In the Doon, kuth is made from this tree, but the natives of Rajpootana seem not to understand the preparation of it.

The gum is sweet and much relished when prepared with sugar. Babool is reserved. The mowah bears fruit from which spirits are distilled, and is a source of considerable revenue when plentiful, the tax on it being as much as a rupee a tree. Beir (plum) and bel are used by Sheriahs and Bheels for food. The fruit of the former (not similar to the garden plum, but resembling the berry called jhar beri) is dried and grounded down into flour; after being mixed with an equal quantity of atta it is baked into chuppatees; the latter is the same as that used for medicinal purposes in diarrhœa and dysentery, but the poor eat the pulp mixed either with milk or water to the consistency of a custard. The forests are well protected, cutters being allowed to hew by paying a tax of 8 annas a hatchet per month, but are permitted to cut only what is absolutely needed.

The soil of those portions of Rajpootana which have come under my observation is chiefly sandy, and the crops almost altogether dependant on the rain-fall. Soil and mode of irrigation. Irrigation, whenever it is resorted to, is carried on by means of kutchas wells containing a very limited supply of water, and fail altogether during years of drought.

Wheat, barley, joar, bajra, gram, moth, arhar, and moong dall, rice in small quantities, cotton and opium. The two first mentioned and opium are only brought under irrigation, the rest depending on the rain-fall. Productions. Opium cultivation is on the increase annually, its consumption is very great; the people from the highest to the lowest eat it from their very childhood. So strongly are they addicted to it, that a man in the last stage of starvation or sickness will prefer opium to food if given the preference. Joar and bajra compose the staple food of the poor.

The prices of staple commodities during the last year were—

| | | | | | |
|-------------------|-----|-----|-----|-----|-------------------------|
| Wheat | ... | ... | ... | ... | 6 to 7 seers per rupee. |
| Barley | ... | ... | ... | ... | 6 to 7 ditto. |
| Joar | ... | ... | ... | ... | Not procurable. |
| Bajra | ... | ... | ... | ... | Ditto. |
| Gram | ... | ... | ... | ... | 6 to 7 seers per rupee. |
| Moth | ... | ... | ... | ... | Not procurable. |
| Arhar Dall | ... | ... | ... | ... | 4 seers per rupee. |
| Moong do. | ... | ... | ... | ... | Ditto. |
| Rice | ... | ... | ... | ... | Ditto. |
| Fowls, full grown | ... | ... | ... | ... | 2 to 3 per rupee. |
| Goats | ... | ... | ... | ... | 2 to 3 Rupees each. |
| Sheep | ... | ... | ... | ... | Rs. 1-8 each. |

About one-third of the land belongs to jageerdars, chiefly Thakoors and Bhaie Bunds of the chiefs, who show considerable opposition to Surveyors, refusing to assist them with supplies, and frequently, even with guides and coolies. The vaqueels of the State sent to aid us in our operations are powerless, and when any demand is made by them, they are rudely refused; the authority of the Rajahs over these jageerdars being merely nominal. Land in the Jeypore State is divided into three equal portions, State, mundeers or temples, and jageerdars, about Rs. 3,00,000 falling to each share. The cultivators are chiefly Minahs, who pay a heavy land tax. There are only two classes, thakoors composing the aristocracy and labourers. The former so insolent, that they seldom give a civil reply, even if one be deigned, which is exceedingly unlikely. The Rajahs seldom exercise the right of resumption, as the act is attended with much personal danger to themselves.

With the exception of the main or Jeypore and Agra Road, I saw none within the area which came under observation. The lines of communication are mere tracks fit for small country carts; camels are chiefly used for carriage, being bred in large numbers. Between Agra and Jeypore a very good carriage dāk runs, of which the Maharaja is the proprietor; the trip is expensive; being Rs. 70 for a single seat, or 8 annas a mile. Between the same places, the Government mail cart also runs

and carries two passengers, but the journey of 144 miles without a break is tedious along this road ; there are excellent Dāk Bungalows, built by the chiefs, through whose territories the road runs, and are a source of great convenience to travellers.

The principal cities only have Post Offices, runners being employed to carry the letter bags escorted by two sowars, by way of security against dacoits. The chiefs supply the escorts, as they are held strictly responsible for any robberies committed in their respective States. Last winter, the dāks were plundered several times.

At Rajmahal, Latitude 26°-3'-44" and Longitude 75°-3'-12" in the Jeypore territory, and at Sarwar, Latitude 26°-53'-35" and Longitude 75°-30'-28" in the Kishengurh State, there are quarries of garnet. Between the last named place and Delhi and Agra a large trade is carried on ; some of the stones are about the size of pigeon's eggs and valued up to Rs. 500 or Rs. 600. The smaller ones are neatly cut for rings, studs, earrings, &c.

When the party entered the Jeypore State on its march from Agra, the famine was beginning to be severely felt. The camp being a large one, provisions in sufficient quantity were procurable with difficulty, and fodder was exceedingly scarce. At Jeypore, I saw numbers of people emigrating from Jodhpore into British Territory. Many terribly reduced by want. A month later, the distress was very great, not that the stock of grain had been exhausted, but by reason of the crops having totally failed, and prices risen greatly, the people had not the means of purchasing grain. Whole villages were deserted, and cattle were dying by thousands for want of pasture. Their carcasses were thrown immediately outside the villages, and the stench was so overpowering that it was necessary to take a wide circuit round a village to pass it. There is not the slightest attempt at sanitation ; consequently, when cholera or any other epidemic breaks out, it carries off its victims by thousands. Last winter smallpox raged with unusual severity ; scarcely a house escaped. While I was encamped at Boondi triangulating for the city plan it was frightful ; adults and children covered with the eruption were lying about the streets begging. A case occurred in my camp, but the patient, as he got fever, was separated and there was not another. Mr. Baness had a case also, but having to come a long journey, *viz.*, from Neemuch to Jeypore, to join the Head Quarters camp, on its return to recess quarters, the unfortunate man was completely exhausted and died a day or two after his arrival ; otherwise the establishment was healthy, having only the usual fever cases, which are always pretty numerous at the commencement and close of the field season. The great evil to be feared this season is, that even if there is a favorable rainy season, plenty cannot be restored, as there are not sufficient plough cattle remaining, and the country can scarcely recover itself for two or three seasons. At the suggestions of the Political Agents, several relief works were opened, such as a road from Tonk to Deolee, another from Deolee to Ajmere *via* Kekree, Surwa, and Nusseerabad ; a large bund or embankment for a tank at Jhajpore, and many similar bunds for purposes of irrigation and reclamation of waste lands. Were the railway commenced through Rajpootana, for which the line has been surveyed and sanction obtained, it would afford occupation and food to thousands, who would rather die than emigrate to more favored localities.

APPENDIX A.

