GENERAL REPORT

ON THE

Topographical Surveys of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT,

FOR SEASON

1873-74.

BY

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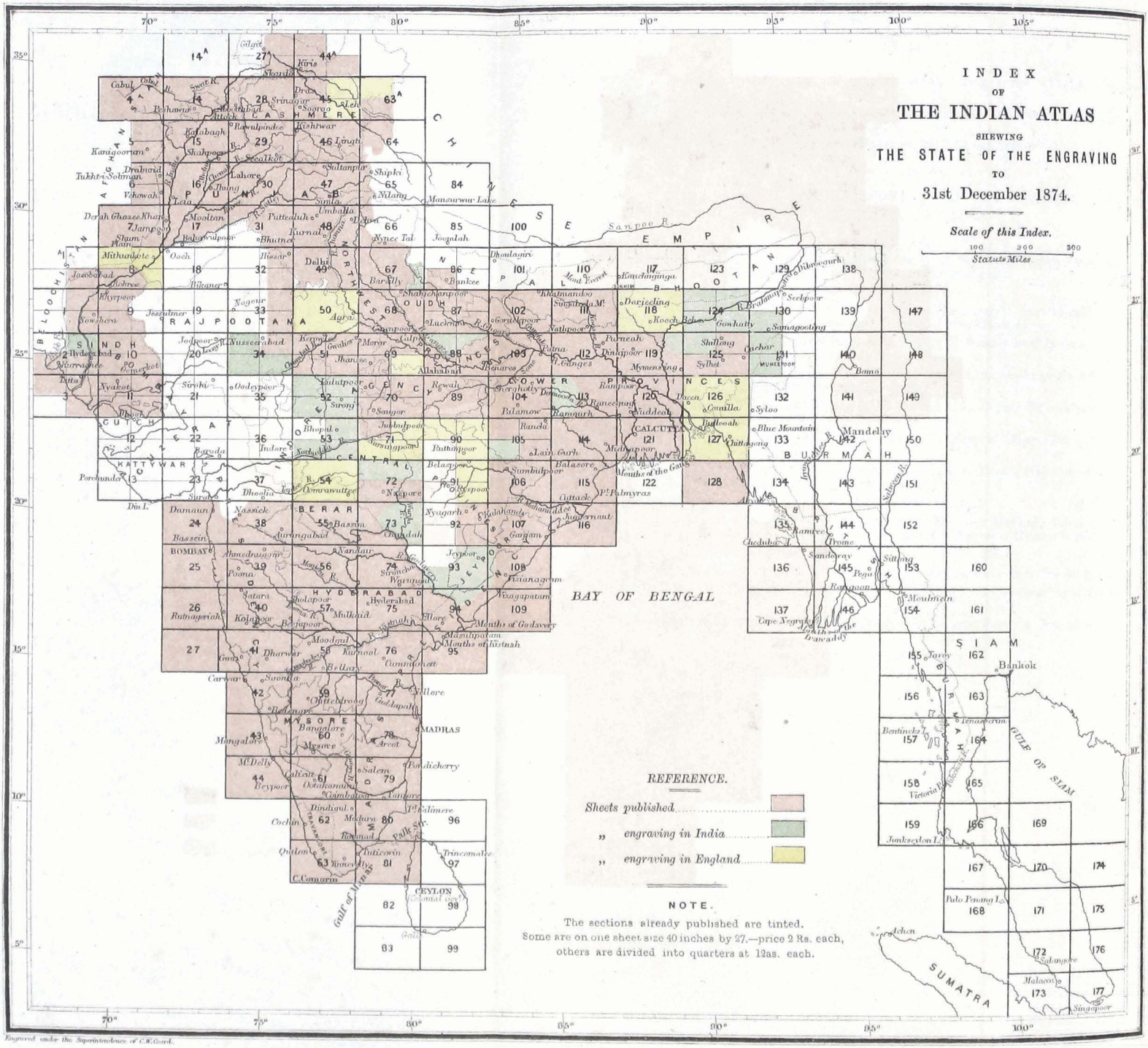

GENERAL REPORT

ON THE OPERATIONS OF THE

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FOR SEASON

1873-74.

Dated Calcutta, 15th January 1875.

General remarks.

In continuation of the Report for the season 1872-73, dated 20th January 1874, the following review is submitted of the operations of the Topographical Surveys of India for the professional season of 1873-74, and of the work performed in the various branches of the Head Quarters Office during the year ending 31st December 1874.

Parties employed—

5 in Native States.
2 British Non-Regulation Districts.

2. The field of employment of the seven Topographical parties, as described in several previous Reports, and as detailed in Statement A (*vide* Appendix,) remained the same, and the operations were advanced in compact blocks without leaving any gaps, in continuation of the work completed during the previous season. Full details connected with the progress of each party are given under the head "Executive Establishments," and the several index maps attached to this report very clearly illustrate the area accomplished up to date in the ground allotted to each, as well as what remains to be taken up.

Results and cost of the season's operations—

* On 1 inch	= 1 mile	... 14,902
" 4 inch and 1 inch	= 1 mile	... 9,201†
Square mile		... 24,103

* Military reconnoissance and exploration in the Naga Hills and Manipur Native State.

3. The aggregate results of the season's survey by this branch of the Department amount to 24,103* square miles of final Topography chiefly on the one inch scale, and 19,623 square miles of Triangulation in advance, which cost Rs. 4,25,041, yielding an average rate of Rs. 17-10-0 per square mile, inclusive of the cost of the large scale surveys of several military and civil stations, native cities, the survey of Simla and Jutog, and of the season's triangulation. In Statement *A* in the Appendix the relative out-turn both of topography and triangulation, and the cost of each party, are shewn, and in Statement *B* the professional results of triangulation and the average number of plane-table fixings per square mile, in each party, are given.

Comparison of the results and cost of seasons, 1872-73 and 1873-74.

4. Compared with the results obtained during the previous season, the outturn is nearly the same, while the mileage rate is a trifle lower. There is an increase of 693 square miles in the area triangulated in advance of Topography, and a decrease of Rs. 24,855 in the total outlay cost of the season's operations, *viz.*, from 1st October 1873 to 30th September 1874.

5. The decrease in the area of final topography of 1,223 square miles is due to a slightly smaller outturn than last season in the area accomplished by No. 6 party, employed on the military reconnoissance and exploration of the Eastern Frontier, in the Naga Hills and the Manipur State, over ground which can only be visited for a very short period of the year under proper political protection and guidance, and in which even during the winter months the weather is most uncertain for observing.

6. The progress of these small scale military reconnoissances or explorations, depending on so many conditions, physical as well as political, the areas achieved one season with another, must of necessity vary, but the out-turn of both years has been large and most promising towards a complete delineation of the topography of this long unknown and intricate Frontier.

7. These general results are most satisfactory, and, considering the great difficulties of much of the ground both in the hills and plains in which the several parties are now operating, are highly creditable to the executive officers under whose direct management the season's field work was conducted, and to the efficient and zealous exertions of the European staff. As usual, a very full and large area has been returned by every party, and no disappointments have occurred anywhere, notwithstanding the variety of the nature of the operations, and of the peculiarity of the different widespread fields of employment.

8. In Statement *C* (Appendix) a comparison of the general results, total expenditure and average mileage rates for the seasons 1872-73 and 1873-74 is shewn.

Season's fair mapping.

9. The season's fair mapping is represented on 38 standard sheets (15′ of latitude by 30′ of longitude) of which 27 are on the full scale of 1 mile to the inch, and 11 on 2 miles to the inch: these embrace a total area of 21,383 square miles, nearly all of which has already been reproduced by photozincographic transfers.

10. A great portion of this has also been reduced and compiled in outline on the ¼ inch (4 miles=1 inch) scale in my Drawing Office at Head Quarters for the sheets of the Indian Atlas, now in the engraver's hands, and the remainder will very soon be ready in a similar form.

Nos. 20 N. E., 20 S. E., 34 N. W., 34* S. W, 35 S. E., 35 N. E., 36 S. E., 37 N. W, 52 S. E., 52 N. W., 52 S W., 53 S. W., 53 N. E., 53 S. E., 54 (old full plate) 71 N. E., 71 S. E., 90 N. W., 90* S. E., 90 S. W., 93 S. W., 94 (old full plate) 119 (old full plate) 124 S. E., 130 S. E, 130 S. W., 130 N. W., 131 N. W., and 131 S. W.

NOTE.—Those marked with an asterisk will be completed.

11. These geographical materials will enable us to fill portions of the Atlas Sheets marginally noted, filling up all blanks for complete editions of those marked with an asterisk.

Simla and Jutog 8 sheets—scale, 24 inches = 1 mile.
Ditto 1 sheet hills in brush shading, scale 8 inches = 1 mile.
Erinpura, 1 sheet, scale 12 inches = 1 mile.
Beawur or Nyanagar, 1 sheet, scale, 12 inches = 1 mile.
Mahesar city, 1 sheet, scale, 12 inches = 1 mile.
Airi forest reserve (district Mandla), 1 sheet, scale, 4 inches = 1 mile.
Chaoringoghur forest reserve (district Mandla) scale, 4 inches = 1 mile.

12. Large scale plans, in sheets, of the several civil and military stations and forts and cities in the Native States, as per margin, have been rendered by executives, all of which, with the exception of the general reduced plan of Simla and Jutog, which must be treated by lithography, have been reproduced by photozincographic transfers, and are available for issue

Combined results of Topographical and Revenue Surveys for the season.

13. By the Imperial Topographical and Revenue surveys under my control, a total area of 44,004 square miles, at a total cost of Rs. 14,38,371, has been completed during the season. By Revenue Survey, on the scale of 4 inches=1 mile, 4,708 villages have been completed, together with 804 blocks, without the definition of village boundaries, on a scale of 2 inches=1 mile. In the Upper Circle of superintendence under Colonel J. E. Gastrell, the Cadastral survey in the North-West Provinces (scale, 16 inches=1 mile) of 1,763 villages, embracing 1,501,398 fields, have been executed at a cost per acre of 3 annas 6 pie, or 8 pie less per acre than during the previous season. The grand area accomplished by the Revenue Survey will now be reduced annually by the number of parties employed in the cadastral or large scale measurements of fields, which, of course, render progress much slower, and diminishes the amount of the ordinary 4-inch survey for Topographical purposes.

	Area.	Cost	Average rate.
	Sq. miles.	Rs.	Rs. As.
Topographical surveys ...	24,103	4,25,041	17 10 per sq. mile.
Revenue surveys ...	17,371	6,63,128	38 3 ditto.
Total ...	41,474	10,88,169	26 4 per sq. mile.
Cadastral surveys, scale 16 inches=1 mile	2,530	3,50,202	3 6 per acre.
Total ...	44,004	14,38,371	

14. All details connected with the execution, progress and cost of the Revenue Surveys will be found in the Administration Report of that branch of the Department, which is separately submitted by the joint Superintendents.

15. In para. 16 of the last report, the aggregate results of the modern Topographical and Revenue Surveys up to 1873 were given. This information, completed up to date, is as follows :—

Aggregate results brought up to date.

	Area in sq. miles.	Cost, Rs.
Total up to 1873	743,802	2,00,28,330
Add for 1874	44,004	14,38,371
Total up to 1874 ...	787,806	2,14,66,701

16. This enormous area of nearly 800,000 square miles represents what has been accomplished by only two branches of the department, in about the past thirty years, almost wholly under the superintendence of the same officer. The entire results have been published in various forms and on different scales.

17. In 1857 the first great effort was made to render the officers of Government more generally conversant and familiar with the country, by the publication and issue of general maps on moderate scales through the agency of lithography only; the demand for these was excessive for the use of troops marching in pursuit of rebels, and by Civil Officers for local administrative purposes. Ere long larger scale maps were demanded both for military and civil objects, local improvements, railways, canals, new roads, &c., and fortunately the new system of photozincography came to our help and enabled us, after some difficulties and disappointments were overcome, to reap great benefits, which could not otherwise have been met, and up to the present time the requirements of the public service continue ever increasing, taxing the resources of the field establishments for new surveys and of the Head-Quarters compiling and publishing offices to the very utmost.

18. In the appendix, the progress in detail, during the past year, made in the Drawing, Geographical, Compiling and Engraving branches is given in a Tabular Statement by Mr. J. O. N. James, Assistant Surveyor General, the indefatigable officer in charge. It is impossible to convey any adequate idea of the nature and extent of the work performed, or of the real progress made in the compilation, drawing and copying of Maps, Plans and Charts on various scales, without entering into very minute details, more especially when it is necessary to utilise the latest survey results for the correction of old materials, and to keep abreast of the yearly progress of surveys: this remark applies equally to the engraving of maps of such a country as India. All that can be done is to state what sheets of different provinces or smaller territorial sub-divisions have been dealt with, or which may be in various stages of progress, and this briefly is as follows as regards the more important compilations and maps.

Cartography.

19. The work of completing all the old sheets of the Indian Atlas and such as were left partly blank on the transfer of the engraving from England to India, by incorporating the results of the latest surveys, as well as the preparation of drawings for new sheets from materials annually furnished by the Topographical and Revenue Surveys in progress, continues to receive earnest attention, and I have much satisfaction in stating that the greater portion of the results of the past season's Topographical surveys have been rendered and compiled in outline for the Atlas Sheets, and are in the engraver's hands. The sheets of the Indian Atlas marginally noted have all had considerable additions made to them to bring them up to date.

Sheets of the Indian Atlas.

34 N. W. and S. W.; 49 old full size plate; 52 N. W. N. E. S. W., and S. E.; 53 N. E.; 67 old full size plate; 72 N. W.; 93 N. E. and S. W.; 105 S. W.; 106 old full size plate; 107 and 108 old full size plate; 113, 115, 116, 119 old full size plates; 124 N. E. S. E. and S. W.; 125 N. E. S. and N. W.; 130 S. W.; 131 N. W. and S. W.

20. For the plates still engraving in England additions have been made to the following :—

50 old full size plate; 71 N. W. and S. W.; 89 old full size plate; 90 N. W.; 104 and 118 old full size; 126 four quarters; 127 four quarters; proofs examined and corrected 8 S. E. 69 S. E.; 70 N. E.; 92 S. E.; 105 N. W.; 128 N. E.

All the above have been returned to the Geographical Department at the India Office. Additions to date are being inserted on sheets 90 S. E. and N. E. and 91 N. E. and S. E.: these as soon as ready will also be forwarded to the India Office for completion of the engraving.

21. A compilation of the province of Assam comprising the new Chief Commissionership, scale 8 miles=1 inch, as a sister map to that of Bengal on the same scale, has been started. This map has long been a great desideratum, but in consequence of the obstacles and delays in the progress of the trigonometrical operations up the valley of the Brahmaputra river, not yet completed, no geodesical co-ordinates were available for the compilation of the results of the Revenue Surveys long since executed in the eastern and northern districts of this province.

Geographical and miscellaneous maps and compilations.

22. A new map of Bhutan (scale 8 miles=1 inch) has been completed and lithographed. District Darjeeling (scale 4 miles=1 inch) completed and lithographed. Districts Chindwara and Hazara (the latter in English and Persian in outline only) completed and published. The Garo Hills district, Assam (scale 2 miles=1 inch), compiled and published. Compilations in

outline of the districts of Nowgong, Sibsagar, and Lakhimpur in Assam and of Baitul and Raepur in the Central Provinces (scale 4 miles=1 inch) are in progress.

23. Skeleton maps of the Divisions or Commissionerships (scale 8 miles=1 inch) of Patna, Dacca and Cooch Behar, and of the several districts marginally noted (scale 4 miles = 1 inch), were prepared and published to meet the urgent demands of the Government of Bengal and of local officers to illustrate the famine relief operations.

Lower Provinces of Bengal.
1. Lohardugga.
Shahabad.
Monghyr.
Bhagulpur.
5. Purneah.
Midnapur.
Burdwan.
Jalpiguri.
Southal Parganas.
10. Chumparun.
Sarun.
Tirhoot.
Bankura.
Singbhum.
15. Rajshahi.
Gaya.
17. Cooch Behar.

24. The map of Sindh (scale 16 miles=1 inch) has been completed and is now engraving. Various additions have been made to the standard map of India, scale 32 miles=1 inch, and it is expected that some of the sheets will soon be ready for Photozincographic reproduction (in outline only) as a preliminary issue; considerable additions from survey have also been made to the map of India, scale 64 miles=1 inch, and the engraving in outline is well advanced.

25. Of the maps of the earlier Topographical surveys referred to in paragraph 28 of my last report, 10 of the Chota Nagpur Division Survey and 10 of the Old Ganjam and Orissa Survey have been fair drawn and 20 are in progress in various stages, with a view to reproduction by the photozincographic process, and so to bring out the whole series of the entire Topographical surveys from the commencement.

26. A very large amount of miscellaneous drawing and copying, examination and correction of proofs, &c., as usual, has been accomplished in addition to the above, whilst the coloring of printed maps forms a very serious business of itself, not only for the regular issues of the current survey maps, but for report and book publishing, the demands for which from all the local Governments continue unabated. The very large amount of work thus performed, and the severe pressure thus put on the office the moment any map is printed, entails considerable expenditure in the contingent bills for the coloring, which is of necessity chiefly done by extra job work.

27. Very good progress has been made during the year in the engraving of Atlas Sheets, and especially of other maps of a more general character.

Engraving.

28. Of the Atlas Sheets published during the year,* 2 S. E., 9 N. W., and 72 S. E., are complete up to margin, the remaining four have blanks awaiting further materials from surveys in progress.

* 2 S. E. Sindh, finished in August.
9 N. W. „ „ „ April.
9 N. E. „ „ „ October.
53 S. W. Central Provinces finished in Dec.
72 S. E. ditto ditto.
124 S. W. Assam, finished in July
131 N. W. ditto in October.
7 Plates.

29. Various additions and corrections, &c., have been made on 34 new and old plates as detailed in the appendix, such as the insertion of new roads, canals, railway lines, recutting of names on much worn plates, repairing of worn out hill work, filling in of small blanks, &c., and 33 plates in various stages of progress are in the engravers' hands, several of which are new quarter plates, some fast approaching completion, others completed in outline, and some just commenced. It is expected that a large proportion of these will be completed and published during the current year (1875).

30. The present state of the engraving of the sheets of the Atlas of India is shown in the Index Map attached to this report, and by a comparison with the Index Map given with the report for 1870-71, the great progress made in publishing the sheets, since the engraving has been carried on in this country, will be apparent.

31. For the *Imperial Gazetteer* the following small scale maps have been engraved: Bengal, Behar, Orissa and the province of Assam, scale 32 miles=1 inch. The Presidency Division, Burdwan Division and Eastern Districts of the Dacca Division (3 maps), scale 16 miles=1 inch. A map of Oudh for the Local Gazetteer, scale 16 miles=1 inch, has been completed. Sindh on the same scale has just been commenced for the same purpose. After much labor and many heavy corrections and revisions, the four plates of Simm's plan of the town of Calcutta are now approaching completion, and a new edition will be shortly issued.

Engraving of Gazetteer and miscellaneous maps.

32. The new map of India scale 64 miles=1 inch, in four sections, which forms such a desideratum, has been well advanced in outline and names, and every effort is being made to publish as soon as possible, a preliminary edition, on which the portions of country which have not yet come under survey and cannot therefore be inserted on the copper, will be filled in from the best available sources, and printed from the stone.

33. The progress report of the Engraving Branch given in the appendix, enters into full detail as to all the miscellaneous work performed, which is very considerable.

34. During the year 1874 the following engraved copper plates were received from the Geographical Department of the India Office : 1 S. E. ; 51 N. W. ; 70 N. W. ; and 105 S. E.

Copper-plate printing.