COMPILING AND DRAWING BRANCH, SURVEYOR GENERAL'S OFFICE.

STATEMENT showing the nature of the work performed, and the progress made from 1st December 1868 to 31st December 1869.

| MAPS. | SCALE. | PROGRESS AND REMARKS. |
|---|--------------|---|
| COMPILATIONS. | | |
| | Miles. Inch. | |
| INDIA.—For a general Map of the World—publishing by Sir Henry James, Eastern Bengal Section, between the parallels of 20° & 25° North Latitude and Meridians of 90° and 94° East Longitude. | 10 = 1 | Reduced from the $\frac{1}{4}$ inch District Maps and inserted the Districts of Noacolly, Tipperah and Hills, Chittagong and portions of Mymensing, Dacca and Backergunge. Inserting District Altyab. In progress. |
| INDIA.—Central Bengal. Section between the parallels of 20° & 25° North Latitude and Meridians of 86° & 90° East Longitude. | 10 = 1 | Completed the lines of road, railways, &c.; inserted the Hills in the Cuttack Tributary Mehals and part of Hazareebaugh. Completed and ready for publication. |
| INDIA.—Standard Map in 6 Sheets; compiling from the actual results of Surveys completed, based upon the Great Triangulation of India; Sheet No. 1, containing the North-Western portion of India. | 32 = 1 | Reduced from various Atlas Sheets and District Maps, and inserted the details for the Districts of Mozuffernugger, Saharanpore, Dehra Dhoon, Umballah, Loodiana, Ferozepore, Jheend, Rohtuck, Sirsah, Puttiala, Jhung, Mozuffergurh, and Mooltan. In progress. |
| INDIA.—Sheet No. 3 containing the Central and Western portion of India. | 32 = 1 | Reduced and inserted in outline, the Nizam's dominions and Coast Line, Bay of Bengal. In progress. |
| INDIA.—Sheet No. 4 containing the Eastern portion of India. | 32 = 1 | Reduced and inserted the Districts of Chota Nagpore, Mannbhoom, Hazareebaugh, Bancoorah, Midnapore, Singhboom, Balasore, Cuttack, Pooree, Sumbulpore, Patna, Tirhoot and Chumparun. Also portions of Oudh, North-West Provinces, British Burmah, Nepal and Bhootan. |
| PUNJAB.—Index or Hand Map. | 16 = 1 | Completed and sent to Press; proofs under correction; the Map will soon be ready for issue. |
| PUNJAB.—General compilation in 8 Sections; portions of Sheets 5 and 8 from surveys lately completed. | 8 = 1 | Sheet 8 completed and sent to Press; proofs examined. |
| PUNJAB.—Umballah, Delhi, and Hissar Divisions, in 6 Sections. | 4 = 1 | Corrections and additions from information supplied by local Officers; proofs examined. |
| CENTRAL PROVINCES.—Index or Hand Map. | 32 = 1 | Specially compiled for the Gazetteer of the Central Provinces. Entire Map under revision to suit the names in the Gazetteer. |
| BERAR ASSIGNED DISTRICTS.—Index Map. | 16 = 1 | Specially compiled for the Gazetteer of the Berars. Photozincographed; proofs under revision. |
| CHOTA NAGPORE DIVISION.—Topographical Survey. General Map of the— | 4 = 1 | For Office Record. Survey of 1866-67 inserted in outline. |
| GWALIOR SURVEY.—Degree Sheet No. 2. | 4 = 1 | Reduced and drawn for Photozincography. Published. |
| GWALIOR SURVEY.—Standard Sheets, Nos. 1 (b), 1 (c), 2 (b), 3 (a), 3 (c), 4 (a), 4 (b), 5 (b), 7 (a), 9 (a), 9 (b). | 1 = 1 | Redrawn for Photozincography from the Field Maps; 11 sheets completed and published. |
| GWALIOR SURVEY.—Standard Sheets, Nos. 3 (b), 6 (b), 10 (a), and 10 (b). | 1 = 1 | Being redrawn for Photozincography from the Field Maps. In progress. |
| GWALIOR SURVEY.—Degree Sheet No. 5. Exaggerated. | 2 = 1 | For reduction to 1-4th scale, specimen Map. In progress. |
| RAJFOOTANA SURVEY.—Exaggerated Sheets Nos. 1, 2 and 2 (a). | 1 = 1 | For reduction to 1-4th scale. In progress. |
| CENTRAL PROVINCES.—Topographical Survey. Index Map to the Sheets of the— | 8 = 1 | Completed and published. A rough outline Index to the Survey Sheets. |

| MAPS. | SCALE. | PROGRESS AND REMARKS. |
|--|--------------|---|
| | Miles. Inch. | |
| THE EASTERN BRITISH FRONTIER.—Bordering on Burmah and Munnipore from the latest surveys; Sketch Map. | 4 = 1 | A rough preliminary Map intended for the use of the Military expedition in 1869. Reduced by Photography to $\frac{1}{2}$ scale, and zincographed on 8 miles to the inch. |
| ROUTE FROM INDIA TO CHINA.—Proposed to be taken by Mr. T. T. Cooper. | 64 = 1 | Rough sketch photo-zincographed. |
| PROVINCE OF OUDH. | 16 = 1 | Especially compiled for the Oudh Census Report. Ready for publication. |
| SHAHABAD.—District. | 16 = 1 | Specimen Map for the Gazetteer of India. Completed and lithographed. |
| AFGHAN—TURKISTAN.—Sketch Map to illustrate a memorandum on— | 16 = 1 | Compiled under the special and sole direction of Mr. J. Talboys Wheeler, Assistant Secretary to Government, Foreign Department. Lithographed and supplied to the Foreign Department only. |
| EASTERN BENGAL, BURMAH, & PART OF CHINA. | 32 = 1 | Compiled from various materials to illustrate the trade routes from Bengal to China. Completed. |
| ATLAS OF INDIA.—Quarter Sheet, No. 125, North-East (Eastern Bengal). | 4 = 1 | Comprising a portion of the Khasia and North Cachar Hills. Completed as far as materials have been received. |
| ATLAS OF INDIA.—Quarter Sheet, No. 125 South-East (Eastern Bengal). | 4 = 1 | Portions of Sylhet and Cachar. Completed. |
| ATLAS OF INDIA.—Quarter Sheet, No. 125, North-West (Eastern Bengal). | 4 = 1 | Portions of the Khasia and Garrow Hills inserted. In progress. |
| ATLAS OF INDIA.—Quarter Sheet, No. 125, South-West, (Eastern Bengal). | 4 = 1 | Portions of Sylhet and Mymensing inserted. Completed. |
| ATLAS OF INDIA.—Quarter Sheet, No. 87, South-West (part of Oudh). | 4 = 1 | Portions of Lucknow, Barabankee, and Sooltanpore, districts in Oudh. Completed in outline. |
| ATLAS OF INDIA.—Quarter Sheet, No. 87, South-East, (portions of Oudh and the North-West Provinces). | 4 = 1 | Portions of Fyzabad and Bustee inserted. Completed in outline. |
| ATLAS OF INDIA.—Quarter Sheet, No. 87, North-East (portions of Oudh and the North-West Provinces). | 4 = 1 | Portions of Baraitch and Bustee Districts. Partly completed in outline. |
| ATLAS OF INDIA.—Quarter Sheet, No. 87, North-West (part of Oudh). | 4 = 1 | Portions of Sectapore and Baraitch Districts. Outlines in progress. |