35. The amount of copper-plate printing accomplished is as follows :—

Transfers	662
Proofs	1,206
Impressions or copies ...	10,529
TOTAL ...	12,397

Several excellent district maps on the ¼ inch scale have been obtained by transfers to stone taken from the plates of the atlas and rubbing off the parts not affecting the district, thus saving the cost and labor of re-drawing for lithography ; and this system will be continued in future for all districts where the plates are available.

36. The great advantages resulting from the engraving of the sheets of the Indian Atlas in India, and possessing the plates here, are now becoming more and more apparent. The results of surveys in progress are annually added on to a large number of plates, and ere long a very considerable portion of these will be ready for issue in a complete form, filled up to margins. All plates for which complete survey results are available are at once finished and published. Blanks in various plates of old date are filled without delay from new surveys in progress. New lines of road, canals, and railways, are added on from time to time, and worn plates are renewed by means of native agency. Various additions and corrections, consequent on local changes and improvements, are likewise effected.

37. Mr. C. W. Coard as superintendent, and the European staff of engravers, continue to give me every satisfaction.

38. The native engravers and apprentices, 30 in number, shew steady improvement, and some very creditable work has been turned out by the best of them. The utmost exertions continue to be made in training the native agency and bringing them on to take part in the real work of the Department.

Photographic Branch.

39. During the past year, Captain J. Waterhouse, Assistant Surveyor General in charge, reports (*see Appendix*) that 1,280 original maps, charts and plans have been dealt with in this branch of the office: 812 transfers have been made to zinc: 1,53,242 complete copies of maps, &c., have been printed, besides 1,324 silver prints and 1,495 photo-collotypes.

40. No less than 27,800 copies of outline maps of districts and divisions in Western and Northern Bengal were printed to meet the demands of the local administration for the purpose of aiding the famine relief operations.

41. The following abstract shews the nature and amount of the work completed, compared with that of the year 1873 :—

Maps or subjects.	Number of sheets or sections.	Number of zinc printings.	Number of complete copies.	Remarks.
Topographical survey maps ...	140	21,565	21,760	In addition, the following work was performed :—
Revenue survey maps	689	46,676	39,908	Collotypes 1,495
District maps	25	14,810	10,470	Silver prints 1,324
General maps	23	8,930	5,874	Transfer prints ... 1,926
City and cantonment plans ...	69	14,418	5,040	Zincographic and anastatic
Miscellaneous maps, &c. ...	334	50,070	70,190	transfers 812
Proofs	...	1,131	...	Proofs 1,131
Totals for 1874 ...	1,280	1,57,600	1,53,242	
„ for 1873 ...	1,611	1,11,876	1,05,753	
Difference ...	—331	+45,724	+47,489	

42. The increase of work in printing alone is very great, nearly 32 per cent. above that of 1873; and to accomplish this immense out-turn of 1,53,242 complete copies of maps and other subjects by zinc printing alone, the strain on the small existing establishment has been very great throughout the year.

43. Complete details under each head connected with the several processes of photo-transfers, collotypes, silver-prints, &c., are given in the report of the Photographic branch in the Appendix.

Photo-collotypes.

44. The photo-collotype process has not yet been found to work sufficiently successfully for the reproduction of maps, owing chiefly to climatic influences, which necessitate various modifications in preparing and working the gelatine films during different seasons of the year. Experiments are still being made to endeavour to utilise this beautiful process for many other purposes, but for the printing of large maps requiring many sections to be joined together, it cannot be said to be adapted, or likely to answer.

45. A series of excellent plates have been produced from casts made from the caves of Cuttack, to illustrate Baboo Rajendralal Mitra's work on "The Antiquities of Orissa" ordered to be printed in this office by the Bengal Government, which bear ample proof to the value of the photo-collotype process for illustrations and delicate subjects of various kinds in which half tones or a variety of shades are desired or necessary.

Transit of Venus.

46. Captain Waterhouse's services were temporarily placed at the disposal of Colonel J. F. Tennant for the Transit of Venus observations at Roorki in November and December last, where he was most successful in securing a fine series of plates of the transit: 107 photographs on 6-inch plates were taken at intervals of 2 minutes during the progress of the transit, besides 5 circular plates of the three last contacts and two intersections taken in the Janssen apparatus, each circular plate comprising 60 separate pictures taken at intervals of about 1·21 minutes. A summary of the results of these experiments, and a full account of the operations at Roorki, are given in the memorandum attached to Captain Waterhouse's report in the Appendix. Similar photographs were taken at this office and 39 plates have been obtained of the Transit of Venus, in connection with a series of observations, with moderate size instruments, carefully reduced to Calcutta mean time.

Lithographic Branch.

47. The work required of this branch of the office, which has likewise been under the immediate superintendence of Captain Waterhouse, Assistant Surveyor-General, is shewn to be largely on the increase. The out-turn of work of different kinds performed during the year 1874, compared with that of the previous year, is as follows:—

	1873.	1874.	Increase.
New drawings on transfer paper	274	271	...
Ditto on stone	25	37	...
Color stones prepared	139	142	...
Subjects printed	481	602	121
Complete copies	1,59,652	2,14,153	54,501
Pulls	2,38,712	2,77,501	38,789
Sheets of Forms, &c., (type)	594	2,100	...
Complete copies	2,75,334	1,95,876	...
Pulls	3,80,693	3,28,583	...

Of the 2,14,153 complete copies of maps, plans, &c., printed during the year, 46,584 were the regular publications of this Department, the balance (1,67,569) were for various other Government Departments: 602 new subjects were dealt with, of which 220 were Departmental and 382 for other branches of the public service.

48. Chromo or color printing for tints, territorial boundaries, geological and forest conservancy, sanitary and vaccination report maps, &c., has been very successfully worked, and has proved an invaluable substitute, as far as it has gone, for the very tedious, expensive, and unsatisfactory process of coloring by hand; but, of course, a very large amount of coloring has still to be done by the latter method, owing to the vast rapidity of photozinco-printing.

49. The combined out-turn of the three different descriptions of printing presses is as per margin, which gives an increase of nearly 1,00,000 over that of the previous year.

	Number of complete maps.
Photo-zincographic	1,53,242
Lithographic	2,14,153
Copperplate	10,529
Total ...	3,77,924
Do. for 1873 ...	2,81,036
Increase ...	96,888

50. Experiments are now making to introduce the use of grained transfer paper for shaded chalk drawings applicable for rapid hill sketching, for miscellaneous maps, in the place of vertical hachuring or horizontal contouring, which is so tedious and frequently so unsatisfactory except done by a first-rate draftsman. Mr. Fraser Crawford's method of drawing lithographic transfers over photographic prints made with gelatine and bichromate of potash has been largely and successfully practised. By this process very accurate

copies or reductions of drawings or maps, charts and plans, which are unsuited for photozincography, can be obtained.

51. Details connected with all the work accomplished in the lithographic branch are given in Captain Waterhouse's report in the Appendix.

Office accommodation.

52. The arrangements in progress during the past year for the preparation of a suitable design for a new building to accommodate and combine the several detached branches of the Head Quarters offices, on the land purchased in Park and Wood Streets have not as yet resulted in any definite or finally approved plan and estimate, but the subject is now well in hand, and it is hoped that the Public Works Department will be in a position to break ground during the current year, and that the object may then be vigorously prosecuted to completion, as every day and month adds to the great difficulties and inconveniences at present existing for want of room, with heavy stock of records increasing in the ratio above described, and for which temporary provision has now been ordered to be carried out.

Re-organisation of the Department.

Revenue, Agriculture and Commerce Department, No. 812, dated 13th December 1873.
Financial Resolution No. 3235, dated 27th November 1873.

53. During the past year, a new system of consolidated salaries for the entire Department, and a re-organisation of the several grades of the Senior Branches, has been carried out with effect from the 1st April 1874, the commencement of the Financial year, under the orders of Government specified in the margin.

Consolidated Salaries.

54. The revised strength and salaries of the administrative staff and graded officers is contained in the following statement, issued with departmental order No. $\frac{331}{123}$, dated 5th May 1874 :—

	Trigonometrical.	Topographical.	Revenue.	Total Number.	Sanctioned maximum salary of each.
ADMINISTRATIVE.					
					Rs.
Surveyor General	.....	1	.....	.....	3,000
1st Superintendent, Great Trigonometrical Survey	1	.....	.....	.....	2,500
2nd Superintendent of Survey and Deputy Surveyor General	.....	... ...	1	—...	2,200
3rd Superintendent of Survey and Deputy Surveyor General	.....	... ...	1	.....	2,000
Three Assistants Surveyor General (average Rs. 1,233)	.....	.....	.....	.....	3,700
EXECUTIVE.					
Deputy Superintendents, 1st Grade ...	2	1	3	6	1,600
Do. do. 2nd do. ...	4	2	5	11	1,300
Do. do. 3rd do. ...	6	3	6	15	1,000
Assistant Superintendents, 1st Grade ...	4	3	5	12	750
Do. do. 2nd do. ...	4	2	6	12	600
Do. do. 3rd do. ...	4	3*	4*	11	500
TOTAL ...	24	14*	29*	67	.....

Combined Departmental graded list.

55. The general lists of the Topographical and Revenue branches have been combined into one roster or cadre as regards the Assistant Superintendents for future amalgamation. The object of introducing consolidated salaries has been to assimilate civil with military incumbents, when holding like appointments, in accordance with the principle prevailing in the Public Works Department, and also in some measure to avoid the anomalies caused by military officers of higher rank holding junior positions. Engineer officers only receive military pay proper in addition to the salary of their grade.

Temporary absence of the Surveyor General.

56. The Surveyor General having been granted privilege leave for three months, to visit England on private affairs, was absent from the 9th May to the 5th August last, during which time Colonel J. T. Walker, R. E., Superintendent, Great Trigonometrical Survey, was appointed by Government to officiate as Surveyor General.

* Exclusive of two supernumeraries on probation for either branch.

57. With so large an establishment, and so many hands employed in the various branches of this Department, it would obviously be impossible to shew successful results every year, and those of a very extensive character, the real effect of which has yet to be realised and understood in comparision with what is derived in other countries with corresponding means, without really efficient and zealous aid and co-operation. I have always, therefore, felt a peculiar gratification in acknowledging and recording the good and zealous services of my surbordinates, more especially of the excellent executive officers and their staff, whose devotion to the cause of the great work on which we are all employed, and in which we all take so deep an interest, is worthy of all praise.

Services of officers.

58. The several officers named under the head of Executive Surveys, as well as the Assistants Surveyor General, Mr. James, Deputy Superintendent of Survey, and Captain Waterhouse, Assistant Superintendent, attached to the administrative staff at Head Quarters, I commend to the special notice of the Government of India, as continuing in the highest degree to merit the confidence I place in them for their zealous and valuable labors during the period under review.

59. During the past year the total issue of maps to all Public Departments on service and to agents for sale, were as follows :—

Issue and sale of maps.

	Copies.	*Value Rs.*
To Government officials *bonâ fide* on public service	29,774	37,425
„ Despatches to the Geographical Department, India Office, London ...	4,313	5,660
„ Agents for sale to the public and for local service issues	3,935	8,546
TOTAL ...	38,022	51,631

60. The sales effected by the several agents represent 3,198 copies of maps, the value of which, less commission, amounts to Rs. 4,084 annas 2 ; this sum, as soon as realised or paid by the agents, will be at once deposited in the Treasury as heretofore done. The sales of maps to private persons in India are so limited ; because everybody almost is in the Government service, and claim maps for official purposes free of charge.

61. All monies realised on Government account during the year 1874 (*vide* statement in Appendix) amounting to Rs. 5,324-13-4, have been lodged in the Treasury Branch, Bank of Bengal, and the receipts of the Bank have immediately been sent to the Comptroller General. No cash balances are retained by this Department.

Account sales.

62. A review in detail of the operations of each Executive establishment or Topographical Survey party follows.

EXECUTIVE ESTABLISHMENTS.

No. 1.—TOPOGRAPHICAL PARTY.

GWALIOR AND CENTRAL INDIA SURVEY.

63. In continuation of the work of the previous season, chiefly in Sindhia's territory, the operations of this party under the command of Captain Charles Strahan, R. E., with Lieutenant E. P. Leach, R. E., as Assistant Superintendent, as described in the programme given in paragraphs 68 and 69 of the Report for season 1872-73, were extended West of the meridian of 76° 30′ over portions of the Native States marginally named, in the vicinity of Jhalra Patan, East of the district of Neemuch, and between the parallels of 24° and 25°, the southern limit of this division survey.

Detached portions of Sindhia's territory (portions of the Oojein, Mundisore and Neemuch soubats or districts), Holkar's territory, portions of Tonk, Kotah, Jhalawar, Pertabgurh, Udeypore, Bhynsoragurh and Joura in the Central India and Rajputana Political Agencies.

64. The final topography completed covers an area of 2,783 square miles between latitudes 24° and 25° and longitudes 75° 30′ and 76° 30′, the greater portion of which has been rendered in standard sheets Nos. 57, 60, 61 and 71. The triangulation in advance of the detail survey has been extended over 4,080 square miles, embracing Neemuch, Mundesore, &c.

Strength of party and outturn.

	Triangulation square miles.	Final topography, square miles.
Captain Charles Strahan, R. E., Deputy Superintendent, 3rd grade, in charge.	4,080	
Mr. C. A. R. Scanlan, Assistant Surveyor, 1st grade ...		242
Lieutenant E. P. Leach, R. E., Assistant Superintendent, 3rd grade.		294
Mr. R. D. Farrell, Surveyor, 4th grade		363
„ W. J. Cornelius, Assistant Surveyor, 2nd grade		200
„ P. J. W. Doran, „ 2nd „		327
„ C. T. Templeton „ 3rd „		252
„ W. M. Kelly „ 4th „		143*
„ G. A. Knight „ 4th „		204
Sub-Surveyor Abdul Samud Khan		251
„ Joula Pershad		265
„ Abdul Gufar		242
„ Girdhari Lall		
Total square miles ...		2,783

* Also large scale plan of Jhalra Patan city.

Observations were taken at 83 stations, from which 508 points were fixed and 256 elevations determined trigonometrically, and well based on the series of the principal triangulation.

65. Captain Charles Strahan reports favorably of the results of the out-turn and of the test he applied to the work of the several plane-tablers, which I found during my inspection of the party to be the case. The season's fair mapping contrasts very favorably with that of former years, and meets my full approval.

66. These results are very satisfactory in every way, and are due to the good management of the party by Captain Charles Strahan, Deputy Superintendent in charge, and his energetic Assistant Superintendent, Lieutenant E. P. Leach, of whom the Deputy Superintendent reports in high terms of praise. Messrs. Farrell, Scanlan and Cornelius, Surveyor and Assistant Surveyors, worked well and rendered good aid both during the field and recess seasons.

Opinion on the season's out-turn.

67. The country surveyed in detail has already been described (*vide* paragraph 61 of the report for season 1872-73, and appendix therein referred to), and a full description of the ground triangulated during the season under review will be found in the Appendix of this report (Extracts from the Narrative Report by the officer in charge No. 1 party, and notes by Mr. C. R. Scanlan).

68. During the current season of 1874-75, the plan of operations laid down for the guidance of the party may be briefly described as the extension of the detail work or plane-tabling in a westerly direction from longitude 75° 15′, between the parallels of 24° and 25°, and the continuation of the triangulation in the same direction so as to cover the ground in Meywar, Pertabgurh, &c., in the western half of the square degree formed by the parallels of 24°—25° and meridians 74°—75°.

Programme for season 1874-75.

69. During the month of September, on return from three months' privilege leave, I inspected the party and had much satisfaction in observing the state of efficiency of every member composing it. The professional records and fair mapping were all well and creditably completed up to date, leaving no arrears of any kind. Various professional matters regarding the future working of the party, and ground to be gone over, were fully discussed and arranged with the executive officer. I have particular pleasure in noticing the absence of all complaints against the party in their intercourse with the people in these Native States.

Inspection of party.

70. In consequence of an experienced Assistant Superintendent being needed with No. 7 Rajputana Survey, owing to Captain George Strahan's temporary absence on duty connected with observations of the transit of Venus, and the transfer of Captain J. R. Wilmer, Assistant Superintendent, from No. 7 party to take the charge of No. 5 Bhopal and Malwa Survey, as approved by Government in letter marginally cited, Lieutenant E. P. Leach, R. E., was transferred from No. 1 to No. 7 Rajputana Survey, from the 28th October 1874, and his place was filled up by Lieutenant J. R. Hobday, appointed to the Survey Department as a Probationary Assistant Superintendent by the orders of Government marginally noted, and he joined on the 10th October 1874. No. 1 party has always proved an excellent training school, and has turned out some of the best men in the department. It continues to maintain its high reputation and co-operates very fully in the difficult task of training fresh hands, which is a severe tax on any Field Establishment.

Transfer of Assistant Superintendent.

Revenue, Agriculture and Commerce Department No. 673, dated 14th November 1874.

Revenue, Agriculture and Commerce Department No. 538, dated 11th September 1874.

71. The progress of the publication of the 1-inch Standard sheets of this Survey is shown on the annexed index map, which describes likewise the proposed limits of the operations in connection with the other Survey Parties working in its vicinity. The extent to which the survey may be carried eventually westwards in the Myhekanta and Palhanpoor country is at present uncertain, and is therefore not defined on the index map.

No. 2.—TOPOGRAPHICAL PARTY.

KHANDESH AND BOMBAY NATIVE STATES SURVEY.

72. Owing to the general weakness of the party which had only been resuscitated a short time, and the failure of health of the senior Surveyor (Mr. R. Chew) early in January, the complete execution of the programme for the season, as detailed in paragraph 81 of the last report, was not practicable, so far as the triangulation in advance of final survey was concerned; but the detail operations were fully and successfully carried out, and the topography of 2,285 square miles (inclusive of overlaps with other surveys) was obtained. Of triangulation, an area of only 1,000 square miles was completed on the Vindhia hills, by observations at 18 stations, from which 73 positions were determined: and the elevations of 68 points were trigonometrically obtained; also heights of 231 obligatory points, such as watersheds, passes, river beds, temples, masonry buildings, &c. The season's operations extended through portions of the States above marginally named within the Central India Agency.

Portions of Foreign (Holkar's) Nimar and Malwa (Sindhia's territory,) also of Barwani, Dhar, Dewas, the Bhomias or Bheel Chiefships of Jamnia, Hindola and Rajghar, and the British Pergunnah of Manpur, North and South of the Nerbudda river.

Strength of party and outturn of work.

F. B. Girdlestone, Esq., Deputy Superintendent, 3rd grade, in charge.	Triangulation 1,000 square miles and triangulation of ground for the plan of Mahesar city and environs.	
Mr. R. W. Chew, Surveyor 3rd grade, privilege leave for three months		
		Final topography square miles.
Mr. A. G. Wyatt, Surveyor, 4th grade	...	315
„ W. C. Barckley., Assistant Surveyor, 3rd grade ...	...	300
„ E. Graham „ 4th „ ...	...	289
Sub-Surveyor Shaik Omer	...	310
„ Mr. Rozario	...	169
„ „ Holtham	...	122
„ Churamun Lall	...	301
„ Gunesh Waman	...	168
„ Keshun Waman	...	191
„ Abdul Rahim	...	58
„ Hyder Ali	...	61
Total square miles	...	2,284

In addition to the above, the large scale (12 inches=1mile) survey of the city, fort and environs of Mahesar was completed, covering an area of 9 square miles, besides 328 miles of check traversing was run with the chain through certain parts of the season's topography.

73. A survey of the large and important city of Mahesar (Maheshwar) on the Nerbudda, the summer residence of the Maharaja Holkar, a very interesting description of which is given in the Appendix, page 34, of my last report, was surveyed on a scale of 12 inches=1 mile; and to test the accuracy of the general work performed by the plane-tablers during the season, chain traversing was run over 328 linear miles.