Miscellaneous Maps.

| | | |
|--|--------|--|
| AGRA.—Country around. | 2 = 1 | Drawn on transfer paper for lithography. Completed. |
| BERRAR.—Comprising the Districts of Booldanah, Bassim, Akola, Ellichpore, Omraott, and Yewutmull. | 8 = 1 | Exaggerated Map for reduction and publication by Photo-zincography. In progress. |
| Map of the Head Waters of the Kinchar-Kiang, Lantsan-Kiang, Noukiang, and Great River of Thibet, laid down from Chinese Maps, by Mr. T. T. Cooper. | ..... | A Chinese Map drawn on transfer paper for Zincography. |
| ORISSA DIVISION.—Comprising the Districts of Ballasore, Cuttack, and Pooree, exhibiting the civil and criminal jurisdiction. | 4 = 1 | Formed from the engraved Sheets of the Indian Atlas. New roads, canals, boundaries of subdivisions and districts inserted. |
| Map illustrating the routes taken by Mr. Johnson, Civil Assistant, Great Trigonometrical Survey, in travelling from Leh to Khotan and back. | 16 = 1 | On transfer paper for Zincography; 700 impressions furnished to the Foreign Department. |
| DISTRICT CACHAR.—Rough outline. | 4 = 1 | For the Government of Bengal. Drawn on transfer paper for Zincography. |

Cantonment and City Plans.

| PLANS. | SCALE. | PROGRESS AND REMARKS. |
|---|-------------------------|--|
| | Miles. Inch. | |
| Plan of the Cantonments, Civil Station and Environs of Cawnpore, in 10 Sheets. | 1 = 12 | Fair drawn for reproduction and reduction by Photo-zincography. Completed. Proofs under examination. |
| Plan of the City and Cantonments of Deolee, in Rajpootana. | 1 = 10½ Feet. Inch. | Fair drawn for reproduction and reduction by Photo-zincography. Completed. |
| Infantry lines at Nowshera (Punjab), in eight Sections. | 500 = 1 Miles. Inch. | For the Inspector General of Military Works. Drawn on transfer paper. Completed. |
| Plan of the Civil Station, Town, Cantonment and Environs of Agra, in 15 Sheets. | 1 = 12 | Fair drawn for reproduction and reduction by Photo-zincography. Completed. |

Extracts of Charts and various Maps.

| | | |
|--|----------|---|
| Charts and extracts of charts of Triangulation of the Great Trigonometrical Survey; nine in number. | 4 = 1 | For Office record, for the Superintendent Great Trigonometrical Survey; for the Revenue Survey, and other Government officials. |
| Charts of Triangulation of the Topographical Survey Parties; three in number. | 4 = 1 | For Office record. Fair copies with numerical data. |
| Various copies, reductions and extracts from original Field Maps, routes, boundaries of districts, &c. | Various. | For local Authorities and other Government officials. |
| Map of the Shum, Bhoor, Phylawur, Chut and Siab-Tunk Plains, and country West of the Rajupore Frontier. | 1 = 1 | For Office record. |
| Trace of Map showing the extent and degree of damage done to the Revenue Survey Records in the North-Western Provinces during the rebellion of 1857. | 16 = 1 | For Office record. |
| Inserted a portion of the Hyderabad survey in Atlas Sheet No. 94 (reduced and compiled). | 4 = 1 | For the Officer in charge No. 2 Topographical Party. |
| Tracings to show the portions of the principal stations of the Amua, Gora, Karara, and Gurwani Meridional Series, Great Trigonometrical Survey. | Various. | For the Superintendent, Great Trigonometrical Survey. Completed. |

Coloring of Engraved and Lithographed Maps and corrections and additions to ditto.

| | | |
|---|-------|--|
| Coloring of Lithographed and Zincographed Maps. | 6,949 | Copies on various scales. |
| Engraved Atlas Sheets | 1,300 | Sheets. |
| Proofs examined, corrected, &c. | 257 | Sheets; many examined and revised twice. |
| Revision of boundaries, inserting of railway lines and corrections of various kinds too numerous to detail. | 882 | Engraved and lithographed Sheet Maps, various additions and corrections. |

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

| | | |
|---|--------------|--|
| | Miles. Inch. | |
| Pergunnah Buttala, District Goordaspore. ... | 1 = 1 | For the Deputy Commissioner. Fair drawn for Photo-zincography. Completed and proofs taken. |
| Killahs Bankee, Ungool, Talcheer, and Hindole, of Cuttack Tributary Mehals. | 1 = 1 | For the Commissioner, Cuttack Tributary Mehals. Drawn on transfer paper and zincographed. |

| MAPS. | SCALE. | PROGRESS AND REMARKS. |
|--|-----------------------|--|
| Extracts from Maps of the Dewani Mehals in District Wone of the Hyderabad Assigned Districts. | Miles. Inch. 1 = 1 | Trace for the Superintendent, Geological Survey. |
| Extract from Maps of the Goloonda, Colconda, Mulkaid, and Koolburgah Circars, Nizam's Dominions. | 1 = 1 | For the Chief Engineer, Hyderabad. |
| MAP OF PERSIA.—Under compilation. ... | 48 = 1 | For the Government of India, Foreign Department, under instructions from J. Talboys Wheeler, Esq., Assistant Secretary to Government. In progress. |
| Postal Map of Bengal. | 16 = 1 | For the Post Master General, Bengal. In progress. |

SURVEYOR GENERAL'S OFFICE, }
Calcutta, 1st January 1870. }

J. O. N. JAMES,
Assistant Surveyor General.

APPENDIX B.

FROM

CAPTAIN W. G. MURRAY,

Assistant Surveyor General, in charge Lithographic Branch,

TO

COLONEL H. L. THUILLIER,

Surveyor General of India.

SIR,

I have the honor to submit, for your information, the report on the Lithographic Press Branch of your Office during the past year, *viz.*, from 1st December 1868 to the 31st December 1869.

The Lithographic Press may be said to consist of the undermentioned—

The Transfer Drawing Branch,

The Type Printing Branch,

The Stone Drawing and Correcting Branch,

The Lithographic Printing Branch,

The Copperplate Printing Branch, and I purpose to take these in detail, and report briefly upon each.

The Transfer Drawing Branch consists of 16 Draftsmen and 1 Examiner, and these have during the year under review, and during regular office hours, executed 187 transfer drawings of maps, and, in addition, have, during their spare hours, made up 84 more transfers, for which they have received extra payment. The total out-turn of this Branch of the Office was therefore 271 transfer drawings, of which 58 were thickly printed Revenue Survey Sheets.

The Type Printing Branch consists of 3 Compositors and 1 Distributor, who keep 3 presses at work. They are chiefly employed in printing forms for the use of the Department, Department orders, headings, notes, &c., to maps; 1,24,105 copies of sorts have been printed, but as most of them are printed both sides of the paper, the total number of pulls or impressions has been 2,24,280.

The Stone Correcting Branch consists of 11 Draftsmen, who have been especially trained to this most useful and most necessary art. Some of them have been employed in drawing the maps direct on to the stone, and although, there is no doubt, the work turned out is far superior, yet the length of time that must elapse before a full sized map can thus be drawn is so great as practically to nullify its effective adoption in general. It is impossible to estimate the amount of work done by this Branch of the Office.

The Lithographic Printing Branch has done good work, and its results contrast favorably, both as regards quantity and quality, with those of former years. It has printed 97,647 copies of 355 maps, sketches, diagrams, &c., put on to the stones, including some reprints of old maps. Some of these were printed in colors, so that, the true way of estimating the amount of work done is by the number of pulls or impressions. This amounts to 1,11,684. There were 13 presses at work, more or less, throughout the year.

The Copperplate Printing Branch is only a temporary addition to the Lithographic Press. I will be moved over during the course of the year to the large office in Park Street, here the rest of the Engraving Branch is located. Copperplate proofs have been taken of

the small map of India, scale 256 miles=1 inch, and 150 impressions with hills have been printed therefrom, and also of hand map of India, 128 miles=1 inch, and of several Atlas Sheets, scale 4 miles=1 inch. Five hundred copies of a compass card suitable for European or Native Surveyors have been struck off, whilst plate transfers of the headings and foot notes of the standard sheets of the Revenue and Topographical Surveys have repeatedly been turned out as required for current work.

The money balance, in favor of the Office is greater than last year, for, after deducting the permanent and contingent expenses of the Office, and allowing a fair sum for cost of paper, &c., there is a sum of Rs. 8,606-5-7 to the credit of the Department, and this balance would be most materially increased were we to take into account the cost of the Departmental forms and other printed matter that has been turned out during the year, and which may be estimated at the very lowest possible figure as Rs. 21,814.

I have had to regret the severe illness of Mr. H. A. D. Lawrence, the Head Assistant, whose life has been despaired of more than once during the time he has been away. He was seized with cholera on the 29th August, and although he recovered from this, was again struck down by bronchitis at a time when his system had scarcely recovered from the former serious attack. His able assistance has been greatly missed and regretted by me.

Mr. Niven, the Head Printer, has been as usual most energetic and painstaking, and I think the printing has somewhat improved under his able superintendence and practical knowledge of his duties.

I must also record my thanks to Abdool Haleem, the Senior Draftsman and Examiner, upon whom a good deal of Mr. Lawrence's work has devolved.

I have also much pleasure in testifying to the uniform good and steady conduct of all the members of this important Branch of your Office during the period I have been in charge, and the punishments throughout the year have been but nominal.

I beg to annex the usual abstract of results which will show at a glance the condition of the Lithographic Press Office.

I have the honor to be,

Sir,

Your most obedient Servant,

W. G. MURRAY, *Captain,*

Assistant Surveyor General,

In charge Lithographic Press Office.

*Abstract of the work executed in the Surveyor General's Office, Lithographic Branch, from 1st
December 1868 to 31st December 1869.*

| Scale, &c. | New Maps, &c., the Lithographic drawings of which were completed during the present year. | Size. | No. of Sheets. | |
|-----------------------|--|--|----------------|-----------------------|
| 16 Miles = 1 inch ... | Punjab Compilation ... | Atlas ... | 4 | Rejected and re-done. |
| 8 " " ... | Punjab Compilation, Sheet No. 6 ... | Double Elephant ... | 1 | |
| 8 " " ... | Ditto ditto ditto " 8 ... | Ditto ... | 1 | |
| 4 " " ... | Hills to the Map of District Maunbhoom ... | Royal ... | 4 | |
| 4 " " ... | Sindh Compilation Map, Sheet No. 7 ... | Imperial ... | 1 | |
| | Hills to the Map of District Chittagong ... | Ditto ... | 3 | |
| | Index to the Sylhet Sheets ... | Demy ... | 1 | |
| | Hills to the India Hand Map, skeleton edition ... | Atlas ... | 1 | |
| | Index to Engraved Sheets of the Indian Atlas ... | 1/4 Sheet Foolscap ... | 1 | |
| 32 " " ... | The North-Eastern Frontier of Bengal ... | Demy ... | 1 | |
| 64 " " ... | Index to the District of the Lower Provinces of Bengal ... | ... .. | 1 | |
| 16 " " ... | Index to Sheet Maps of the Province of Sindh ... | Imperial ... | 1 | |
| | Index to Sheets of the Central Provinces and Vizagapatam Agency, Topographical Survey ... | Ditto ... | 1 | |
| | REVENUE SURVEY CIRCUIT MAPS. | | | |
| | 1 Inch = 1 Mile. | | | |
| 1 " " ... | Noacolly District Survey Circuit, Nos. 1, 2, 3, 4, 5, 6 and 7... .. | Comprising { Double Elephant ... Imperial ... | 3 | |
| 1 " " ... | Cachar District Survey Circuit, Nos. 1 and 2 ... | | 2 | |
| 1 " " ... | Gogra River Survey Circuit, Nos. 1, 2 and 3. ... | Ditto ... | 1 | |
| 1 " " ... | Ganges Survey River Circuit, Nos. 1 and 2... .. | Ditto ... | 1 | |
| 1 " " ... | Ganges and Gogra River Survey Circuit, Nos. 3, 4, and 5... .. | Ditto ... | 1 | |
| 1 " " ... | Ganges River Survey Circuit, Nos. 5 and 6 ... | Ditto ... | 1 | |
| 1 " " ... | Ditto ditto, " 8 and 9 ... | 2 Sheets Super Royal ... | 2 | |
| | SHEET MAPS. | | | |
| 1 " " ... | Oudh Revenue Survey Sheet, Nos. 11, 29, 35, 36, 43, 44, and 47 | Double Elephant ... | 7 | |
| 1 " " ... | Sindh Revenue Survey Sheet, Nos. 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 21, 25, 26, 27, 37, 38, 39, 52, 68, 69, and 72... .. | Comprising { Double Elephant ... and Imperial ... | 17 | |
| 1 " " ... | Hoshungabad District. Sheet Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13 | | 8 | |
| 1 " " ... | | Imperial ... | 26 | |
| | | Carried over ... | 91 | |