74. The Deputy Superintendent reports very favorably on the results of his examination of the topography completed, and the field and fair maps testify to the care with which all details have been represented. Vigilant supervision was exercised throughout the field season over each detached party, and each plane-tabler working in difficult ground in which trigonometrically fixed points were not easily visible, was made to chain distances or to traverse for all details. The amount of work completed, considering the strength of the party and the very difficult nature of the ground, is very good.

Opinion on the season's topography and general outturn of work.

75. In the Appendix (extract from the Narrative report of the officer in charge, No. 2 party) valuable and interesting geographical notes are given of the country visited during the season's operations, also a description of the ancient capital of Malwa (Mando) now in ruins, of several other large towns, and of the fort of Mahesar.

Description of country and geographical notes furnished by executive officer.

76. The fall of the river Nerbudda between the town of Mortakka and the village of Kheri has been carefully determined by points fixed in the river, in a total distance of 73½ miles, measured along the river; the difference of height is 147 feet, giving an average fall of nearly two feet in every mile between the places above named.

Fall of the Nerbudda river.

77. During the recess season, the work which devolved chiefly on the Deputy Superintendent and his small staff of European assistants was exceedingly heavy, but by good management all the professional records, computations and fair mapping were completed. Six standard sheets on the inch scale, plan of Mahesar city and environs, and the chart of triangulation for Degree sheets I and IV, scale 2 miles=1 inch, were completed and rendered to this office. The Deputy Superintendent reports that no arrears of any sort exist.

Recess duties.

78. Early in August this party was visited by myself. The inspection of the records of all the field and office work proved that they were in perfect order, and all the work well in hand. The arrangements for the ensuing field season which, owing to the physical difficulties of the country along the Sathpuras, needed careful consideration, were fully discussed and arranged with the Deputy Superintendent. Measures were also adopted to secure the co-operation of the Bombay Settlement authorities for the survey of the northern portion of the plains of Khandesh, in the same manner and on the same scale as the topographical operations which are progressing in the Nassick and Ahmednuggur Collectorates.

Inspection of party.

79. The party has again suffered much from the effects of malarious fever early in the season, and latterly the native establishment suffered from guinea-worm. Water is very scarce throughout the western portion of the Sathpoora hills, and the little that can be obtained is seldom pure or wholesome. The severe losses in European life reported last year (paragraph 83) has necessitated great caution in working in the unhealthy parts of the Sathpura hills at particular seasons, and I trust we may be more fortunate in future.

80. The Deputy Superintendent, Mr. F. B. Gridlestone, was compelled, owing to the state of his health from climatic influences, to obtain furlough to Europe; and Mr. Horst, the next senior Assistant Superintendent, was transferred to this party from No. 5 Bhopal and Malwa Survey in October. Mr. Girdlestone availed himself of his furlough from the 19th October 1874.* To increase the efficiency of the party, both in strength and training agency, Mr. D. Atkinson, Surveyor 2nd grade, and Mr. A. J. Wilson, Surveyor 4th grade, who were on duty at Head-quarters, were transferred to No. 2 Survey from the 1st September and 1st August 1874, respectively. Both these Surveyors possess considerable experience, and are desirable additions to this party.

Vide my letter to Government, Revenue, Agriculture and Commerce Department, No. 339F., dated 22nd September 1874.

81. The able and energetic manner in which Mr. F. B. Girdlestone has conducted the operations of this party since he started work in December 1871, cannot be too highly commended. His devotion to duty has ever been conspicuous, and the out-turn of work, *viz.*, 8,000 square miles of triangulation and 4,157 square miles of final topography in three years, in such very difficult ground, with agency chiefly trained by himself, testifies to his zeal and ability. During his absence, Mr. H. Horst, Assistant Superintendent, officiating now in charge, will, I have no doubt, fully maintain the efficiency of the party in all respects. He has a difficult task before him, owing to the increasing difficulties and insalubrity of the ground under survey, portions of which are uninhabited, and also in consequence of his having to work on two different systems and scales in the wild, hilly, and non-revenue-paying, as well as in the open revenue-paying portions of Khandesh, but I have every confidence in his well-proved experience and sound judgment.

Mr. Girdlestone's good services.

82. Mr. Girdlestone reports very favorably of the excellent services rendered both in the field and recess by Messrs. Wyatt and Barckley, and Sub-Surveyor Shaik Omer, who are deserving of commendation and honorable mention.

Services of subordinate staff.

83. For the current field season, the plan of operations is as follows: a strong detachment under Mr. D. Atkinson, Surveyor 2nd grade, will proceed to triangulate the ground north of the Nerbudda river in Allirajpur and Rewakanta, between the parallels of 22° and 22° 30′ and meridians of 74° and 75.° The usual 1-inch topographical work will be continued in the Sathpuras south of the parallel of 21° 45′ down to 21° 15,′ below which the larger scale survey (2 inches to the mile), based on traversing, will be taken up for the plains of Khandesh, for the incorporation of the village boundaries from the old Bombay Revenue and Assessment survey, on the same system as is being pursued in the Poona and Nassik districts of the Bombay Presidency.

Programme for season 1874-75.

* Revenue, Agriculture and Commerce Department Notification No. 9, dated 5th January 1875.

84. The dangerously malarious tract in the Sathpura Hills cannot be entered before the end of January, and it has therefore been necessary to provide suitable work in the open country along the Taptee, in the plains of Khandesh, for the employment of the party in November, December and January. For this purpose, the Bombay local civil authorities were moved to advance the demarcations or fixing of the village triple-junction points in the talukas around Bhosawul, so as to admit of the prosecution of the detail survey from East, on the completed Central Provinces side, towards the West, with the view of filling up all the area between the Nerbudda and Taptee rivers according to the original intention.

85. The sphere of action of this party is described in the annexed index map, showing the portions of the Central India Political Agency, both North and South of the Nerbudda, together with the Native States of the Bombay Presidency lying between the Nerbudda and Taptee rivers, and the plains of Khandesh South of the latter. The sheets of the survey tinted pink on the Index Map are published.

No. 3.—TOPOGRAPHICAL PARTY.

CENTRAL PROVINCES AND VIZAGAPATAM AGENCY SURVEY.

86. Lieutenant T. H. Holdich, R. E., Assistant Superintendent, received charge of the party from Colonel G. H. Saxton, Deputy Superintendent, (who had obtained furlough* to Europe) on the 15th December 1873, after all necessary arrangements for the field season had been effected by the latter officer at the depôt station at Vizagapatam, and by the first week in January the several surveyors entered the ground to be occupied during the season, as the earliest safe date for such a country (*vide* paragraph 94, printed report, for season 1872-73).

Portions of the Madgul and Golgonda estates in the Vizagapatam Agency, and of the taluk of Rampa, district Rajamundry, Madras Presidency.

Strength of Party and Season's outturn.

Lieutenant T. H. Holdich, R. E., Assistant Superintendent, 1st grade, in charge.	Triangulation	1,800 Square miles.
	Topography.	
Mr. J. Harper, Surveyor, 3rd grade	172	Square miles.
,, J. A. May, ditto 4th ,, ...	187	,,
,, F. Adams, ditto 4th ,, ...	189	,,
,, T. E. Claudius, Assistant Surveyor 1st grade	220	,,
,, W. F. Pettigrew ditto 2nd ,, ...	184	,,
,, A. Cooper, ditto 3rd ,, ...	95	,,
,, Geo. Vanderbeek ditto 4th ,, ...	123	,,
,, Duncan Campbell, Sub-Surveyor	169	,,
,, Donald Campbell ditto	59	,,
,, Lall Singh ditto	30	,,
TOTAL ...	1,428	square miles.

87. The season's final topography covers an area of 1,428 square miles in the estates or zemindaries of Madgul and Golgonda of the Vizagapatam Agency, and of the Rampa taluk of district Rajamundry. On the North and East it is in continuation of the work of the previous season, whilst on the South it closes, on the old Topographical survey of the districts of Vizagapatam and Rajamundry, executed in the years 1821 to 1825. All this particularly wild and densely covered ground, is much infested by tigers, and the dread of these beasts is fast driving the wretched and almost helpless inhabitants out of some of the finest country in these parts. All the topography completed was tested by the officer in charge, who states that, as far as it came under his observations, it was undeniably good.

Topography completed.

88. The Triangulation in advance of Topography was started independently of that of former seasons from the sides of the Beder Longitudinal series, Great Trigonometrical Survey, Narakonda, H. S., to Bodanally, H. S., and Bodanally, H. S., to Devargunta, H. S., and was extended northwards to a little beyond the parallel of 18°45'; the limit on the East being about the meridian of 81°30', so as to establish a junction with the stations of the triangulation previously completed, and on the West closing on the work of the old Hyderabad topographical survey in the Upper Godavery talukas of Bhadrachellam, Cherla, and Albaka. The area Triangulated covers 1,800 square miles in the southern portion of the zemindaries of Bustar, the wildest and most inhospitable country imaginable. Observations were taken at 20 stations, from which 210 points and 118 elevations were determined.

Triangulation completed in advance of detail survey.

89. In executing this work, Lieutenant Holdich and his small advance party experienced unusual difficulties and hardships. The dread of tigers, the labor and difficulty of moving daily through trackless forests, the want of proper shelter, and the constant attacks of malarious fever from which the party suffered, to which was added the frequent desertion of carriers or porters employed for the conveyance of provisions and such scanty camp equipage as could be carried about in these jungles, and without which the party could not have existed, were sources of constant anxiety.

90. A very complete and interesting description of the country visited during the season is given in the appendix extracted from the Narrative Report of Lieutenant T. H. Holdich, R. E., Assistant Superintendent.

3rd February 1874.

Recess duties.

91. During the recess all the professional records and computations and the season's fair mapping were completed and rendered, and Lieutenant Holdich states that no arrears exist. I had fully hoped to visit this party after my inspections were concluded at Poona, but urgent duty compelled me to return to Calcutta in the month of August last. There is much in the constitution and arrangements of this party, which has been segregated for so very long a period from the rest of the Department, which I am anxious to see into and to alter, and which I hope may be done during the current year. In the meanwhile, I have directed the instrumental equipment of the party, in use for so many years, to be carefully inspected; old and worn out instruments to be returned into store and replaced by new, and all superfluous articles dispensed with, which I hope will prove advantageous.

92. During the long recess at Ootacamund, some of the senior assistants have been taken out for training in the use of the larger instruments and on triangulating, with the view to greater efficiency in such important parts of their duty.

Reduction of the scale of survey.

93. Owing to the increasing difficulties of the country remaining for survey (about 9,000 square miles) in the western wilds of the Bustar State and its dependent zemindaries, within the Central Provinces, the very unprofitable nature of the country, the serious risk to health and life in surveying such malarious tracts, and the expense of conducting survey operations in such ground on the standard scale of 1-inch to the mile, I considered it my duty to submit for the consideration and orders of Government, a proposal to reduce the scale of this survey to ½ inch, or 2 miles to the inch. This measure received the approval and sanction of Government;* the remainder of the ground in the south-east portion of the Central Provinces will therefore be completed on the ½-inch scale, and I have every reason to hope that all that now remains to be surveyed on this side will be accomplished perhaps during the next two seasons. More than a quarter of a century has already elapsed since the work of this party was first started in the Khond hills and Tributary States of Orissa, and nowhere in India has the country presented such obstacles to fair progress. The effects of the climate has left its mark on many members of this Department, who have cheerfully, season after season, returned to the country, and who now have a good prospect of a successful and speedy termination to their labors and trials in this inhospitable direction.

Opinion on the season's out-turn.

94. The work accomplished during a short field season, and under unusual and ever increasing difficulties, is fair; more could not be expected. The whole party has throughout the season suffered very severely from fever, and, but for the return to a Hill Station, it is doubtful whether any work at all could be performed with such reduced physical powers as are left to the European staff after a field season in these jungles. To the energetic action and excellent judgment of Lieutenant Holdich is due the credit of the season's work.

95. Messrs. May and Claudius rendered good and efficient aid both during the field and recess, and received favorable mention by Lieutenant Holdich.

96. Mr. Pettigrew, Assistant Surveyor, 2nd grade, owing to ill health, has obtained two years' medical leave to Europe from 30th December 1874, and Mr. Donald Campbell, Subsurveyor, was permitted to resign his appointment from the 1st October 1874. These vacancies in the party it has not been possible to fill as yet, and for the change in the system of survey it is not so necessary.

Programme for season 1874-75.

97. During the ensuing season the triangulation in advance of Topography will be undertaken by Lieutenant Holdich and his senior Surveyor, Mr. Harper,—the former completing the work, as far as practicable, south of the Indrawutty river, while the latter pushes on northwards.

98. The topography will be continued to the west of that of previous seasons so as to establish a junction with that completed in the Aheree zemindaree of the Chanda district, as well as with the Upper Godavery taluk by the old Hyderabad Topographical Survey, and on the completion of this remaining tract allotted to No. 3 party, as shown in the annexed index map of that survey, the whole of the zemindaries in the southern part of the Central Provinces as well as of the Vizagapatam Agency will have been provided for, and No. 3 party will then be available for other work elsewhere.

99. The index map shows what portion of this survey, covering an approximate area of 50,193 square miles (as stated in paragraphy 97 of last report), has been published on the 1-inch scale. The diversity of execution of the original maps over a period of a quarter of a century, together with fluctuations in the scales of survey at different times, has rendered it difficult to illustrate the publication of the maps in a clear and intelligible manner. The old records are being gradually re-drawn in this office for reproduction by photozincography according to our limited means and the exigencies of the executive field parties, but it is hoped that the whole series may be accomplished within a reasonable time, and my earnest attention is directed to this object. At present the sheets most urgently needed for local investigations are first taken in hand and published. The utilization and issue of our 1-inch surveys of Native and of British Non-regulation States and Districts is of very great importance, and for which we are entirely indebted to the modern invention of photographic reproduction by transfers to zinc.

* Vide Revenue, Agriculture and Commerce Department's letter No. 532, dated the 10th September 1874.

No. 4.—TOPOGRAPHICAL PARTY.

NORTH-EASTERN DIVISION, CENTRAL PROVINCES SURVEY.

100. Full effect was given to the programme detailed in paragraph 108, page 16, of the printed report for 1872-73, and the topography and triangulation were successfully conducted through the portions of the new acquisitions of the Rewah State, and the districts of Mandla, Balaghat, and Bilaspur of the Central Provinces, marginally noted, in continuation of the work of former seasons.

The western portion of pergunnah Singwara, taluk Sohagpur, of the Rewah State. Portions of the Tehsildaris of Mandla and Ramgarh, in District Mandla, and of the zemindaries of Surmi, Karangi, Pandaria and Bijnipur, in District Bilaspur, Central Provinces.

101. By the triangulation in advance of detail survey, an area of 1,600 square miles in the southern portion of Mandla was covered. Observations were taken at 58 stations, from which 277 points and 163 elevations were trigonometrically determined. Final topography for 2,419 square miles was obtained, and this was fully tested by traverses over 274 linear miles and examinations *in situ*. The forest reserves of Chauarighogar and Airi, in the Mandla district, covering 3,812 acres, were minutely surveyed on the large scale of 4 inches to the mile.

Strength of party and out-turn of work.

	Triangulation. 600 Square miles.	Final Topography. Square miles.
Lieutenant-Colonel G. C. Depree, Deputy Superintendent, 1st grade, in charge, assisted by Mr. Vanderputt, 3rd grade Surveyor		
Mr. G. A. McGill, Surveyor, 2nd grade		248
„ J. Vanderputt, „ 3rd „		159
„ A. James, Assistant Surveyor, 1st grade ...		275
„ J. A. Barker, ditto 2nd „		235
„ J. H. Wilson, ditto 3rd „		297
„ G. Read, ditto 4th „		31
„ G. L. Fleming, ditto 4th „		138
Sub-Surveyor, Dutt, ...		265
„ Eusaf Shariff		336
„ Imam Shariff		226
„ Shere Shah		156
„ Atma Singh		53
TOTAL ...		2,419

This includes 37·5 square miles of overlap survey and the large scale (4 inches = 1 mile) surveys of the Forest reserves of Chauarighogar and Airi = 3,812 acres.

102. A good junction was effected, by means of triangulation, with the revenue survey village tri-junction masonry platforms in the districts of Bilaspur and Raipur. In the Mandla district the tri-junction points of villages fixed at the time of the assessment survey were found marked by a pile of stones and poles; all these were fixed and are shown on the season's maps, as such information may hereafter prove very valuable aids to future revenue or settlement surveys.

103. The country visited during the season throughout Mandla and down to the limits of the Balaghat district was precisely of the same bad nature as has already been described in the reports of previous seasons. All the hill ranges are elevated plateaux covered with heavy forest, and the entire surface of the ground is stony, presenting great difficulties for transit in any direction.

104. The Deputy Superintendent states that all the topography executed is minutely accurate. A considerable amount of traversing was performed by each plane-tabler in tracing up the details of ground features.

105. During the recess, six standard maps from the results of the season's survey were completed and rendered, and, in addition, four standard sheets of the old Ganjam and Orissa and Chota Nagpore Topographical surveys were re-drawn by this Party. The half-degree chart No. IV. of Triangulation was also completed. The usual records of observations and all professional computations and registers were completed up to date. The Deputy Superintendent reports that no arrears of any kind exist in his office.

Recess duties. Fair mapping, &c.

106. The Party was inspected by myself in September last, and I had every reason to be satisfied with the quality of the work performed both in the Field and Recess. The excellent state of all the records and the means adopted by the Deputy Superintendent, Lieutenant-Colonel G. C. Depree, to maintain the efficiency of the party in all respects, was very gratifying. Ample evidence was placed before me of the accurate manner in which all the field work of the party is performed under Lieutenant-Colonel Depree's judicious and vigilant supervision.

Inspection of Party.

107. Messrs. G. A. McGill and J. Vanderputt, Surveyors, are favorably mentioned by the Deputy Superintendent, who also reports well of the zeal of all his assistants. The health of Mr. George Read, Probationary 4th Grade Assistant Surveyor, having failed shortly after he was detached on field work, and having been medically reported as unfit for such hard work, he was permitted to resign his appointment from the 6th May 1874.

108. In continuation of the topography completed during the season under review, the detail operations will be extended towards the south-eastern portion of the Mandla District as far as to the limits of the Seonee district already surveyed, and northern portion of District Balaghat, also into the States of Pandarha and Kawardha in Raipur. Some of the forest reserves in

Programme for the season 1874-75.

Maudla and Balaghat will also be surveyed on the scale of 4 inches. Of triangulation in advance of details, only 500 square miles remain for completion in the district Balaghat to connect with the revenue surveys of the Central Provinces; this will be dealt with in due course during the now current field season. The filling up of the topography of this unknown and very wretched tract of country will take another season or two, when the party will be available for other work elsewhere. With this the Central Provinces will have been entirely completed, both as regards topographical and revenue surveys.

109. The index map of this party annexed shows the progress of these operations, and the area remaining to be executed, which, when completed, will embrace all the wild and unprofitable tracts between the Regulation districts of Bengal and Jubbulpore. The sheets published are also specified.

No. 5.—TOPOGRAPHICAL PARTY.

BHOPAL AND MALWA NATIVE STATES SURVEY.

110. It was arranged (*vide* para. 125 of the last printed report) that the topography of the western half of Degree Sheet III and the north-eastern section of Degree Sheet V immediately north of the Nerbudda in the Bhopal territory and above the station of Hooshungabad, should be completed; while the triangulation in advance of topography was advanced to the west and south of the work of former seasons.

Part of Bhopal in the Nizamuts of Duraha, Raisen, and Kalliakhera, with detached portions of the zemindaris or districts of Augur and Shajehanpur, in Sindhia's territory and a small portion of Holkar's territory; portions of Tonk, Rajgarh, Nursingarh, Maksudangarh or Naia Killa.

111. This programme was fully carried out under Captain Riddell's superintendence, and the final survey of the country round Bhopal and Sehore between the meridians of 77° and 77° 30′, and the parallels of 23° and 24°, together with the portion further south between the meridians of 77° 30′ and 78° and the parallels of 22° 45′ and 23,° embracing portions of the Native States above marginally noted in the Rajputana and Central India Agencies, covering an area of 2,812 square miles, was completed, and the triangulation was extended over an area of 2,833 square miles. Observations were taken at 57 stations and 491 positions and 659 elevations were trigonometrically determined; of these, 281 were within the triangulation of previous seasons, and were dependent on distances measured on the plane table field sections, and the triangulation for a large scale plan of the city of Sehore, the Head-quarters of the Bhopal Agency, was completed.

Strength of party and season's out-turn.

Captain R. V. Riddell, R. E., Deputy Superintendent, officiating 2nd grade, in charge	Triangulation. 961	square miles.
H. Horst, Esq., Assistant Superintendent, 1st grade	1,872	,,
TOTAL	2,833	square miles.
	Topography.	
Mr. C. F. Hamer, Assistant Surveyor, 1st grade	301	square miles.
,, E. A. Wainwright ,, 2nd ,,	281	,,
,, H. Kitchen ,, 3rd ,,	318	,,
,, W. H. Lilley ,, 3rd ,,	323	,,
,, J. Murray, Assistant Surveyor, 4th grade	225	,,
,, A. Kitchen ,,	222	,,
,, T. Downes ,,	219	,,
,, G. R. Copping ,,	273	,,
Sub-Surveyor Prem Raj	270	,,
,, Abdul Rahim	246	,,
,, Goburdhun	100	,,
,, Mowla Bux	34	,,
TOTAL	2,812	square miles.

112. In addition to the above, test lines were run by the Executive Officer, the Assistant Superintendent, and the Senior Surveyor attached to the party, through the detail work of each plane tabler, together with the usual examination *in situ* during the progress of the field sketching, from which it appears that all the topography obtained is reliable, and the features of the country fairly delineated.

113. This outturn for a field season of about six months' duration is very good, and is sufficient evidence of the energy and excellent management which has always characterised every duty entrusted to the Deputy Superintendent in charge, Captain R. V. Riddell, R. E., who conducted the duties up to the 15th September last, when he was granted three months' privilege leave, and subsequently directed to do duty at Head-quarters temporarily, in consequence of a very severe accident to his eye, which I much regret prevents his taking the field during the current season, and will necessitate his applying for furlough to Europe immediately. Captain Riddell's loss from executive management is much regretted, and I express a hope that he may be able to return to the department where his services are highly appreciated.

Opinion on the season's outturn.

114. The Assistant Superintendent, Mr. H. Horst, as usual, rendered good aid in the field, and his assistance receives due acknowledgment from Captain Riddell.

115. During the recess the usual professional computations, original and duplicate, were completed, together with the fair drawing of six, 1-inch scale standard sheets, Nos. 11, 13, 15, 17, 26, 28, and the triangulation chart of Degree Sheet III. These sheets have been rendered to this office and have been re-produced for issue. All the mapping of this party is rendered in excellent style, and shows a very satisfactory state of progress.

Recess duties.

116. I was much satisfied during my inspection of the party, both in the field in the Bhopal State, as well as in the recess subsequently, with its state of efficiency and the good management displayed both in the field and recess, of all details by the Deputy Superintendent. The standard fair maps are excellent, evincing much improvement over former years and admirably suited for immediate reproduction. All the computations and records were well arranged and in good condition, and no arrears of any description of work existed in the office.

Inspection of Party.

117. Captain Riddell reports favorably of the services of the assistants under his command, all of whom have well performed the duties entrusted to them, both in the field and recess.

118. The programme for the current season is as follows,—The final topography of the North-East quarter of Degree Sheet IV and the north-west quarter of Degree Sheet V or Standard Sheets 18, 20 of Rajgurh, with 27 and 29 of Bhopal, to be completed. The triangulation in advance of details to be extended so as to cover all the ground between the meridians of 75° 30′ and 76,° and from latitude 22° 50′ to 24° so as to embrace the country round Mhow and Indore, which is of greater importance, and has been urgently called for by the Political authorities, and if time permits, to be further advanced east of the meridian of 76° so as to cover a portion of the southern half of Degree Sheet V, subtending the Nerbudda river. The general direction of these operations is between 24° and 22° parallels from east to west, through Indore, Amjhera, Oojein, Mundesore, Rutlam, Partabghar, Banswarra and Jabooah, including parts of Mahikanta, of Rewakanta, Pahlanpur, &c., in the Bombay Presidency, as described in the Index Map of this division attached.

Programme for season 1874-75.

119. To give effect to this programme will be the duty of Captain J. R. Wilmer, Assistant Superintendent, 1st grade, who has been placed in charge of the party, as reported to Government in my letter. Captain Wilmer was for several years the Assistant Superintendent in No. 5 Party, and has a good knowledge of the country in which he has now to operate. He is a most efficient officer of several years' experience in the Department, and will do ample justice to the work.

Charge of Executive Officers.

No. 501 F, dated 29th October 1874.

120. Mr. Horst, Assistant Superintendent, was towards the close of the recess season transferred to the charge of No. 2 Khandesh Topographical Survey for the reasons already given in my review on the operations of that party. In consequence of the pressing necessity of Mr. Horst relieving Mr. Girdlestone at Poona, the current duties of No. 5 Party were well performed by Lieutenant Leach, R. E., Assistant Superintendent, who happened to be on the spot, and was of the utmost assistance when Captain Riddell was incapacitated, and until the arrival of Captain Wilmer from Simla.

121. In the Appendix extracts are given from Captain Riddell's narrative report descriptive of the country through which the season's operations passed.

No. 6.—TOPOGRAPHICAL PARTY.

KHASIA, GARO AND NAGA HILLS SURVEY.

122. For reasons which have been fully explained in the reports of two previous seasons (1871-72 and 1872-73) the work of this party continues to partake of the character of a good and reliable geographical reconnoissance and explorations on a reduced scale, based on triangulation, along the North-Eastern Frontier and in the Manipur State; and, as described in paragraphs 141 to 145 of the last report, three distinct detachments were formed with the object—1*st*, of continuing the exploration in the Eastern Naga hills, south of Seebsagur and Lakhimpur districts; 2*nd*, the completion of the central portion of the "Naga hills or Samagooting district," and 3*rd*, to fill up the blank or western portion of the Manipur Native State between the meridians of 93° 15′ and 94°.

The Garo hills, Western portion, Naga hills district, central portion, continuation of the Naga Hills and of the Manipur Native State.

Strength of party and season's out-turn.

	Triangulation in square miles.	Topography completed. Scale, 2 miles =1 inch.	Topography completed. Scale, 4 miles =1 inch.
Captain W. F. Badgley, Officiating Deputy Superintendent, 3rd grade, in charge	800	...	2,294
Lieutenant R. G. Woodthorpe, R. E., Assistant Superintendent		1,153	...
Mr. M. J. Ogle, Surveyor, 4th grade	2,300	145	694
,, A. W. Chennell, Assistant Surveyor, 1st grade ...	...	1,068	...
,, W. Robert, ditto ditto, 3rd ditto ...	...	1,130	...
,, J. McCay, ditto ditto, ditto ...	...	931	...
Sub-Surveyor Shah Nasirudin	...	708	...
Ditto Dalliludin	...	299	...
Ditto Moung Hay	...	779	...
		6,213	2,988
TOTAL ...	3,100	9,201	
MARGINS AND OVER-LAPS ...		Sqr. miles 1,590	

123. These objects were fully attained, the

only exception being the non-completion of a small strip of country in the Naga Hills district running parallel with the Doyang river for a distance of about 25 miles, and the season's topography fills up several blanks between the work of previous seasons which were unavoidable, owing to the special and detached nature of the previous explorations connected with the military expeditions on the Frontier.

Season's outturn.

124. The total outturn of Topography thus rapidly obtained over a most difficult tract of inhospitable hilly country covers 9,201 square miles, of which 6,213 square miles were on the reduced scale of 2 miles to the inch, and 2,988 square miles on the still smaller scale of 4 miles to the inch, inclusive of 1,590 square miles of margins and over-laps along the limits of previous survey. Captain Badgley, Deputy Superintendent in charge, reports that all the work thus completed is very good and quite sufficient on the scales mentioned for the purposes intended of such peculiar description of country of so little value and so impenetrable. The ground in the central portion of the Naga Hills district was low and covered with dense forest, most difficult of access and accomplishment.

Triangulation.

125. The season's triangulation covers an area of 800 square miles in the Naga Hills, and 2,300 square miles in the Native State of Manipur; total 3,100 square miles. Observations were taken at 18 stations, from which 90 positions and 48 elevations were determined.

Opinion on the season's results.

126. The difficulties encountered by the whole party were very trying, and many and great privations, as regards food and proper shelter, were experienced throughout the season, yet every member zealously performed his share of duty and thus contributed to a very successful season's outturn.

Course of the Lanier river.

127. A considerable portion of the country visited and mapped was totally unknown, except by name, to our oldest and most experienced Frontier officers, and the Lanier river, which has long been supposed to be a branch of the Doyang draining into the Brahmaputra, has been proved to be one of the tributaries of the Namtonai or Kyandwein river which takes its rise in the Hookoong valley in Northern Burmah and joins the Great Irawadi river about latitude 21° 35′, longitude 95° 10′, almost due west of Ava.

128. The Lanier river (Lang-tang-khong of the Manipuris) takes its rise to the west of the well known peak in Manipur of Shiruifirar ($\frac{\text{latitude } 25° 6' 14''}{\text{longitude } 94° 30' 8''}$) estimated height 8,266 feet above sea (*vide* Yule's Map of Burmah, London, 1857) and flows thence in a north-easterly direction for 44 miles to the Naga village of Thetchunasa, where it suddenly turns off at a right angle in a south-easterly course and breaks through the high range on which the great snow-clad Saramethi peak (elevation 12,622 above sea level $\frac{\text{latitude } 25° 44' 22''}{\text{longitude } 95° 4' 41''}$) is situated (about 15 miles south-west of the peak) joining, it is believed, the river named Numpugna on Wilcox's map of the sources of the Brahmaputra and Irawadi rivers, 1828.

129. The country visited by the exploring party under Captain Badgley is inhabited by various Naga tribes, *viz.*, "Angamies," "Semas," "Rengmas," "Lotas" and "Naked Nagas," and most of it is well populated. It is throughout hilly, and the inhabitants do not take kindly to the intrusion of strangers, which adds greatly to the difficulty of survey operations. Very interesting details connected with the season's survey are given in the Appendix: *vide* extracts from the narrative report of Captain W. F. Badgley, Deputy Superintendent in charge of No. 6 Topographical Survey. See also "Report on the Exploration Survey of the Naga hills by Captain John Butler, Officiating Political Agent, Naga Hills," published by the Chief Commissioner, Assam, 1874.

Services of Captain Badgley and party acknowledged.

130. It affords me great pleasure to bring prominently to the notice of Government the continued good services which Captain Badgley and his small party have again rendered on the Eastern Frontier. Life and health have been freely risked, orders have been cheerfully obeyed under very trying circumstances, and without exception every member of the party has been actuated by the one feeling of striving to do his utmost in the interests of Government and for the credit of the Department. More or less, the whole party has suffered much from the effects of bad and insufficient food, fever, and from complaints brought on from exposure during very inclement weather in low pestiferous valleys, and also in the higher hills (often snow-covered) in the Eastern Naga Hills. Eight of the native establishment died from cholera and dysentery.

131. Captain Badgley throughout the season took a leading share in the season's operations, and has well maintained his reputation as a pioneer in the interests of geography. He was well and ably seconded by Lieutenant R. G. Woodthorpe, R. E., Assistant Superintendent, whose zeal, energy, and well-directed aid contributed much to the season's outturn.

132. Messrs. M. J. Ogle, A. W. Chennell, and W. Robert rendered excellent service: Mr. Ogle in particular, to whom was entrusted the work in Munipur, and who was for the whole season completely isolated with his small detachment from the rest of the party, did exceedingly well and did not leave his ground, though it was late in the season and bad weather had set in, until the completion of every portion of the work entrusted to him. Mr. Ogle is a most valuable assistant, to whom the highest credit is due.

133. The work during the recess was heavy, but all the professional records and computations were completed and the fair mapping (15 sheets ½-inch scale), with the exception of 4 sheets containing large blanks still remaining for survey, were finished and rendered to this office. The mapping of this party is well executed, and fairly represents the wild and mountainous nature of the country along the Frontier.

Recess duties.

134. During the now current season of 1875-76 the party is again employed in three separate detachments. By the return of Major H. H. Godwin-Austen from furlough* a strong party was formed to accompany the military expedition against the Duffla tribe on the Northern Frontier of Assam: this detachment, as per margin, will explore as much of the hills along the northern frontier as can be visited either under military protection or political aid. Under the able direction of Major Godwin-Austen, who has had such extensive experience in this sort of military exploration of totally unknown countries, great expectations are formed of the probable results of the season's work, and when the Duffla hills are evacuated by the British force, it is hoped that the remaining Northern Frontier of Lakhimpur along the other friendly hill tribes' border may be visited and mapped in connection with our triangulation up the valley of Assam, and the revenue survey already completed to the north of the Brahmaputra.

Future operations.

* Returned 27th October 1874.

Major H. H. Godwin-Austen, Deputy Superintendent, in charge.
Lieutenant J. Harman, R. E., Assistant Superintendent, Great Trigonometrical Survey.
Mr. M. J. Ogle, Surveyor.
„ W. Robert, Assistant Surveyor.

135. The *second* detachment under Captain Badgley, assisted by Mr. Channell, and the *third* under Lieutenant R. G. Woodthorpe, R. E., assisted by Mr. McCay, will continue the exploration and survey of the Eastern Naga Hills, south of the Sibsagar District, on the reduced geographical scale. By these means it is expected that a very sensible impression will be made on the hitherto unknown hill tracts north and south of the Assam valley, and by the extension of the triangulation along the frontier, that we shall hereafter be able to continue our exploratory surveys to the Eastern head or limit of the Assam valley, touching on Tibet, China, and Burma, of which there is much still remaining to be done.

136. The index map attached shows the large area already accomplished, and the probable extent of the country remaining to be taken up.

No. 7, TOPOGRAPHICAL PARTY.

RAJPUTANA AND SIMLA SURVEY.

137. Full effect was given to the programme for the season under review, as detailed in paragraph 158 of the last report; the triangulation in advance was extended through the greater portions of Degree Sheets IX and X, embracing Ajmere and Jodhpur or Marwar and well connected to the east with the sides of the Gurhagurh Series Great Trigonometrical Survey in Jeypur territory. An area of 5,210 square miles was thus covered by observations at 57 stations; 567 points were fixed, and 316 elevations determined.

Portions of District Ajmere and Mhairwarra and of the Native States of Udeypur, Marwar or Jodhpur and Kishengurh.

Strength of Party and season's out-turn.

	Triangulation. Square miles.
Captain George Strahan, R. E., Deputy Superintendent, 2nd grade, in charge	2,160
„ J. R. Wilmer Assistant „ 1st „	3,050
Total Triangulation ...	5,210

	Topography. Square miles.
Mr. E. S. P. Atkinson, Surveyor, 4th grade	945
„ R. Todd, Assistant „ 1st „	135
„ C. Tupsell „ „ 1st „	335
„ F. Kitchen „ „ 1st „	270
„ W. Statesbury „ „ 1st „	475
„ W. W. McNair „ „ 2nd „	270
„ F. Warde „ „ 3rd „	460
„ P. White „ „ 4th „	270
Sub-Surveyor Mr. J. Nooh	270
„ Kalka Pershad	340
Total ...	3,170

138. The final topography of 3,170 square miles in Mhairwarra, parts of Udeypoor and Jodhpur, was completed and tested by 95 linear miles of test routes. Large scale plans (12 inches = 1 mile) of the cantonments of Erinpura and Beawar were also completed. The Deputy Superintendent reports that all this work has been well and carefully executed.

Check routes 95 linear miles. Triangulation for the large scale plans of Beawar and Nasirabad by Captain George Strahan and Captain Wilmer. Plan of Erinpura Cantonment (scale 12 inches = 1 mile) by Mr. F. Kitchen and of Beawar or Nynagar by Sub-Surveyor Kalkapershad.

139. The triangulation was extended by a series of 1st class secondary triangles northwards from the city of Jodhpur to latitude 27°, and then running east along this parallel was connected with the Gurahagurh series on about the meridian of 75°,—a net work of triangulation was

Description of the country.

then thrown over nearly the whole of Degree Sheet IX or from about latitude 26° to 27°, longitude 74° 10′ to 75°. All the northern portion of this ground is described by Captain George Strahan, R. E., Deputy Superintendent, as difficult for triangulation, being a flat plain with occasional groups of sand-hills rising from 80 to 100 feet above the general level of the country. No rivers or water-courses were met with, water was scarce and brackish and found only in wells at a great depth. Marching over the ground was tedious and very fatiguing owing to the depth of the sand, and from its being extensively undermined by rats; supplies and grass for horses were scarce and only obtainable with difficulty from long distances.

Simla and Jutog Survey.

140. The party having closed satisfactorily the Rajputana work, returned to recess quarters early, in order to take up the Simla and Jutog large scale survey (24 inches = 1 mile, or natural scale $\frac{1}{2640}$) prior to the heavy rains, and was again employed on the same work in September and October, so as to ensure the completion of the field work, which was most satisfactorily effected before proceeding to the distant scene of operations in Rajputana for the now current season.

141. All that now remains to be done is the insertion of the boundaries of estates, regarding which, in some cases, the local civil authorities and municipality have not yet succeeded in arriving at any final decision. As fast as the investigation of disputed and doubtful boundaries is completed and final decisions arrived at, the boundaries will be inserted on a second edition of the photographed sheet plans: the survey preliminary plans as reproduced on so large a scale are a great help to the adjustment of all disputes and outstanding uncertainties.

General reduced plan of Simla and Jutog.

142. In addition to the excellent and elaborate large scale sheet plans, 20 in number, for the Simla survey, Captain George Strahan has completed and rendered a most artistic general plan of Simla and Jutog in brush shading, on a scale of 8 inches to the mile, or natural scale $\frac{1}{7920}$ (or one-third of the original scale), which will be invaluable both to the permanent residents and visitors to Simla as a guide or hand map for easy reference. This map will be published in the best possible style as soon as possible.

Details connected with the Simla and Jutog survey.

143. The labor imposed on the party by this hill survey may be reckoned from the following details: 67 linear miles of traversing on 24 inches = 1 mile along roads; 502 points and 277 elevations trigonometrically determined; field sketching on 24 inches of 19·03 square miles or 12312·3 acres of hills. It is a matter of congratulation that the double object of the survey in the plains, together with the laborious large scale survey of the hill sanitarium, has thus been successfully and efficiently accomplished. An admirable outturn has been effected in both cases at a most moderate cost.

144. An immense amount of drawing has been accomplished on the unusually large scale of 24 inches to the mile, which could not have been accomplished except by very superior management and the most indefatigable exertions of all concerned.

Recess work.

* Fair standard sheets Rajputana survey 1-inch = 1 mile, Nos. 43, 50, 51, 52, 53, 65, 69.
Triangulation chart degree sheet VIII.
Plans of Erinpura and Beawar or Nyanaggar.
Simla and Jutog sheets 24 inches = 1 mile, Nos. 13 to 18 inclusive.
Simla and Jutog brush-shaded completed map, scale 8 inches = 1 mile.