*Abstract of the work executed in the Surveyor General's Office, Lithographic Branch, from 1st
December 1868 to 31st December 1869,—continued.*

| Scale, &c. | New Maps, &c., the Lithographic drawings of which were completed during the present year | Size. | No. of Sheets. |
|------------|---|----------------------------------|----------------|
| | PLANS OF CANTONMENTS AND CIVIL STATIONS. | Brought forward ... | 91 |
| | Civil Station and Fort of Monghyr ... | Atlas ... | 1 |
| | City and Civil Station of Nursingpore ... | Imperial ... | 1 |
| | Town of Sylhet, including Cantonments ... | Ditto ... | 1 |
| | Rohree, Sukkur, and Fort Bukkur ... | Atlas ... | 1 |
| | THANNAH MAPS. | | |
| | 4 Inches=1 Mile. | | |
| | Thannah Rughoonathgunj, Sub-division Jungpore, District Moorsshedabad ... | Double Elephant ... | 4 |
| | Thannah Santipore, Sub-division Ranaghaut, District Nuddeah ... | Ditto ... | 4 |
| | Thannah Chogdab, Sub-division Ranaghaut, District Nuddeah ... | Imperial ... | 5 |
| | Thannah Burwa, Sub-division Berhampore, District Moorsshedabad ... | Atlas ... | 6 |
| | Miscellaneous Maps and Drawings of various sizes, ranging from $\frac{1}{2}$ Sheet Demy to Imperial | Various sizes ... | 71 |
| | EXTRA WORK. | | |
| | <i>During the year the following Drawings were completed by special Draftsmen.</i> | | |
| | Raeppore District (Sketch Map) ... | Imperial ... | 2 |
| | Country west of Rajunpore Frontier ... | Demy ... | 1 |
| | Tritio Doodputlee State, District Cachar ... | Double Elephant ... | 1 |
| | Central Asia ... | Ditto ... | 1 |
| | Afghan-Turkistan ... | Imperial ... | 4 |
| | Sketch showing various routes between India and China ... | Demy ... | 1 |
| | Julpigooree, Military Cantonment ... | $\frac{1}{2}$ Sheet Foolscap ... | 1 |
| | Jessore District, Sheet Nos. 1, 2, 3, 4, 5, 6, 7, 8, and 9 ... | Double Elephant ... | 9 |
| | Miscellaneous Maps, Drawings, Sketches, Diagram, &c., of various sizes ... | Various sizes ... | 66 |
| | | | 86 |
| | Total Transfer Drawings completed ... | | 271 |

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

| SUBJECTS. | No. of Sheets. | No. of Copies. | No. of pulls or impressions. | Value or selling price. | | |
|---|----------------|----------------|------------------------------|-------------------------|----|----|
| | | | | Rs. | A. | P. |
| NEW WORK. | | | | | | |
| District and General Maps, on various scale, from } 2 miles = 1 inch and upwards ... } | 32 | 3,570 | 8,580 | 3,456 | 0 | 0 |
| Revenue Survey Circuit Maps, scale 1 mile = 1 inch ... | 13 | 3,010 | 3,212 | 4,515 | 0 | 0 |
| Ditto Sheet Maps, ditto ... | 94 | 10,810 | 12,884 | 16,215 | 0 | 0 |
| Thannah Maps, scale 4 inches = 1 mile ... | 19 | 75 | 300 | 300 | 0 | 0 |
| Plans of Cantonments and Civil Stations (large scale)... | 4 | 127 | 127 | 190 | 8 | 0 |
| Miscellaneous Maps, Sketches, Diagrams, &c. ... | 136 | 71,130 | 76,388 | 16,569 | 11 | 0 |
| REPRINTS. | | | | | | |
| District and General Maps ... | 20 | 1,777 | 2,641 | 2,003 | 0 | 0 |
| Revenue Survey Maps ... | 36 | 6,612 | 7,016 | 9,768 | 0 | 0 |
| Miscellaneous Maps ... | 4 | 536 | 536 | 118 | 4 | 0 |
| | 355 | 97,647 | 1,11,684 | 53,135 | 7 | 0 |
| FORMS.—For the use of the Department ... | | | | | | |
| | | 53,965 | 1,47,340 | | | |
| Topographical and Revenue Survey Departments } Orders and Memoranda, &c. ... } | | 70,140 | 76,940 | | | |
| | | 1,24,105 | 2,24,280 | | | |
| COST OF LITHOGRAPHIC BRANCH. | | | | | | |
| Permanent Establishment ... | | | | 36,596 | 5 | 7 |
| Contingent Expenses ... | | | | 1,912 | 0 | 0 |
| Ditto ditto Extra ... | | | | 1,233 | 0 | 0 |
| Estimated cost of paper, &c. ... | | | | 4,698 | 0 | 0 |
| | | | | 44,429 | 1 | 5 |
| Difference to credit of the Department ... | | | | 8,706 | 5 | 7 |
| N. B.—In compliance with the orders of Government, no credit has been taken for these forms; they constitute a large portion of the work performed at press and have been moderately estimated at ... | | | | 21,814 | 0 | 0 |

This, together with the above balance, would show a difference in favor of the Lithographic Branch of Rs. 30,520-5-7.

W. G. MURRAY, *Captain,*
In charge Lith. Press Office,
Surveyor General's Office.

SURVEYOR GENERAL'S OFFICE, }
LITHO. BRANCH, }
CALCUTTA, December 31st, 1869. }

APPENDIX C.

SURVEYOR GENERAL'S OFFICE,
PHOTOGRAPHIC BRANCH,
Calcutta, 1st December 1869.

FROM

LIEUTENANT J. WATERHOUSE,

*Assistant Surveyor General, in charge of Photographic Branch,**Surveyor General's Office,*

TO

THE 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 year, extending from the 1st December 1868 to the 30th November 1869. The amount of work may briefly be stated as follows:—578 original maps, &c., have passed through the office, of which 3,773 silver prints and 44,092 complete printed copies have been struck off.

2. CHANGE OF SUPERINTENDENT.—On my return from England, in February, I was ordered to resume charge of the office in room of Captain A. B. Melville, who had just before been obliged to proceed to Europe on medical certificate. I regretted not being able to confer personally with Captain Melville, but he had left detailed information regarding the state of the work and the mode of conducting it, so that, I had no difficulty in taking charge and carrying on the work.