145. All the professional records and computations in duplicate and all the fair mapping, which was exceedingly heavy in consequence of the large area completed in Rajputana in addition to the Simla and Jutog sheets,* has been completed and rendered in excellent style. All the mapping is well and carefully executed, and is most creditable to the party.

Opinion on the season's results.

146. The outturn of the season is very good and most creditable to the officer in charge, his Assistant, Superintendent Captain Wilmer, and the surveyors and assistants, all of whom have exerted themselves to the utmost to maintain the credit of the party, both as regards the quality and quantity of the work performed. The office was frequently inspected by myself at Simla, and full advantage taken of constant personal communication for the conduct of the work in advance.

147. Captain George Strahan, Deputy Superintendent in charge, continues to take a leading share in every duty connected with the season's work, and is indefatigable in his exertions to maintain the highest efficiency by imparting careful instruction to every assistant in all professional duties, both in the field and recess season. Great credit is due to Captain George Strahan for his excellent services.

148. Captain J. R. Wilmer, Assistant Superintendent, rendered excellent aid both in the field and recess, and Captain George Strahan testifies in very complimentary terms to this officer's qualifications. Captain Wilmer has now been entrusted with the charge of No. 5 Party, to which he will do ample justice. Mr. W. W. McNair has as usual rendered good aid, and is specially distinguished by the Deputy Superintendent in his report, not only for the important part he took in the season's work, but also for his contribution to the archæological history of the places he visited. His description of the Ranpur Temple in the Aravalli Range is given in the Appendix. Messrs. Atkinson, Todd, Kitchen, Tapsell and Stotesbury are also deservedly favorably mentioned.

Change of Assistant Superintendent.

149. Captain George Strahan's services being urgently required temporarily for the Transit of Venus observation at Lahore, was deputed in November last accordingly to place himself under the orders of Colonel Tennant, R. E., for the purpose, and after the completion of the duty rejoined at Ajmere on the 27th of December 1874, in good time to conduct the season's work. Captain Wilmer, Assistant Superintendent, having been necessarily appointed to be the officer in charge of No. 5 Party, Bhopal and Malwa Survey, Lieutenant E. P. Leach, R. E., was transferred to this party from No. 1, Gwalior and Central India Survey, and joined it at Simla on the 21st October 1874. He conducted the party into the field and started the season's operations in Rajputana according to the programme laid down, and under the instructions of Captain George Strahan. Lieutenant Leach also did excellent service with No. 5 Party, temporarily during the recess at Mussoorie, when Captain Riddell was incapacitated by his accident, and my cordial acknowledgments are due to Lieutenant Leach for his successful exertions.

Programme for season 1874-75.

150. During the current season, the triangulation in advance of details will be extended northwards into Degree Sheets XI and XII, through the Jodhpur State into Bikanir. The final topography will be taken in hand of the Western and Southern portions of Degree Sheet IX, containing nearly all the British District of Ajmere and a portion (Eastern) of the Jodhpur Native State. The index map attached shows the present direction the operations are taking, as well as the area completed since the last index was published with the Annual Report of 1869-70.

151. During the ensuing recess months the survey and introduction of the boundaries of estates in Simla, on the plans, will be advanced as far as possible, and the approaches to Simla from the north and east as far as Mahasu will be taken up on the scale of 6 inches=1 mile and continued south, with the view of connecting the surveys of the several Military Cantonments of Dugshai, Subathoo, and Kussowlie, and their several approaches, which will be laid down as time permits, on convenient scales, according to the original programme.

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

SURVEYOR GENERAL'S OFFICE,
CALCUTTA,
15th January 1875.

APPENDIX.

STATEMENT A

Showing progress and cost of each Survey during season 1873-74, *with general average mileage rates.*

DESIGNATION OF SURVEY.	Final topography completed, square miles.	Triangulation completed, square miles.	Stations observed at.	Number of points fixed.	Square miles to each point.	Heights trigonometrically determined.	Square miles to each height.	Amount of fair mapping rendered.	Total cost of Survey.	REMARKS.
No. 1 Survey, Gwalior and Central India	2,783	4,090	83	568	7·2	310	13·2	2,163	59,838	
No. 2 Survey, Khandesh and Bombay Native States ...	2,284	1,000	16	73	13·7	351	2·8	2,203	51,203	
No. 3 Survey, Central Provinces and Vizagapatam Agency ...	1,428	1,800	20	210	8·6	118	15·3	1,205	58,058	
No. 4 Survey, North-Eastern Division, Central Provinces ...	2,425	1,600	59	277	5·8	163	9·8	2,771	60,921*	* Includes cost of two Forest Reserve Surveys on 4 inches=1 mile.
No. 5 Survey, Bhopal and Malwa	2,312	2,833	57	491†	5·8	650	4·3	2,728	60,858	† Include heights determined from bases taken from plane table survey.
No. 6 urvey, Khasia, Garo and Naga Hills	0,201	3,100‡	19	90	34·4	48	64·8	6,562	61,044	‡ 6213 square miles on scale 2 miles=1 inch; 2933 square mile on scale 4 miles=1 inch.
No. 7 Survey, Rajputana ...	3,170	5,210	57	667	9·2	316	16·5	3,751	73,319§	§ Includes cost of the survey of Simla and Jutog.
TOTAL ...	24,103	19,023	311	2,276	8·7	1,965	9·9	21,383	425,041	General average mileage rate, 17-10-2 per square mile.

STATEMENT B.

Professional results and value of the Season's Triangulation and average No. of Plane Table fixings of Detail Survey, Season 1873-74.

SURVEYS.	NUMBER OF TRIANGLES.				TRIANGULAR ERROR IN SECONDS.		MEAN DIFFERENCE IN COMMON SIDES IN INCHES PER MILE.				Average plane table fixings in each square mile of survey.	REMARKS.
	1st class.	2nd class.	3rd class.	4th class.	1st class.	2nd class.	1st class.	2nd class.	3rd class.	4th class.		
No. 1 ...	...	142	58	910	...	4·5	1·20	1·68	5·64	...	9·5	
„ 2 ...	3	55	...	172	2·8	11·75	..	5·4	...	16·4	9·1	
„ 3 ...	...	39	21	311	...	7·2	...	2·76	2·04	9·0	6·5	
„ 4 ...	...	52	56	303	...	4·0	...	7·9	7·3	14·9	8·9	
„ 5 ...	...	140	1,030	...	...	9·1	...	1·54	4·1	...	8·6	
„ 6 ...	14	4	3	128	3·1	6·7	3·5	1·1	...	27·6	0·35*	* Military reconnoissance and explorations on 2 and 4 miles to the inch.
„ 7 ...	11	102	...	1,113	1·01	5·3	...	2·1	9·1	...	6·49	
TOTAL ...	29	543	1,168	2,997	2·30	6·9	2·35	3·21	5·76	17·0	6·9	

APPENDIX.

Statement C.

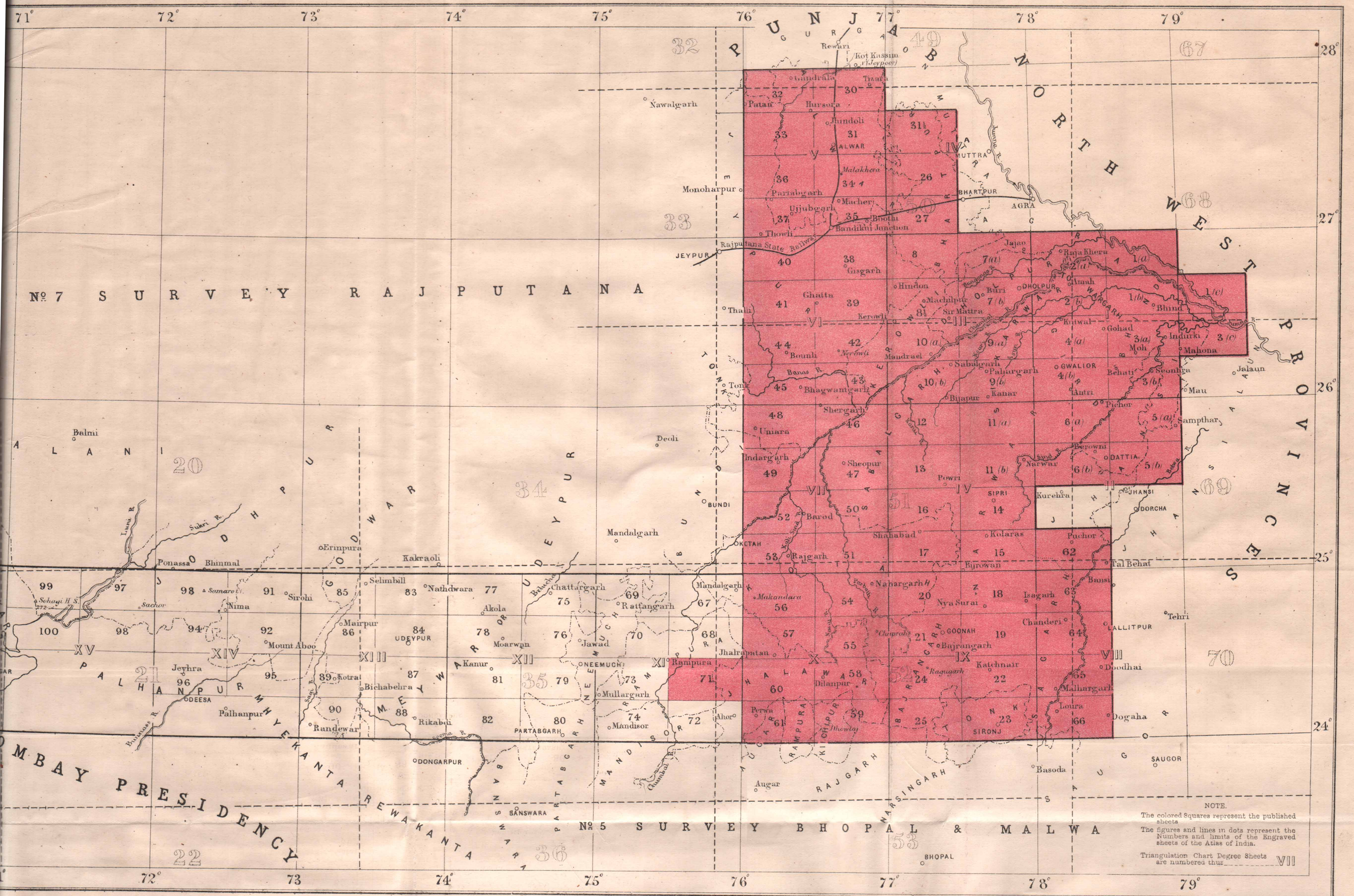
Comparative results and costs of Seasons 1872-73 *and* 1873-74.

	Final topography, square miles.	Triangulation, square miles.	No. of Stations observed at.	No. of points fixed trigonometrically.	Heights determined trigonometrically.	Cost.	Rate per square mile.			Remarks.
						Rs.	Rs.	A.	P.	
Season 1872-73	25,327	19,030	379	1,885	1,365	449,896	17	12	0	Includes cost of the [illegible] Jutog Survey and of several cantonments, towns, and [illegible] on large scales.
,, 1873-74	24,103	19,623	311	2,270	1,965	425,041	17	10	2	
	−1,224	+603	−68	+391	+600	−24,855	−0	1	10	

No. 1 PARTY

INDEX TO THE SHEETS OF THE GWALIOR & CENTRAL INDIA TOPOGRAPHICAL SURVEY.

On the Scale of 1 Inch = 1 Mile.



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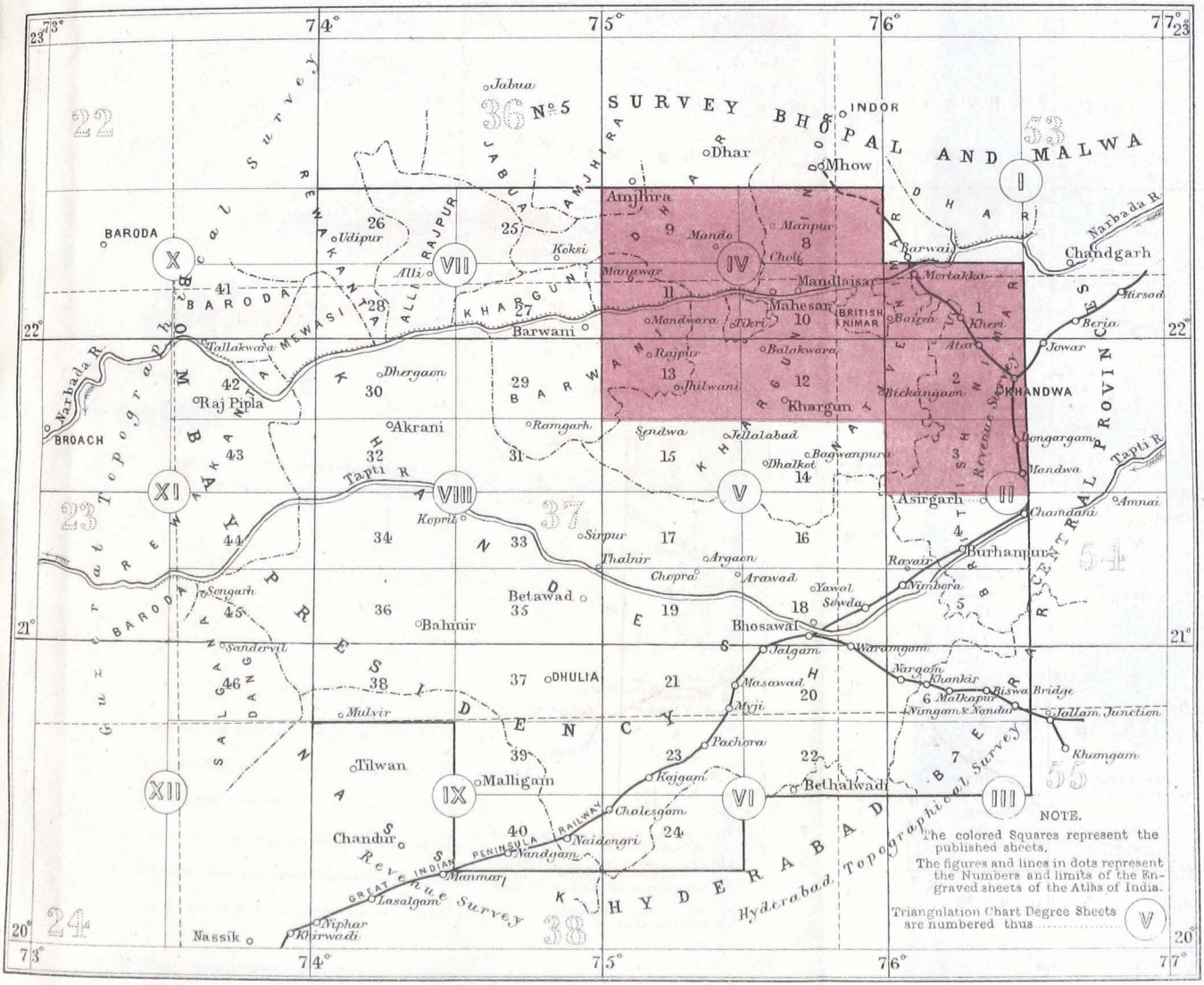

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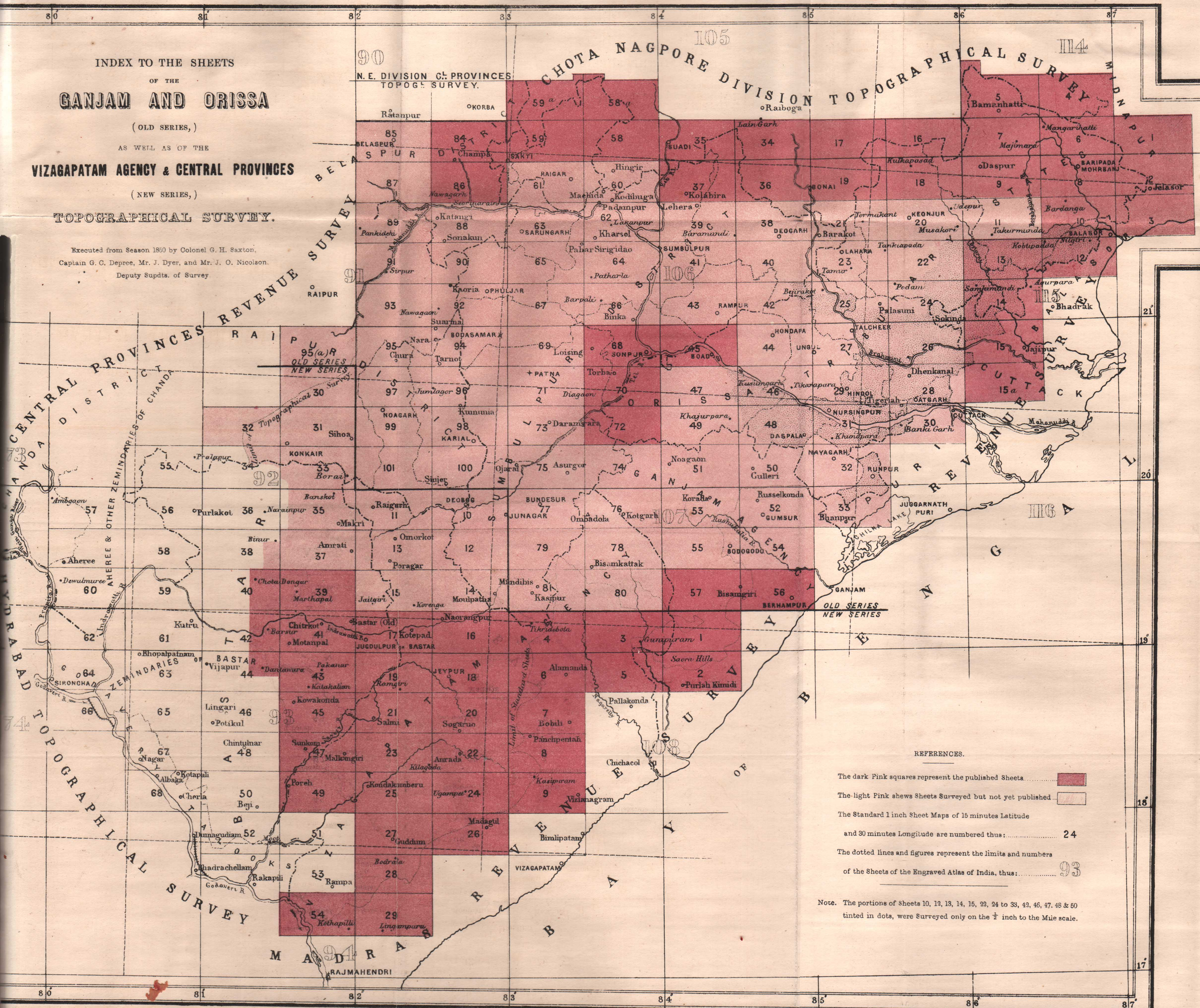

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AS WELL AS OF THE

VIZAGAPATAM AGENCY & CENTRAL PROVINCES

(NEW SERIES,)

TOPOGRAPHICAL SURVEY.

Executed from Season 1850 by Colonel G. H. Saxton,
Captain G. C. Depree, Mr. J. Dyer, and Mr. J. O. Nicolson.
Deputy Supdts. of Survey

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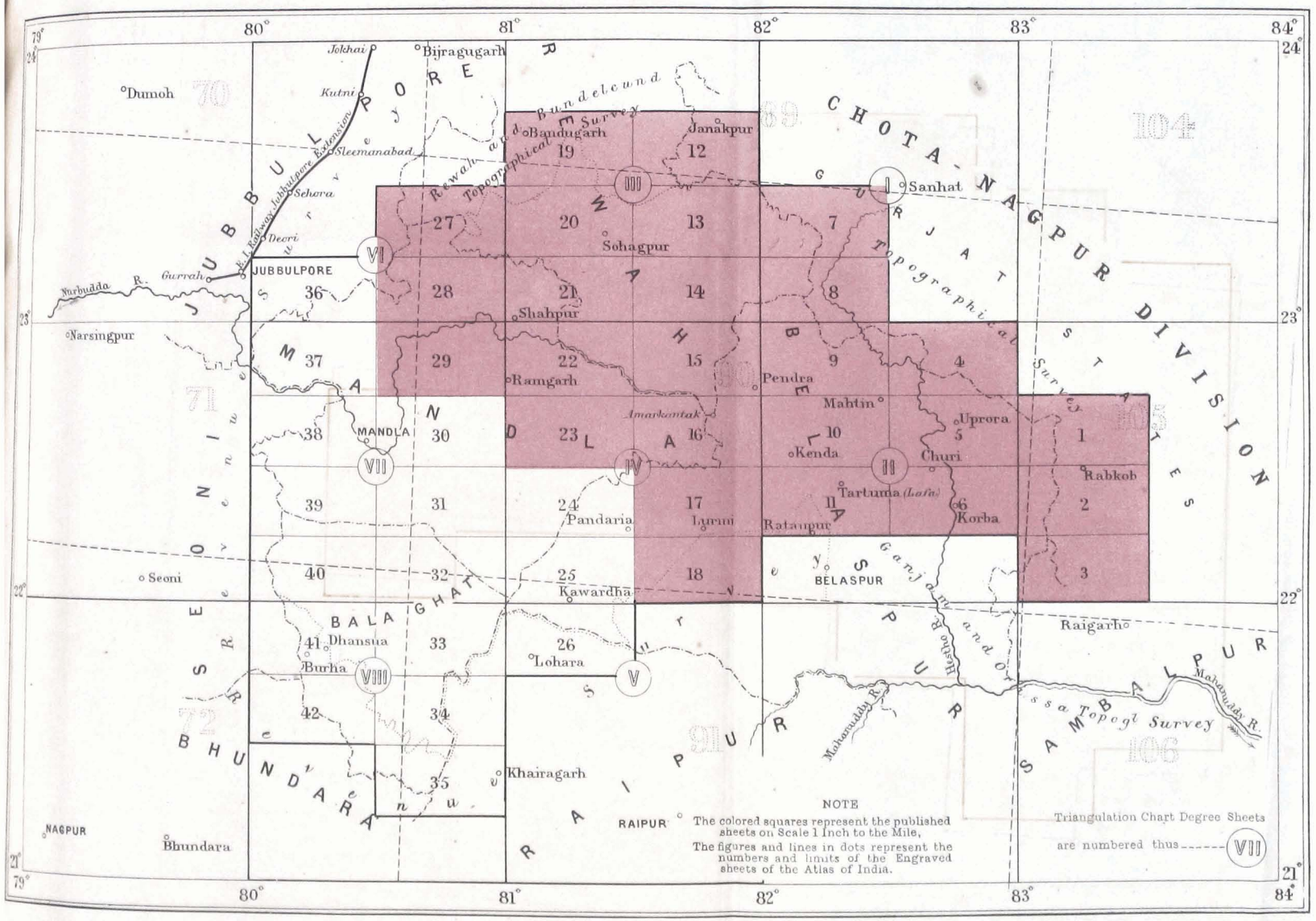

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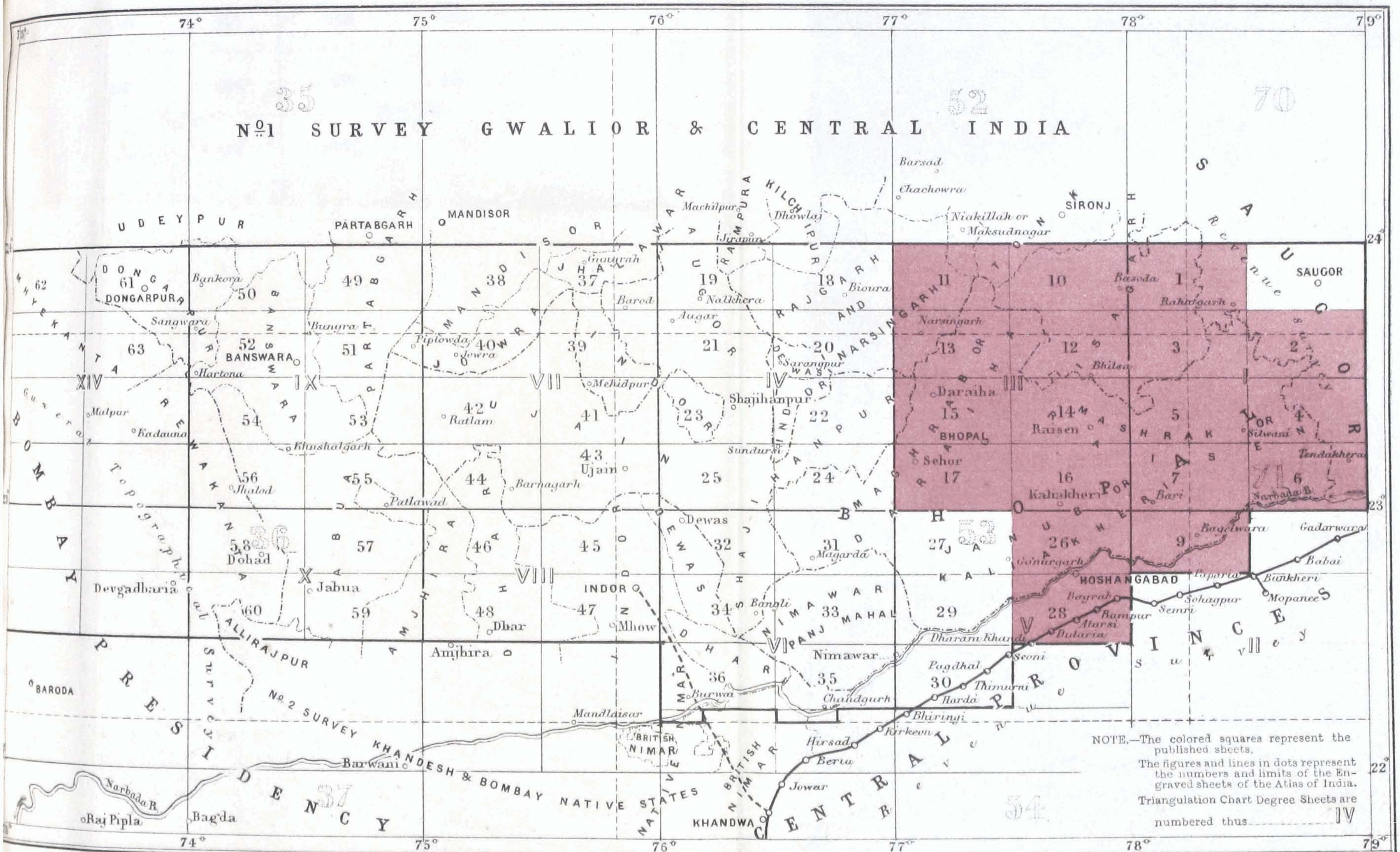

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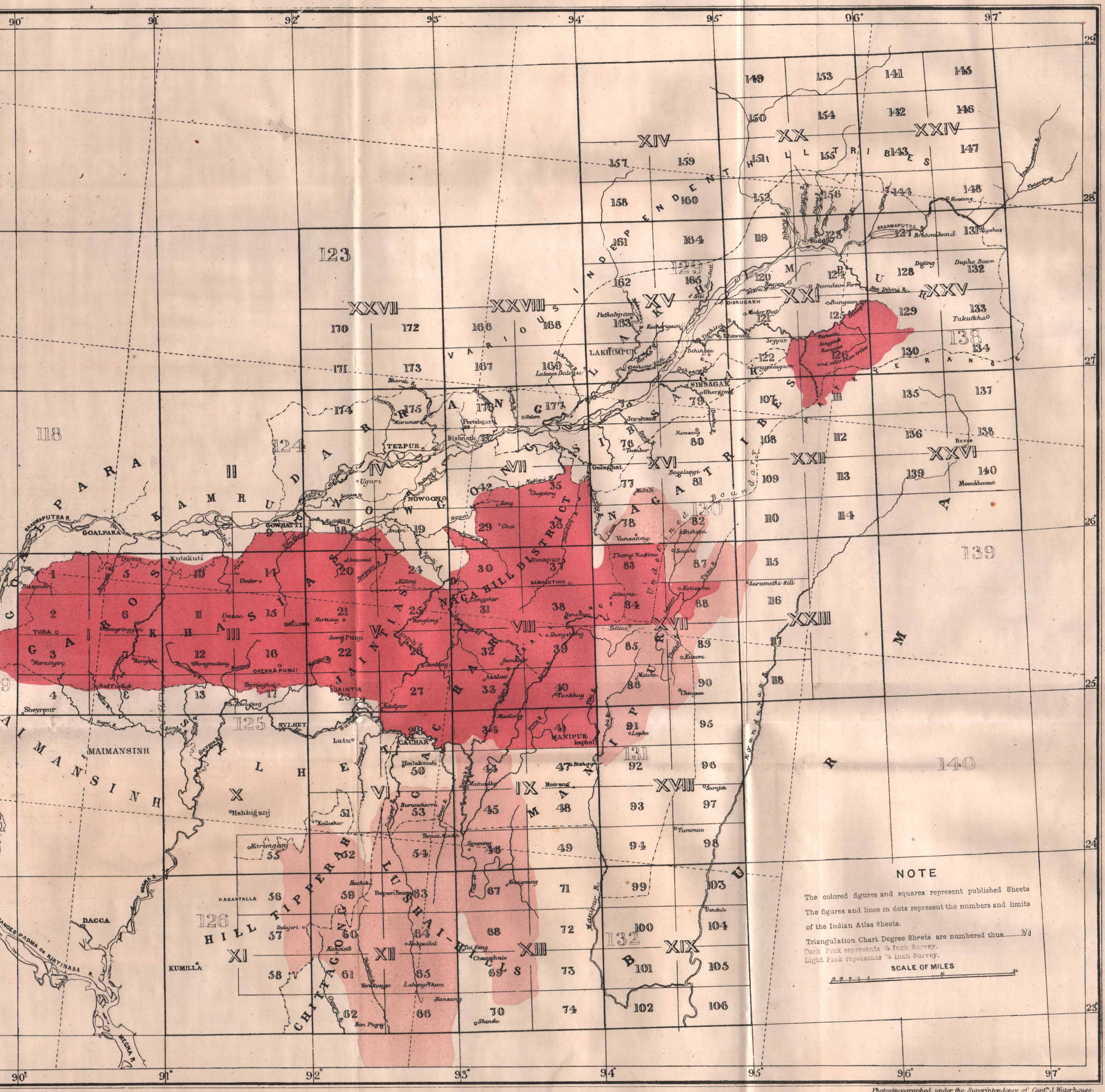

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SCALE OF MILES

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1875

Photozincographed under the Superintendence of Capt.n J. Waterhouse,

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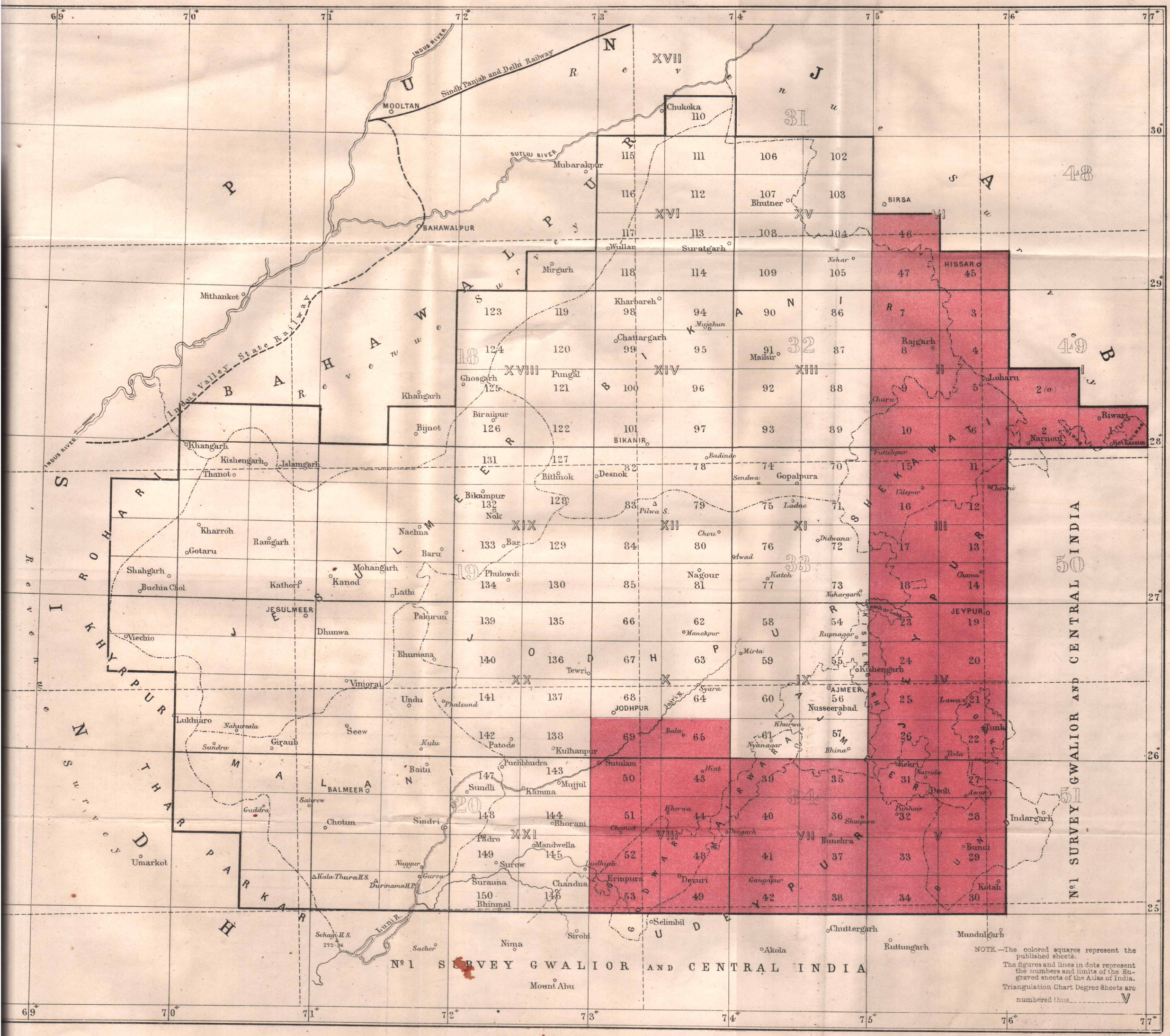

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1875

APPENDIX.

REMARKS, PROFESSIONAL, GEOGRAPHICAL, AND STATISTICAL, &c., BY EXECUTIVE OFFICERS.

Extract from the Narrative Report of CAPTAIN CHARLES STRAHAN, R. E., *Deputy Superintendent in charge No. 1 Topographical Survey, Gwalior and Central India.*

Neemuch, Mundesore, &c.

The country that I was about to reconnoitre was divided into two portions by three very prominent scarps running nearly East and West, and facing Southwards. The northern slopes were very gradual, and as a rule very little broken, and, being covered with heavy jungle, would, I knew, present great difficulties to a triangulator. My starting point Rampura H. S. G. T. S. was well adapted for commencing such ground, as it was on the edge of the 1st or Southern scarp, and being on rising ground, had a good view over the jungle, and saw a considerable portion of the scarp to the North. Having reconnoitred over rather more than 200 square miles in plane-table, 158 in intricate jungly country, I observed over this bit, as at that time the weather was very clear, and I thought it better to observe at once under such favorable circumstances, rather than to run the risk of having thicker weather later on in the season, besides the chance of poles being blown down or removed, which in such ground would be a very serious inconvenience. On the 13th of December, hearing Major Martin, the Political Agent of Western Malwa, was to be at Rampura the next day, I rode into his camp and had an interview with Holkar's Subah of the District in his company, which I think facilitated our operations in his Subat. Major Martin has always been particularly willing to help us in every way, and without his efficient aid we should have had far more difficulty in a country so much cut up into small districts belonging to different Chiefs, as is the country between Neemuch and Jhalra Patan. After this I continued my reconnoissance Westwards as far as the meridian of 74° 30′ through the other three southern plane-tables (Nos. 160, 166, and 168) of my half of the triangulation ; but then, finding that in consequence of the large extent of jungle I should not have time for a thorough inspection of the detail work if I attempted to complete the whole of the ground I had allotted myself, I omitted the North-Western plane-table No. 167 and returned through plane-tables 165, 159 and 157. I had the less scruple in doing this as plane-table 167 is in open, very easy ground, and including Mr. Scanlan's triangulation, I foresaw that there would be more than sufficient ground prepared for the season 1874-75. The three plane-tables (157, 159 and 165) were all more or less densely covered with jungle, so that with the exception of about 350 or 400 square miles, the whole of my triangulation (1,904 square miles) lay in difficult ground. Having completed my reconnoissance on the 3rd February 1874, I observed over it, following nearly the same route that I had taken whilst poling up, and observed at Bissangarh my last station on the 11th March. From there I marched *viâ* Bhynsrorgarh to Lieutenant Leach, whose work I inspected and then commenced the check lines through the other plane-tables.

Mr. Scanlan's triangulation.

After leaving Mr. Scanlan at Chichor H. S. in plane-table 161, I recommended him to work Westwards through plane-tables 164, 170, and 172, returning Eastwards through 171, 169, and 163, following the same general plan in observing so as to close near Rampura, that he might be at hand to take up any other work afterwards. This he did and met with no difficulty till he reached the Western portion of plane-table 170 and plane-table 172, all of which country was not only covered with forest, but was also inhabited by Bhils, who were very much averse to his even entering their country. He was at one time placed in a very awkward position near one of their Pals, as their villages are termed ; but the Rajah of Pertabgarh in whose territory the Pal was situated, took up the case at once, and Mr. Scanlan afterwards became better friends with these wild tribes, and was enabled to finish his triangulation. I fear these Bhils may cause us serious annoyance hereafter, unless we are very strongly backed up by the Political authorities. When near the meridian of 74° 30′ our Western boundary of triangulation, I met Mr. Scanlan and was much pleased with the way he had reconnoitred and poled up the country. Soon after on the 21st January he commenced observing, and with the exception of a few days lost in consequence of hazy weather, he observed steadily until he finished at Rampura on the 18th March. His outturn is 2,176 square miles, about 400 square miles of which were in bad ground. This amount is I consider very good indeed for a first season's work, and I have much pleasure in reporting that the computations have shown that the character of the work is also excellent. His triangular error of 4″·8 and his linear error per mile of 1·43 inches for first class secondary stations, and of 6·0 inches per mile for intersected points with a 12″ theodolite clearly prove this. Mr. Scanlan bids fair to become a first class triangulator.

Large scale plan of Jhalra Patan city.