3. REMOVAL OF THE OFFICE TO MORE SPACIOUS PREMISES.—On taking charge, I found that although the establishment had been increased nearly five-fold since my departure for Europe in March 1867, the office accommodation had only been increased by 2 large rooms temporarily borrowed from the Mathematical Instrument Department for the zinc printing, and a stable for the silver printing, and that the accommodation was miserably insufficient for carrying on our work. My predecessor, had already strongly represented the evils resulting from this cause, and on my report dated March 31st, you were good enough to again represent the state of affairs to the Government of India and obtain their sanction to the house No. 1, Wood Street, adjoining the Mathematical Instrument Department, being taken for our accommodation. The office was accordingly removed to its new quarters on the 10th May, and I am glad to say, that the accommodation has proved ample for all our requirements, while the increased space and comfort in working, have had a very beneficial effect on the whole establishment.

4. ERECTION OF A NEW GLASS-HOUSE.—Long before the removal of the office the, glass-house had been found to be far too small and otherwise unsuitable for our requirements. On removing to our present quarters, it became necessary, therefore, to consider what improvements might be effected in this respect. As the tenure of our present premises is only temporary, I proposed merely to enlarge the old glass-house, but on examination it was found that to do so would cost a large sum, and after all would not be satisfactory. It was therefore determined after full consideration with yourself, to erect a new house on an improved plan, which would utilise most of the material of the old house, and by increased efficiency, effect a saving of its cost during our present lease. Accordingly, sanction was obtained from the Bengal Government for its erection, by the Department of Public Works, at a cost of Rs. 2,543. The work was entrusted to Messrs. Mackintosh, Burn and Co. about the end of July, and was completed in a satisfactory manner before the end of September. The increase in the number of negatives turned out, and the improvement in their quality, already show the advantage obtained in this respect.

5. **SYSTEM OF WORK.**—The system of working is much the same as detailed in Captain Melville's report for last year, but since the removal of the office, the whole of the establishment have been brought under one roof, and the work of the office is carried on quite independently of the Lithographic Press Branch, thus obviating constant references, and the passage of plates, transfers, &c., to and from another house, and enabling me to superintend the work far more completely.

6. **PROCESSES.**—A few alterations have been made in the processes detailed in Captain Melville's report for last year. I have fully described the present mode of working in Chapter XI of my Special Report on the Cartographic applications of Photography; it will therefore be unnecessary for me to enter into details here.

7. **STORAGE OF CHEMICALS.**—A rigorous system of check has been adopted on the receipts and expenditures of chemicals, by which each assistant enters daily in a book the amount of work he has done, calculated in square inches, and the quantity of chemicals, &c., he has received and expended during the day; these books are made up weekly and compared with a similar book kept by the store-keeper, and thus the expenditure of chemicals can be strictly proportioned to the amount of work performed, and any waste prevented. This system has only been introduced since July, but next year, I shall be able to give a very exact return of the actual work performed, calculated in square feet, the present system of estimating by the number of negatives and proofs, being very fallacious. I may, however, mention that, since the commencement of the new system on the 1st July to the present time, the out-turn in the Negative Department has been 1,56,193 square inches, at an expense of Rs. 2,609-14-0, or Rs. 1-10-7 per 100 square inches, exclusive of glass. In the Photo-transfer Printing Department, the out-turn has been about 1,99,590 square inches, at an expense of Rs. 1,382, or 11 annas per 100 square inches; and in the Silver Printing Department 2,21,180 square inches, at an expense of Rs. 1,391-12-0 or 10 annas per 100 square inches.

8. Syud Ishmail, formerly Assistant Mathematical Instrument Maker, who was under your orders appointed on the 1st August to aid me generally in the duties of the office and act as store-keeper, has discharged his duties very efficiently; his acquaintance with Photography and chemicals, as well as with mechanics, giving him a great advantage in this respect. He has also been of great assistance to me in conducting the correspondence and keeping the records of the office.

9. **PROGRESS.**—The progress made in this branch during the past year, is considerable; but the out-turn shows a slight decrease from that of last year, as will be seen from the subjoined table:—

| | Subjects received. | Negatives. | Silver Prints. | Photo-Transfer Prints. | Transfers to zinc or stone. | Number of pulls. | Number of complete copies. | REMARKS. |
|--|--------------------|------------|----------------|------------------------|-----------------------------|------------------|----------------------------|----------|
| December 1867 to November 1868, inclusive | 427 | 2,012 | 5,151 | 1,743 | 282 | 52,584 | 50,824 | |
| December 1868 to November 1869, inclusive | 578 | 1,784 | 3,773 | 2,273 | 487 | 51,059 | 44,092 | |
| Difference during the year ... | + 151 | — 228 | —1,378 | + 530 | + 205 | —1,525 | —6,732 | |

10. **ORIGINAL MAPS.**—The number of subjects received for reproduction during the year, has been 578, showing an increase of 151 over last year. I am happy to say, the style of drawing the original maps, standard and exaggerated, both of the Topographical and Revenue Surveys, has greatly improved, and consequently the appearance of the photozincographed copies shows a corresponding improvement. A new system has lately been proposed, for drawing the exaggerated maps forming the degree sheets of the Topographical Surveys, by reducing the 1 inch standard sheets to half scale, and furnishing the Surveyors with two photo-zincographed double elephant sheets printed in light blue, each containing four reductions,

on these blue prints, the map is drawn in an exaggerated style in black ink, for reduction to half scale, and then returned to the Photographic Branch. This system will, I believe, greatly facilitate the drawing, and subsequent reduction of these maps; it is now under trial and will be more fully reported on, subsequently.

11. **NEGATIVE DEPARTMENT.**—The number of negatives taken during the year, shows a decrease of 228 under the previous year. This is chiefly owing to the impossibility of usefully employing a second photographer during the hot months on account of the want of proper accommodation. At the beginning of the hot weather, the assistant photographer fell sick from the effects of working in too confined a space, and as I could not make arrangements for his working satisfactorily, I was compelled to discontinue using the second camera, till the erection of the spacious new glass-house enabled me to work it with real advantage, and I shall now always be able to keep the two cameras constantly at work. Arrangements have also been made for working a third large camera very shortly, and with this addition, I shall be in a position to undertake any work likely to come in during the ensuing year. Another cause of the decrease is that, as a rule, the negatives taken this year have been larger than those of last year, but more originals have been sent in, and I do not think there has been any actual falling off of work; at the present time, there is very little work in hand remaining to be photographed. I have now made arrangements for working on glass plates of considerable size, from 18" × 16" to 20" × 22", and thus hope to economise time, labour, and material and obviate the necessity of joining up the maps in several small sections at the risk of errors in scale and distortion of the margins. This part of the work has been carried on by Sergeant James Mackenzie in a very satisfactory manner; the native assistants under his orders have also worked well, and made fair progress.

12. The number of silver prints produced during the year is 3,773 against, 5,151 of last year. The decrease may be accounted for by the fact that, the original maps are now generally suited for reproduction by photozincography, and it is only in special cases, that silver prints are required, but they are generally made of all reduced maps as guides to the zinc correctors and copper plate engravers. Shortly after taking charge, I introduced the Belgian process for rapid silver printing by development with some success, but at the commencement of the hot weather, we found that only weak red prints could be obtained, and several subsequent trials have been made with the same result. This is to be regretted, as the process promised to be of great use. I have therefore been obliged to return to the usual process, though a few alterations have been made in the formulæ with the object of economising chemicals as much as possible. The operations of this Department have been satisfactorily conducted by Mr. W. Maher, who joined the office in November 1868, and has proved an industrious and painstaking assistant.

13. **PHOTO-TRANSFER PRINTING.**—The number of photo-transfers printed during the year, has been 2,273, against 1,743 of last year, showing an increase of 530. On my arrival, I found that the method in use for preparing the sensitised paper, was open to several objections, so I changed it for the method adopted at Southampton, which I had formerly worked successfully at Dehra, and by altering the proportions of gelatine and bichromate of potash according to the temperature and state of the weather, and drying the paper quickly in a special drying box constructed for the purpose, the result has been more certainty in obtaining an even coating of the sensitive mixture and a very great improvement in the working of the process, so that, we now scarcely ever have a failure in the preparation of the paper. Considerable difficulty has been experienced during the year from the want of a regular supply of suitable transfer ink, and we have had to make continual trials of various inks, with more or less success. I have, however, lately received a large supply of English re-transfer ink, and there will be no more difficulty on this score. Altogether there has been a great improvement in this part of the work, and the failures may generally be attributed to defects in the originals, or want of close contact in the printing frames which it is difficult to secure when printing large plates, especially in damp weather.

The work of this Department has been very efficiently performed by Mr. W. Crossley, whose native assistants have also worked with industry and zeal.

14. **ZINCOGRAPHIC PRINTING DEPARTMENT.**—The number of transfers to zinc during the year, has been 487, against 282 of last year, and of finished copies 44,092, against 50,824 of last year. The decrease in the number of copies may be attributed to fewer copies being required of the Revenue Survey Main Circuits' Maps photozincographed as a temporary measure, to meet urgent and special requirements of local officers, &c. Formerly, 300 copies were printed of these maps, but now we only print 50 copies, unless more are specially ordered. At the same time, though the out-turn has diminished, the actual work performed has been greater, as it will be seen, that the number of transfers to zinc is considerably over that of last year, which is attributable to a large number of the maps turned out being in several large sheets, the whole only counting as one copy.

The transfers to stone this year have been very few, and no transfers are ever made to stone now, unless for some special purpose.

The style of printing has greatly improved, and now that the old country-made presses have been replaced by new ones lately received from Greig of Edinburgh and Brisset of Paris, the work turned out will, it is hoped, be of as high quality as it is possible to obtain in this climate.

The usual difficulty of printing from zinc plates was experienced during the hot weather, but was to some extent overcome by the use of ice for cooling the damping liquid; this plan will be tried more extensively next hot weather, and the result duly reported.

The zinc printing department of the office has been ably supervised by Sergeant Bruce Mackenzie, and both he and Sergeant James Watson, the other European zinc printer, have performed their duties to my satisfaction; the native printers have also made considerable progress.

15. **ZINC CORRECTING.**—There is still a vast amount of correction of the zinc plates necessary from defects in the originals, and the addition of detail after the first proof has been submitted for examination. This will probably diminish as the drawing of the originals improves, but at present it is a cause of serious delay and occasionally almost brings the printing work to a stand-still.

The zinc correctors have improved very much in the style of their work, there is still considerable room for improvement, but this will probably come with further practice.

16. **ANASTATIC PROCESS.**—Owing to the breaking down of the second copper-plate press in March last, we have been compelled to suspend all anastatic work, but one of our presses having lately been received from Cossipore after being thoroughly repaired and considerably strengthened we are now ready to recommence operations.

17. **SUPPLY OF PRINTING PAPER.**—Considerable difficulty has been experienced throughout the year, by the want of a good supply of suitable printing paper, and steps must be taken to secure our being supplied with paper of a suitable size and quality.

18. **QUALITY OF THE FINISHED WORK.**—The quality of the printed maps struck off here, has greatly improved, and is, I think, quite equal to that of those turned out in other places, especially if the relative out-turn be taken into consideration. This may be mainly attributed to the great improvement in the style of original drawings sent to us for reproduction by photozincography, as well as to the increased facilities for work afforded by the ample accommodation we enjoy at present, and partly to improvements in the processes in use. The introduction of engraved copper-plate headings and imprints for the standard maps of the Revenue and Topographical Surveys, has effected a great improvement in the appearance of the maps, and they look very much neater than formerly.

19. **EXPERIMENTAL WORK.**—The work entailed by the removal of the office and its re-organisation, has left me but little leisure for carrying out several experiments I have wished to make, but a few trials I have made in printing in pigments and in photo-engraving, with partial success, lead me to hope, that next year I may be able to report that these processes have been turned to useful account.

20. EXPENSE OF WORKING.—The total expense of working the office during the year, has been Rs. 42,163-11-4, and the value of the work executed Rs. 47,438-14-0, showing a profit of Rs. 5,275-2-8, as shown in the annexed statement. Our expenses have been considerably heavier this year, owing to the increased expenditure on account of house-rent and the cost of buying furniture, negative racks, fitting up the glass-house, &c., which were somewhat heavy in consequence of a large amount of furniture and apparatus being required, which would have been bought before had there been any room for them. Next year, our expenditure on this account will be very much less, as I hope to complete all my arrangements during the present financial year.

21. CONCLUDING REMARKS.—In quantity and quality I think the work of this year will compare favorably with that of last year, especially when the interruptions caused by the removal of the office and its re-organisation, and the difficulties under which we laboured during the greater part of the year, from want of suitable glass-house accommodation, are taken into consideration. I have closely supervised every part of the work, and my aim has been to increase the efficiency of the office in every way, so that, the work may be of the best possible quality compatible with its practical utility and production in the most economical manner. My arrangements are now almost complete, and I feel confident that our work next year will far surpass in every respect anything we have hitherto achieved.

I have the honor to be,

SIR,

Your most obedient Servant,

J. WATERHOUSE, *Lieutenant,*

Assistant Surveyor General, in charge Photographic Branch,

Surveyor General's Office.