On completion of his triangulation, I instructed him to take up the large scale plan of Jhalra Patan city. During the previous season the cantonments of that place had been completed; but on hearing that these were all little more than "kutcha" buildings around the Raja's palace, and that the city was really the more important place, being walled and having a small fort commanding it, I determined to make one plan of the whole place, and, if possible, also to include the Fort of Gagrun (in Kotah) on the hills to the North of the cantonments. This fort is in reality the only position of importance in the whole situation, but I have been as yet unable to obtain leave from the Kotah Durbar to undertake it. I have written again on the subject, and hope to hear something definite on the subject soon.* The city and cantonments are now complete, but I am still keeping them in hand until I can ascertain for certain whether we can add Gagrun Fort. In consequence of the nature of the ground round Jhalra Patan, and of the distance between the city and Gagrun, nearly seven miles, I obtained leave to reduce the scale to 6″ to a mile. The cantonments are just about midway between these two places. Mr. Scanlan whilst working at this plan of the city added a few more heights in the neighbourhood.

Lieutenant Leach, R. E.
Plane tabling and supervising detail workers.

Lieutenant Leach commenced his plane table No. 150 at Nimthor H. (S. G. T. S.) on the 30th December. Nimthor, near the city of Bhanpura, is situated on the Eastern corner of the scarp. From Nimthor it runs due North. Above this scarp the country is very flat and covered more or less with jungle, necessitating traversing, giving him an area of about 100 square miles of this tedious style of work. In consequence of the grass and the thickness of the trees in the early part of the season, he confined himself at first almost entirely to the open country below, which was quite flat and highly cultivated. One section of this easy ground he gave to Mr. Knight as soon as Mr. Cornelius reported him fit for independent work. Lieutenant Leach could then closely observe how he got on with his work and was at hand in case he met with any difficulty. On the 16th and 17th of March I visited and inspected Lieutenant Leach's work in the neighbourhood of Hinglazgarh, a large old fort picturesquely situated in the jungle over a long narrow valley with precipitous sides. I found his work accurate and the ground well delineated. His outturn of 241·5 square miles by no means represents his whole season's work, for, as I have already mentioned, he had the entire supervision of the plane tablers whilst I was triangulating; he made several tours of inspection through them, besides having a considerable number of fresh boards to project and plot, so that it was not until my return in the middle of March that his time was uninterrupted. I have much pleasure in stating that he did all his work thoroughly and well, and that without his assistance to me in taking charge of the detail work and in sending me constant reports of progress, I could never have carried on my triangulation without entirely neglecting proper supervision of the rest of the party for three months.

Description of the country surveyed.

Of the country to the East of the Chambal I need not enter into a description, as Lieutenants Holdich and Leach have already described it in previous Reports. Our maps of this year speak for themselves as to the geographical features. I commenced my own triangulation from Rampura, as I have already mentioned, a G. T. Station 4 or 5 miles West of this river, situated on a precipitous abrupt scarp rising to a height of about 600 feet above the plains below. Rampura is a large town, on the site of an important Bhil city, I believe the residence of a Bhil Raja before the conquest of the country by the Rajpoots. Of the Bhil town there is scarcely a trace left, two small ruins on the lower slope of the hill being pointed out to me as the only remnants. It is now the residence of a Subah of Holkar's, having passed into his hands some years ago. A wall encloses the whole town, and indeed a good deal more, for at either end are large spaces now quite deserted, but showing signs of mud huts more or less all about them. There is still, however, a large inhabited portion with a good bazar, a great number of shops being kept by Borahs. I noticed a considerable manufacture of tulwars and knives of all sorts carried on, apparently entirely by these men. I visited the Subah there, who proved to be a most intelligent man, both writing and speaking English fluently. He was very proud of having been to England and of having spent a considerable time in London, where he seems to have been well received in society. He afforded us all the assistance he could in the matter of Vakils, &c., and I regret that he has been sent to another District, as there will be several plane tablers at work in Rampura this season.

This scarp runs nearly East and West, more strictly W.N.W. and E.S.E., to a point North of Neemuch, where the character of the hills changes. To the South the country is open and undulating, but not very fertile in consequence of the extreme stoniness of the higher parts, the vallies alone being fit for crops. Villages are pretty plentiful, and several well known towns, such as Sanjit, Mandesor, Sitamau and Nimbhera, and also the cantonment of Neemuch fall in this portion of the survey. Further West the ground entirely changed and became hilly and in places covered with thick jungle. As Mr. Scanlan triangulated over all this country I have left the more detailed description to him; it will be found at the end of this Report. For about 20 miles West of Rampura, the scarp is very regular and unbroken with only few paths at intervals up it, the better ones being accessible for camels with difficulty. For the

* Since writing the above, I have heard from the Political Agent, who states that arrangements have been made with the durbar for this survey.

next 12 miles the scarp is less marked and much broken, affording many easy roads to the northwards. There is one excellent unmetalled road through here from Neemuch *viâ* Dinkar to Singoli made by our Government before the Neemuch (Jawad) District was handed over to Scindia. After this the scarp again rises to its former height, though less steep, and there is far less jungle; but in a very short distance the character of the hills completely changes, as I will explain shortly. Immediately North of the scarp at Rampura, the country is one mass of jungle, much cut up by small valleys, all running Northwards, most of them having running streams of water, lasting all the hot weather, and flowing into the Ganjali river, which runs from West to East below the next scarp over Kuakhera and Jat, and which is at a distance of about 17 or 18 miles from and parallel to the Rampura scarp. This portion, the whole of plane table 158, is very sparsely inhabited, especially the Northern part, until you reach the strip of country near the Ganjali river, where villages are pretty frequent, and there is a good deal of cultivation where irrigation can be carried on from the river. As you get into plane table 160, to the West of this tract, the jungle becomes much less, and at Dinkar there is a considerable amount of open cultivated ground, the greater part of it being devoted to the cultivation of opium. Further West alternate tracts of stony jungle and of tolerably open country continue for the next 20 miles, until the same change referred to above takes place. Above this second scarp the same long gentle slope northwards is again found, but even more densely covered with forest and less cut up by valleys, and continues to the foot of the third scarp over Singoli. The drainage of this slope is all collected at the foot of the scarp and forms the Bamni River, which joins the Chambal at Bhynsrorgarh. The Singoli scarp is the highest of the three, the culminating points being just over 2,000 feet, the highest points of the southern scarp being between 1,900 and 1,950, whereas the intermediate scarp averages only 1,800. The bed of the Bamni River is about 1,200 feet, of the Gunjali 1,175, or nearly the same, and the open plain below Rampura is in the valleys about 1,350 feet above the sea level. The height of the bed of the Chambal River has not been as yet ascertained, but I propose to take it at a point south of Rampura, again when it enters the hills and also at Bhynsrorgarh, where it leaves our work. As I have already mentioned, these continuous and abrupt scarps terminate about the meridian of Neemuch, and the hills to the West all run North and South in more or less unbroken ridges, forming a number of small straight vallies, the widest of these being only about $\frac{3}{4}$ of a mile, and most of them less than $\frac{1}{4}$ of a mile mile in width. It is a most awkward and difficult country to traverse from East to West, there being so few passes; but from North to South almost all the valleys have more or less good roads. There is one capital track from Neemuch through Bijipur to Bassi, which passes right through these hills without any ascent or descent the whole way. To the South-West and North of this, the country is all open and cultivated with hills scattered about at intervals, but all showing the same tendency to run in ridges North and South. The famous old Rajput fort of Chittorgarh is situated on an isolated ridge to the West of these; it is about 4 miles long and at a distance of about 3 miles from them; and scarcely one in width, completely isolated, more or less precipitous on every side, and about 500 feet high. It is a most interesting place to explore, the Northern half of it being covered with old ruins full of historical interest. A detailed description of the whole fort and its history is given in Tod's *Rajastan*. It is no longer kept in repair, and consequently in many places the wall is falling down.

Difficulty of communication.

The whole country in which our work of this season lay was so divided up into small portions belonging to different Chiefs that it caused considerable trouble in procuring Vakils for every one; and as several of these small sub-divisions had scarcely any sowars to supply me with, I found great difficulty in keeping up my communications. Another cause of great delay in my postal arrangements was that men of one State objected to pass through another; the result was at times that my letters would stop at the boundary and not be forwarded for a day or two, until the men thought they had a sufficient bundle to make it worth their while to pass them on again. Do what I could, I never could make sure of this not happening, for I could never lay a continuous line of sowars or runners till quite the end of the season, when, on completion of my triangulation, I was enabled to make use of kalassies.

Notes by Mr. Charles A. R. Scanlan, *Assistant Surveyor.*

Topographical description.

The country triangulated by me lies between the meridians of 74° 30′ and 75° 30′, and between the parallels of 24° 0′ and 24° 30′, and offered to me the initial elements derivable from 15 Great Trigonometrical stations whereon to base my work; and whilst this circumstance greatly added to enhance the value of it, the nature of the country was, with the exception of an area of 400 square miles, most favorable for Trigonometrical operations, and the only obstructions I met with were offered in the Southern portion of plane table 171, and in the whole of plane table 172, not only from the intricacies of the ground, but from the people of the country. The Great Trigonometrical stations of Rampura, Nankahuaro, and Malkhera, situated on the range described by Captain Strahan, just flanked my work, and rising to an average height of about 1,800 feet above sea-level, show the country to be depressed from 400 to 600 feet below their crests. Centrically placing himself in the considerable town of Mallargarrh, the traveller sees lying before him about 20 odd miles to the north this high range; while the

towns of Barra and Chota Sadri on his West, those of Damotar and Deolia on his South-West, Partabgarh, Mandasor, and Sitamau on his South, and Rampura and Chendwasa on his East (all large and important towns), may be said to be the limits of an open country dotted here and there with low hills, which only rise into prominence in the vicinity of Rewas and the sites known as Gopalpura, Jagapur and Balagara—Great Trigonometrical stations. Otherwise, the delineation may be described to be flat and well cultivated, with a good admixture of rolling and undulating ground traversed by numerous streams; all on the East of the cantonment of Neemuch and the city of Pertabgarh, affording tributaries to the River Chambaz; those immediately to the West of Partabgarh being the sources of the small rivers which ultimately flow into the Nerbudda; whilst those on the west of Neemuch join the Birach which washes the Western base of the hill on which stands the historical fort of Chittor. Lying directly to the West of the towns of Deolia and Damotar is the hilly and jungly ground I have already alluded to, every configuration being covered with dense teak and bamboo forest, which is about as thick a specimen of such as can be found anywhere else in India, and it is in this locality that the geological structure of the country suddenly changes; for whilst the hills already alluded to run East and West, those here, with a gap of about 15 miles between them and the former, lie North and South. The open country has numerous villages of good and respectable dimensions scattered over it, with about them the usual luxuriously plentiful growth of the poppy. There are also many large towns to be frequently met with, so that on the line of march one is always sure of getting some place of importance to encamp at. But I shall not stay to describe them, nor could I do so with satisfaction, traversing the country as I am with the speed of a triangulator: that duty will devolve on the detail surveyor hereafter, but I shall reserve to myself the saying of a few words on Partabgahrh and Deolia.

Historical origin of the town of Pertabgarh and Deolia.

These two towns, separated from each other by a distance of nine or ten miles, have been made famous in the history of Rajasthan from the circumstances of their having been built in about the year A. D. 1500 by Súrajmal, the founder of the present dynasty of Pertabgarh-Deola, and uncle to the Rana Sanga of Udepur. Were I to essay a history of this principality, I should be occupying more space than the limits of this Report permit; but on a future occasion I may be able to contribute a brief narrative of it to the literature of my Department, and so, for the present, I must content myself with a hasty sketch of it. Súrajmal was the uncle of the two brothers Pirthi Raj and Sanga, the latter not only being the heir apparent to, but having been pronounced the future swayer of, the Udepur sceptre by the sibyl of Nahra Magro, with Súrajmal as a portion holder. Immediately the oracle was pronounced by the priestess, Pirthi Raj endeavoured to falsify the omen by cutting down his brother Sanga, who fled, and of whose wanderings and loves many a romantic tale is told. Pirthi Raj assisted his father Raemal in quelling many disturbances and restoring order in disaffected portions of the State. Sanga still continued to live in disguise, whilst the wily Súrajmal was concocting many an intrigue. Eventually the latter was obliged to flee, and passing through the wilds of Kanthal had recalled to his mind the augury which gave birth to these feuds, as Tod in his annals translates it—"A wolf endeavouring in vain to carry off a kid defended by maternal affection;" and then continues: "This was interpreted as strong ground for a building. He halted, subdued the aboriginal tribes, and on this spot erected the town and stronghold of Deola, becoming lord of a thousand villages, which have descended to his offspring, who now enjoy them under British protection. Such was the origin of Pertabgarh-Deola." The town of Deola now presents a sorry appearance, and as one proceeds through it, the desolation of the place at once strikes him. Bounding the narrow streets on either hand stand up high walls composed of brick, off which the plaster has crumbled and fallen. You peer into house after house, and you find it silent and desolate; only here and there is a habitation with a tenant in it, and in street after street you look up in vain at lattices to catch the eye of a dark damsel peeping with curious awe at the European intruder; nor do you catch sight of the ubiquitous and fat and greasy bania, nor of the respectable Hindu with his white coat and variegated turban, nor yet of the slim figure of the impertinent and scowling Moslem with his licentious and bravado looks, for as you thread the ramifications of the town you meet only with the peasant class; and signs of active life, such as are incidental to a large native town, are only to be met with on entering the bazar, which also holds a solemn stillness, and you feel within you, and your eye emphatically tells you, that the shadows of ruin hover over this ancient site. You go on further until you reach the palace-yard, and yet the same stillness. You go through the haunts, the courts, and the halls of a princely domain, and beyond the sleepy guard in the quadrangle below, not a soul obstructs your way. You mount the turrets of the palace and have a bird's-eye view of the whole. Around you on the North-West and South you see naught but hill and jungle, but in the East the country opens out, and you see in the far distance corn-fields stretching miles away; but you cast your eye down, and below your feet lies the town of Deola, once so busy and full of life, now so fast running into decay. Desolation marks this place as her own, and as you visit the little balcony with its many colored glasses, and fine tracery worked out in its walls to enable the princesses to view the elephant fights below, and then as you visit the chief hall decorated from top to bottom and all ablaze with the glass and gold-work peculiar to this place, you cannot but help sighing over the fleeting nature of things human. This is owing to the present chief having removed his court with all its belongings to Pertabgarh, which in itself is by no means a wealthy-looking town, especialy when on his

been through the prosperous and large one of Mandasor, about fifteen miles East, and which promises yet to become larger when the State Railway to Rutlam from Neemuch will pass by it.

Pertabgarh jewellery.

The jewellery manufactured at Pertabgarh and Deola is very peculiar and deserves a passing notice, as at present it is immensely in vogue with our ladies. It consists of all sorts of shapes of green glass in which are set grotesque figures of animals, gods, men and trees, representing hunting scenes; and from the figure of the lion appearing so often among them, we must at once conclude that here in bye-gone times this beast was common and used to be hunted. At present we do come across a stray one now and again in this vicinity, and as we approach closer to the Alpine Aravalli the chances of meeting them not unfrequently occur. These jewels are used for bracelets, earrings, and brooches, and are generally valued at from Rs. 3 to 7 each, but the prices vary according to the size of and working on the stone. The men whose handiwork these little gems are will not disclose the secret of their trade to any one, and so jealous are they of it that they will not permit their daughters to enter the rooms wherein they work, lest on marrying they should divulge it to their husbands. Some of these works of art I have seen executed on a glass of a rich ruby color, and the effect of the gold in antique styles was very pleasing. This is especially the case where several delineations of the chase, the amours of the gods, and other subjects are to be found on the walls of the reception room of the Deola palace, where the plates are about a foot in length and half a foot in breadth.

The caves of Dhamnar.

To the careful inquirer and watchful observer there are many most interesting morceaux which offer themselves for his speculation, and he has only to ingratiate himself in the favor of the lords of the country and he will be able to glean much from them. There is a great deal, too, that will interest the archæologist, and for him mines of wealth lie hidden and unexplored in Rajasthan; and when our Archæological survey enter these fields they will stumble on many a record of antiquity which will serve to throw additional light on the ancient history of the Hindu family which was cradled and reared here. I shall now proceed to describe the caves of Dhamner as I found them, without venturing my personal opinion as to their origin, being thoroughly ignorant of such matters. The hill on which these troglodyte dwellings are situated is the site of a station of one of the Great Trigonometrical Survey, and also of one of our 1st class secondary points, the latitude and longitude of the former being 24° 11′ 37″ and 75° 32′ 27,″ and near which only about 30 feet off to South-West lies the principal temple which is very nearly the centrical situation of the two hills wherein the excavations are. The elevation of the station is 1,591 feet above sea level, and about 200 feet above the surrounding country. Tod describes the rock of the hill to be a cellular iron clay so indurated and compact as to take a polish. I will quote him a little further: "There are traces of a city, external as well as internal, but whether they were contemporaneous we cannot conjecture. If we judge from the remains of a wall, about 9 feet thick, of cyclopean formation, being composed of large oblong masses without cement, we might incline to that opinion, and suppose that the caves were for the monastic inhabitants, did they not afford proof to the contrary in their extent and appropriation." Our author has so fully and perfectly described these curious dwellings, that I shall not dare to offer on the opinions he advances a single one of my own. I shall leave it to General Cunningham and his colleagues to discover whether Tod is right or not; but I lean to the opinion, that whilst they will perhaps be able to add much to what he puts forth, they will certainly not be able to take aught from it. This able and piquant historian, writing almost with the grace, fluency, and retentive memory of a Macaulay, visited these interesting ruins in 1821, whilst I had the fortune to do so 53 years later. I find some of the idols and a few objects he speaks of missing, notably the only few isolated and undecipherable letters he came across; and with the exception of one slab which had the remains of one or two letters on it, I found nothing after a very careful examination to give me even an idea of a once existing inscription on any spot on the surfaces of the multitudinous caves. I am of opinion that something could be gleaned regarding this curious locality if extensive excavations were made, and I am sure that the patient seeker would meet with a rich reward. I do not think much opposition would be offered, and if any were, it could be overcome by the good offices of the Political Agent. There is here a garrulous old fakir who is the only human tenant of the place, and has as his companions many hyænas and a tiger or two. He told me as the place was still the site of an annual religious meeting, it was of course still sacred; and as he was the sole authority there, he would not object to a search being made, provided that if any wealth turned up, he would have half of it. The tops of the hills are flat, and in an excavation cut into the pure and solid rock, 30 feet deep, 100 feet long, and 66 feet broad, stands the principal temple, whose summit rises flush with the surface of the hill. I descended by a flight of steps in its north-west angle: this flight embraces the Northern face of the hollow, and so leads to the base. The temple faces East, and in each of the four angles of the excavation stands a temple, whilst immediately to the back or the west of our principal shrine is another minor one; and also one other at its Northern and another at its Southern face. All these hewn out of the massive rock are of Jain architecture. They are not built, nor does there exist a single seam or disjointed stone to show that they have been so formed. Entering the portal of the chief temple, a passage leads to the sanctum sanctorum, and we see the god Mahadeo, formed of a small block of cylindrical stone, the emblem of procreation. Looking down on him from the face of the wall sits the four-armed deity

Chattarbhuj. In his right hand he holds a baton or gattka; in his left hand a chakar or circle; in the lower left a conch or sank; whilst his other right hand is empty. Entwining their coils over the shins of his legs and appearing from behind are two serpents, nags or cobras; he is surrounded by other images of various forms, and stands about three and half feet high and has a sun refulgent at the back of his head. Four pillars, two on either hand, form the central supports of this massive and colossal structure. On either side are two wings, in each of which is a massive window 5 feet deep, 5 feet broad, and about 6½ feet high; little port holes, 14 in number and of an octagonal form, let in the light through the rock curtain of each window. The middle passage is 28 feet long and 6 feet broad; the two wings being 18 feet long and 5 feet broad. In the eastern extremities of each of these wings is a niche; one is simple, the other has in more recent times been made into a recess, and has engraved on the stones used to form it the god of learning, Ganesh or Ganpatti, showing this addition to be of the Shivite period. In fact, there can be no doubt about it that originally this place was dedicated to the worship of Buddha, and in more recent times changed hands with the votaries of Shiva. The roof of the temple is cut into large leaves and petals, and here and there peeping out among them are small images. The entrance to the sanctum is decorated with an elaborate scroll work of flowers and images, showing men playing the drum, and women in dancing positions and amorous attitudes. In the sanctum itself occupying the centre of the floor is Mahadeo, and as before described, Chattarbuj or Vishnu, moulded apparently out of a finer description of rock than that which is characteristic of the rock of the hill. The roof of this chamber is again cut out in form of leaves, petals and flowers, meant no doubt for the lotus. The south-west temple is empty, as also are those occupying the north-west, the south-east, and north-east corners. When Tod visited them, they all had some gods set up in them. Near the shrine in the north-east corner is a well excavated to catch the rain. The temple to the North contains nine avatars or deities, whilst in the one to the West, Narriana reclines on a serpent monster, with a baton in his upper right hand, and in the lower one apparently a flower with the goddess Lakshmi composedly sitting at his feet. A tiara or crown is suspended over his body; and his left hand being broken, it is impossible to decipher what it grasped. His body is enveloped in the folds of a hydra, which is supported on the heads of human forms, male and female, playing on the tabor, the flute, cymbals, and the lyre. There are some other figures in an excited and fighting attitude at the feet of, and on the same level as, the god. All the effigies in the relievi are naked. On the southern face of the scarp of the excavation containing the temple is cut into the rock a dwelling for the resident priest.