STATEMENT showing Cost of working the Photozincographic Branch of the Surveyor General's Office from 1st December 1868 to 30th November 1869.

| Ds. | No. of complete Copies. | Rs. | | | Cs. | Rs. | | |
|-------------------------------|-------------------------|--------|----|----|--|--------|----|----|
| | | Bs. | A. | P. | | Bs. | A. | P. |
| Topographical Maps ... | 14,033 | 14,033 | 0 | 0 | Sanctioned Establishments and House-rent } (from 10th May 1869) ... } | 18,400 | 12 | 2 |
| Revenue Maps ... | 8,437 | 7,583 | 10 | 0 | Superintendent's salary from 1st December } 1868 to 30th November 1869 ... } | 6,100 | 0 | 0 |
| City and Cantonment Plans ... | 5,790 | 10,370 | 8 | 0 | Contingencies, exclusive of Chemicals re- } ceived from Medical Store Department, } and Presses from England ... } | 11,098 | 6 | 11 |
| District Maps ... | 630 | 3,001 | 4 | 0 | Cost of Paper estimated at ... | 4,559 | 15 | 3 |
| General ,, ... | 1,920 | 2,347 | 8 | 0 | | | | |
| Miscellaneous Maps, &c. ... | 11,230 | 5,615 | 0 | 0 | | | | |
| Anastatised ,, ... | 770 | 605 | 0 | 0 | | | | |
| Zincographed ,, ... | 560 | 210 | 0 | 0 | | | | |
| Silver Prints ... | 3,773 | 3,773 | 0 | 0 | | | | |
| | | | | | TOTAL ... | 42,163 | 11 | 4 |
| | | | | | Balance in favor of Department ... | 5,275 | 2 | 8 |
| | | | | | | | | |
| | | | | | | | | |
| TOTAL ... | ..... | 47,438 | 14 | 0 | TOTAL ... | 47,438 | 14 | 0 |

J. WATERHOUSE, *Lieutenant.*

In charge, Photo. Branch,

Surveyor General's Office.

ABSTRACT.

| MAPS PHOTOGRAPHED. | No. of Sections or Sheets. | No. of Negative Plates. | PRINTS | | Transferred to Zinc or Stone. | No. of Pulls. | No. of complete Copies. | REMARKS. |
|---|----------------------------|-------------------------|---------|---------|-------------------------------|---------------|-------------------------|-------------------------------------|
| | | | Silver. | Carbon. | | | | |
| Topographical Survey Maps ... | 109 | 411 | 719 | 661 | 66 | 13,873 | 14,033 | |
| Revenue Maps ... | 61 | 477 | 438 | 505 | 67 | 8,707 | 8,477* | * 40 zincographed. |
| City and Cantonment Plans ... | 139 | 365 | 428 | 501 | 62 | 13,604 | 5,790 | |
| District Maps ... | 30 | 181 | 255 | 129 | 31 | 4,640 | 1,400† | † 770 anastatised. |
| General ,, ... | 21 | 161 | 651 | 106 | 34 | 3,130 | 1,920 | |
| Miscellaneous maps, plans, sub- } jects, &c. ... } | 133 | 189 | 1,282 | 261 | 44‡ | 6,293 | 11,769§ | ‡ 5 on Stone § 620 zincographed. |
| Difference between Transfers and } number of Zinc Plates ... } | ..... | ..... | ..... | ..... | 133 | ..... | ..... |  |
| Proofs ... | ..... | ..... | ..... | ..... | ..... | 722 | 722 | |
| GRAND TOTAL ... | 578 | 1,784 | 3,773 | 2,273 | 467 | 51,059 | 44,092 | |

J. WATERHOUSE, *Lieutenant,*

In charge, Photo. Branch,

Surveyor General's Office.

APPENDIX D.

STATEMENT of Work performed in the ENGRAVING BRANCH, Surveyor General's Office, during the Year 1869.

| Titles of Maps or Plates, &c. | Scale. | | PROGRESS AND REMARKS. |
|---|------------------------|---|--|
| | Miles. | Inch. | |
| <i>On Copper.</i> | | | |
| Indian Atlas Sheet, 125 S. W. ($\frac{1}{4}$ plate) ... | 4 = 1 | | Border and margin figures completed. Outline and writing completed. Hill Etching in progress; will soon be ready for issue. |
| Ditto ditto, 125 S. E. ditto ... | | | Border and margin figures completed. Outline completed. Writing in progress. |
| Ditto ditto, 51 S. W. ditto ... | | | Border and margin figures completed. Outline in progress. |
| Ditto ditto, 87 N. E. ditto ... | | | Border, margin figures, and outline completed. Writing in progress. |
| Ditto ditto, 87 S. E. ditto ... | | | Ditto ditto. |
| Ditto ditto ($\frac{1}{4}$ plates) Sheets 125 N. W., 125 N. E., 124 S. W., 124 S. E., 124 N. E., 124 N. W., and 51 S. E. | | | Borders and marginal figures completed. |
| Ditto ditto ($\frac{1}{4}$ plates) Sheets 87 S. W. and 87 N. W. | | | Borders and Graticule lines completed. |
| Ditto ditto ($\frac{1}{4}$ plates) Sheets, 131 N. E., 131 N. W., 131 S. E., and 131 S. W. | | | Borders completed. Marginal figures in progress. |
| Ditto ditto (old plates double Elephant size) Sheets 61 and 88. | | | The portions of Oudh engraved on these sheets in England, from old and obsolete surveys, routes, &c., has been entirely erased. Dry prints have been taken from the plates, and fresh compilations from the Revenue Survey in Oudh are in progress, for insertion on the blank portions. |
| Map of the Countries, showing the sources of the Irrawadi River and the Eastern branches of the Bramapootra River, by Lieutenant R. Wilcox, 1828. | | | 16 = 1 | Old engraved Map. Two double Elephant size plates. Cleaned. Outline and writing touched up and impressions taken. |
| INDIA.—(No. 1, Small Map) | 256 = 1 | Completed. Printing for issue. | |
| INDIA.—(No. 2, Hand Map) | 128 = 1 | Without Hills. Completed ditto. | |
| INDIA.—Index to the Sheets of the Indian Atlas and the operations of the Great Trigonometrical Survey. | 96 = 1 | Old plate. Numerous corrections and additions have been made to the Geographical information on this plate, and also to the Series of the Great Triangulation of India, to represent results up to 1869. In progress. | |
| Specimen of vertical hill shading for the use of the Department and for training Native apprentices to Hill Etching. | 1 = 1 | Completed. | |
| Plan of the City of Calcutta, by Simms. | Feet. Inch. 380 = 1 | Four large plates. Cleaned, revisions and additions up to date; in progress. | |
| Headings, foot-notes for Maps, &c. ... .. | ..... | Twenty-two completed. | |
| Office Seals for Letters and Maps ... .. | ..... | Two ditto. | |
| Several Plates of Roulette tinting ... .. | ..... | For tints and shades on Lithographed Maps, &c. | |
| Various small Drawings and Specimens of Writing. | | For the use of Native apprentices under training. | |