Leading to the East of the temple, we stand under a porch still formed out of the pure rock about 20 feet broad, long and high, surmounted by a solid body of rock of about the same cubical measurements. This has also two niches on its southern and northern faces containing images of Bhainro and Devi, respectively. Passing out of this portal we immediately issue into an extraordinary passage in its entire length cut out of the virgin rock. Its total length is 252 feet; it is 12 feet broad and 30 feet deep. At the 146th foot, a bridge, part and portion of the faces of the passage, surmounts it; and here the outlet begins to widen, for we find the bridge to be 18 feet long. At this point this gallery deflects at an angle of about 30 degrees from the east towards the south; and at a distance of 60 feet we stand under another bridge and in another portal, passing out of which, 46 feet more bring us to the end of this strange excavation, and to the beginning of a slope which leads over the last-mentioned bridge to the site of the temple which I have just written off. On the south face or scarp of the hill on which this temple is situated lie the caves, which are still in a semi-state of preservation, and which appear to have been the principal ones, for these excavations are to be found on every aspect of the scarps of the two hills, but all the others, from the action of the weather and other causes, have crumbled away, and huge masses of rock at the bases of the hills show where lie the fragments of these once inhabited dwellings. In one of the apartments of these curious temples we come across gigantic figures, some sitting, some reclining, and some standing, varying in heights. The recumbent one, supposed to be the representation of a dying Jain pontiff, is 14 feet in length. Throughout we notice supporting the roofs, some of which are vaulted and ribbed, emblematical figures, whose base is square, and standing on the latter the shaft of a pillar, which is surmounted by a globe from which proceeds a continuation of the shaft till it reaches the roof, and all these, some huge and some moderate in size, are, like the rest of every other feature on this hill, chiselled out of the rock. Tod styles these supports dhagops, which are all named after the sacred mounts of the Jains. Some of them now stand looking up to the vault of heaven, in dire contradiction of the creed they were meant to illustrate, for their roofs in all probability crumbled away centuries ago. The most extensive excavation locally known as Raja Bhim's Bazar contains a central structure, supported by one of the above described dhagops, and is surrounded by several little rooms, in which we find sitting cross-legged the figure of Chandra Prabhu, and the hole made by the thief Koria Chor who robbed the Pandevas of their kingdom, is still pointed out in the vault of the treasury by the anchorite cicerone. The tree described by Tod is in existence and protrudes out of the rock; it shoots upwards to a height of about 15 feet, then twists itself out of a portal to a length of about 20 feet, and then normally sends its branches forth vertically, and is a flourishing and sturdy old fellow. The entrances to the caves all bear signs of once having had attached to them wooden doors and posts. There are many underground and dark passages. I came across one, but as it was inhabited by a tiger, my spirit of curiosity was not sufficiently strong to induce me to enter it. I am of opinion that these

passages lead into large and spacious subterranean vaults, all connected with one another, and it would, I think, be worth while to explore them. I noticed the remains of an old masjid or Mahomedan place of worship on the hill. But it is only of very recent date, and was most probably erected by some Mussalman in gubernatorial authority under the fanatical and iconoclastic Aurangzeb; and no doubt, no sooner the power of the Holkars was fully re-established, the masjid fell into disuse, and here were heard no more the azans of the Moslem. Such other trogdolyte dwellings are to be found elsewhere in this part of the country; but not having visited them, I cannot say whether they are of the same period architecturally, or formed by men bowing to the same gods as did the ancient inhabitants of Dhamnar. Passing over the traffic, products, roads of communication and such other details which the plane tabler will have more time to enquire into and describe with greater accuracy, I shall close this sketch by narrating what might have been a serious *contretemps* between me and the Bhils of Gangia-ka-Pal.

The Bhils of Gangia-ka-Pal.

It was with no little difficulty that I managed to get into this stronghold, and since the site of the station marked as Gangia-ka-Pal is a *sine qua non* in forming the net work of my triangulation, the necessity was paramount that I should leave no stone unturned to get into this fastness, and to ensure the friendly co-operation of these men, for without their aid it would have been impossible for my heliotropers to have occupied the hill, situated as the spot is in a howling wilderness: and I am certain without such co-operation they would not have permitted my men to remain there. Long ere I came into the vicinity of this locality, its notoriety had reached my ears, and I had over and over again been cautioned to be particularly careful when visiting it; but relying on the prestige of our Government, I entertained the fond and, perhaps, plausible idea that no sooner should I approach this den and amicably explain my purposes, then I should be received and admitted with the same frankness and cordiality with which we are generally greeted all over the country. Having, as I thought, no further need of his help, I had dismissed my Pertabgarh vakil (or agent from that Court) who was replaced by one from Udepur. But as I afterwards learnt this place was in the Pertabgarh principality, I immediately despatched a messenger recalling him, *ad interim* reconnoitering to the West and North-West of this *locale*. On my return to my camp, from which I had been absent two days, I found the vakil had not arrived, and as time was precious, I forthwith ordered a march into the Pal, adopting the precaution of enlisting the services of the Bhumia Thakur of Dhariawad, and as he so readily had proferred them, I accepted them. But it was rather a *faux pas* my taking him. A *Pal* in the parlance of the Bhils means a collection of habitations scattered over an area of perhaps three and four square miles, or more, all bearing the same name, which is that of the headman, similarly as the tents of a body of Banjaras are collectively known as the *Tanda* of such and such a naik. The Thakur had undertaken to precede me, and so I thought all was square; but no sooner did I break into sight on my elephant, than the angry and vituperative shrieks of women assailed my ears, together with the alternating low murmurs and up-raised voices of an angry crowd of men, who, armed with guns, swords, bows and arrows, in the space of a few minutes, confronted me. Expostulation was in vain; to get a hearing impossible. They shrieked and yelled, swore and abused, and imperatively gave us our walking ticket, which we were obliged to accept with all the grace at our command. I am convinced that the slightest indication on our part to make our conduct one of *sauve qui peut* would have formed their minds, and they would have made a closer acquaintance with us than they did. We had not gone far on our return journey when they fired volley after volley to proclaim our defeat, but it was not till afterwards that I learnt they fired in our direction and sent after us such strong arguments as leaden bullets. But as we were well out of the reach of their guns, we were in blissful ignorance of the compliment which had been paid us. I marched into Chitoria quite crestfallen, and my chagrin was great when I thought of the many variations the people would play on the unfortunate chord which I had struck. At about 8 o'clock at night, whilst I was chewing the cud of resentment, my Pertabgarh vakil arrived, and next morning he started for the Pal, accompanied by a trustworthy khalasi of mine, to bring me in an ungarbled statement of what might occur. They were received in precisely the same manner as I was, if anything warmer, as, anticipating my early return, the men of the Pal showed a front of all their braves. At seeing the vakil and his accompaniment they clapped their hands to their mouths and set up their peculiar howl with cries of mar, mar, thirre, thirre, fire, fire, scatter, scatter. For an hour the sword of Damocles hung over the heads of this plucky band of five men; until at last the youngest brother of the Chief Rama recognised an old Pertabgarh sepoy; he gave a magical whistle; every sword was returned to its scabbards; bows were unstrung; and signs of a friendly greeting began to appear. It was then explained that the whole front and root of their conduct arose from the Thakur accompanying me, and as in these parts every man's hand is against his neighbour, so they concluded that the Thakur had brought a Feringi back with a force to avenge the wrong which this clan had inflicted on him. The vakil returned late that night with two brothers of the Chiefs, and next moring I marched again for the Pal. But so suspicious were these men of my intentions, that though they sent the two brothers to me, yet they had an idea my motives were not amicable. I had scarcely gone beyond the precincts of my encamping ground when I was joined by three or four men, and by the time I got into the Pal I had quite a little host of these free-booters about me—clearly showing that they had silently taken up a position near my camp the preceding night immediately to release their Chiefs or avenge them if I attempted aught with them. When in their fastness I was at once

struck with the absence of the women and children, when I discovered them in their black skirts with the aid of my binoculars hidden in the surrounding forest, and when I got close up to the council chamber, from on top of my elephant, I saw its yard crowded with men ready for an affray. But I had not been ten minutes with them ere we were very friendly, and a perfect understanding had been established between us. It is no exaggeration to say we must be very guarded in our dealings with these wild tribes. There are Pals ahead which are spoken of as being more unruly than the one in which my experience has been gained. With a firm will and a kind and courteous deportment we shall effect our purposes; but these men are very suspicious, and on no account must we ever permit their suspicions to get the better of them; for, if they once distrust a man, nothing will induce them again to approach him or do aught for him. Their character has been fully explained to me by the thakurs or lords of the soil; they have given me illustrations in many anecdotes, and it will be wise for us to profit by the admonitions we may thus opportunely get. I have already taken up two much space, and so am precluded from writing on other interesting topics, which I hope I shall be permitted to do in my report for the ensuing season.

Extract from the Narrative Report of F. B. GIRDLESTONE, Esq., *Deputy Superintendent in charge of No. 2 Topographical Survey, Khandesh and Bombay Native States.*

On the Perbudda.

The area partially triangulated and finally mapped during last field season embraces portions of Holkar's territory, Dhar, Burwani, Scindia. The Dewas Rajah's and the several Bhumias or Bhil independent Chiefs in Nimar and Holkar's and Scindia's territory, Dhar and the British Pargana of Manpur in Malwa.

The territory styled "Bhoomiahs" belongs to three Bhil Chiefs who reside at Nimkhera, Jamnia, and Rajgarh. They own, respectively, the parganas called Hindola, Jamnia (also known as the 47 paras), and Rajgarh. These men are entirely independent of all the other States, but are under British protection, and their estates are under the guidance and supervision of the Officiating Bhil Agents at Manpur and Dhar.

These Bhumiah estates are situated on the slopes of the Vyndhias in the midst of very wild and rugged country. They are entirely populated by Bhils. The sunnuds conferring their titles to those estates were given by Sir John Malcolm, many years ago, on the understanding, I believe, that the main passes from Malwa to Nimar were to be protected by the Bhumias, or in compensation, perhaps, for the plunder they used to take from travellers going up and down the same. These Bhumias held great authority and influence over the Bhils.

The following table shows the parganas of the different Native States which have been wholly and partially surveyed by No. 2 Party up to date:—

Completed Holkar's.	*Incomplete Holkar's.*
Amláta.	Barúr.
Bávi.	Chikalda.
Bárwai,*	Cheinpúr.
Bagdhárá.*	Jellalabád.
Balakwárá.	Khargún.
Bamangáon.	Nángalwári.
Bhamnála.	Súngur.
Bhikangáon.	Sarisgar.
Dhargáon.	Sendwá.
Diúlá.	
Hasora or Indora.*	
Haselpúr.*	
Jám or Indore.	
Kásráod.	
Koselgarh.	
Kurgáon.	
Lawáni.	
Múhesár.	
Mundi.*	
Mardána.	
Pasalia or Indore.*	
Sanáwad.*	
Un.	

Completed Dewas Rajah's.
Bagoda.*

Completed Dhar.	*Incomplete Dhar.*
Bálkhar.	Kukse.
Dhár.	
Dharampúri.	
Gújri.	
Mándo.	
Nálcha.*	
Tikri or Sultanabád.	

Completed Scindia's.	*Incomplete Scindia's.*
Amjhara.*	Balwári.
Bákaner.	
Dikthán.*	
Manáwar.	
Piplia.*	

Completed Burwani.	*Incomplete Burwani.*
Anjer.	Burwáni.
	Páti.
	Rájpúr.

Completed Bhoomia.
Hindola* or Nimanpúr.
Jámnia.

Completed British.
Beriá.
Mánpúr.

Remarks on the country finally mapped this season.

Most of the tract mapped this last season has already been described in my two previous annual reports. The chief feature in the season's work is the great range of the Vyndhias, which extends like a great wall from East to West through standard sheets Nos. 8 and 9, and whose Southern edge forms the boundary between Málwa

* Signifies that a portion of this pergunnah has still to be surveyed by No. 5 Topographical Party

Nimár. This range where it enters the eastern limit of standard sheet 10, stands 2,059 feet above sea level or 1,737 feet above Nimár, and 540 feet above the Málwá plateau; between this point and Lalgárh which is on the western edge of sheet No. 9, the range falls considerably, as there its height is 1,796 feet above sea level or 1,150 feet above the plains of Nimár, and little, if anything, above the average height of the Málwá plateau. In this distance of 60 miles there are several high peaks standing on, but well above, the main range; thus there are the well known hills of Dhajárá, a sharp peak in plane table 10 which = 2,676 feet, Singarcháori in plane table 11 = 2,885 feet, Mándogarh in plane table 12 = 2,205 feet, Mograbá in plane table 12 = 2,456 feet, and Arvaili in plane table 11 which = 2,162 feet.

The Vyndhia range falls to the level of the Málwá plateau by long and easy slopes, but to the plains of Nimár the descent is most precipitous. There is a scarp of over 300 feet in height right along the southern face, except in the valleys where the Káram and Mán rivers burst their way through towards the Nerbuddá. All traffic by carts and laden animals is impracticable except by the routes along these rivers. The ground near the fall of the Málwá plateau to the plains of Nimár is everywhere very wild and rugged, and the deep gorges through which the rivers and streams generally run make it a difficult matter to travel about the country. On the Málwá plateau are many isolated hills averaging 300 to 400 feet in height. Below the range in Nimár the ground slopes to the Nerbuddá by a series of undulating plateaus covered with high grass and jungle.

Rivers.

The largest rivers met with were the Chorár in plane table 10, the Káram, Ajnár, and Mándáodi in plane table 11, the Khúj, Mán, and Deláori in plane table 12, and the Deb and Borár in plane table 16. All these rivers flow into the Nerbuddá and take their rise from the Málwá plateau. The great watershed of Málwá is a high ridge, which breaks off from the main range of the Vyndhias, 2 miles to West of Jám in plane table 10 and runs thence in a North by West direction 3 miles east of Mánpúr, and from thence in a northerly direction to a few miles west of Indore. From a flat plateau called Jánápáo on this chain, five large rivers take their origin, the Chámbál and Nákheri flowing to the North into the Ganges, and the Chorar, Kárám, and Gamni south into the Nerbuddá. At this spot a large temple has been built, and it is a great place of pilgrimage from all parts of India. Jánápáo is about 6 miles south-west of Mhow and 5½ miles from Mánpúr on the Agra and Bombay road. The temple on the hill is 2,798 feet above sea level. The Konti and the Bedá rivers drain all the tract surveyed in plane tables 2 and 3. None of the above rivers are navigable, though there is always a considerable amount of water in them even in the hot season.

Nerbuddá river.

The heights of two stations in the bed of the Nerbuddá river have been very carefully determined. The one is the base of the masonry telegraph tripod in the centre of the river ¾ miles East of Mortakka in plane table 1, which is 509 feet above mean sea level. The other is close to East of Kheri village in plane table 17 in $\frac{\text{latitude } 22^\circ\ 4'\ 50''}{\text{longitude } 75\ \ 0\ \ 28}$, which is 362 feet above mean sea level. The distance between these two marks taken along the bed of the river = 73·5 miles, which gives 2 feet as the average fall per mile.

Ferries.

In addition to the ferries over the Nerbuddá named in paragraph 44 of my last Narrative Report, the following have been noted in this season's work, *viz.*, a bridge of boats between Mortakka and Kheri in plane table 1:—

Ferry	Kotár	and	Elsúr	in plane table 1.	
„	Mota Alli	„	Murála	„	
„	Toksar	„	Súnala	„	
„	Datwárá	„	Wurdáná	„	17.
„	Chota Barda	„	Semaldhá	„	
„	Nalwai	„	Ratwa	„	
„	Aoti	„	Ekhalwára	„	
„	Piplúd	„	Gangli	„	

Tanks.

There are 13 large tanks in plane table 12, *viz.*, one at Salkanpúr, one at Pandrika, one at Miapúrá, two at Nálchá, two between Nálchá and Mándo, and eleven on the Mándo plateau, of which those called Datthobán and Ságar are large sheets of water. There are also large tanks at Choli in plane table 11, Kánjer and Sundreil in plane table 2, Jetwai and Jám in plane table 10, and at Singáná, Anjer, Wáil, and Ajendi in plane table 17.

Rivers of Mándo.

Mándo, the capital of ancient Malwa, in $\frac{\text{latitude } 22^\circ\ 20'\ 50''}{\text{longitude } 75\ \ 26\ \ 25}$ and 1,948 feet above sea level, fell within the season's work. To those who do not mind a 30-mile ride from Mhow over bad roads but through well-wooded and cultivated country, the ruins of this large and picturesquely situated city will ever repay the toil and trouble taken to reach them.

The city, whose walls as measured from the field maps are just 30 miles in circumference, stands on a plateau about 8 square miles in extent. This plateau is really a peninsula of the table land of Málwá, from which it is separated by a valley some 200 feet in depth and 300 yards in breadth. On all other sides the plateau is surrounded by precipitous hills. To the

South the Vyndhias completely bar all access, for they there drop to the plains of Nimár by a precipitous wall of 1,254 feet. Indeed, the only access to the outer world from this city was by the five gates called the Delhi gate, the Tarapur gate, the Bagwániá gate, the Jehangirgarh gate, and the Rámpúr gate. Paved roads have at incredible labor and expense been made from the gateways to the plains of Nimar below. Portions of these are still in good order; abundance of water, rich soil, and salubrity of air, together with the natural strength of the position, are probably what caused Mándo to attain its state of great prosperity. The enormous mass of ruins of palaces, tanks and temples, and of towns and villages all round prove that the city must have attained such. For three and half centuries indeed it was the residence of kings and their vast armies, and it was only when these were destroyed and scattered by constant wars that the tradesmen left the place and sought other marts for their wares. The remainder of the townsmen and camp followers then formed themselves into predatory bands, and became notorious afterwards as "Pindharees" and gradually the city became deserted. Mándo, once the mart of merchandise, the place of skilful artizans and the abode of the wealthy, learned and religious, and the stronghold of potentates, rapidly became the refuge of robbers and wild beasts.

Inhabited now by a few wretched Bheels, the ruins are rapidly going to decay. The roots of the pipul trees which are everywhere growing amongst them force the stones asunder and rapidly level to the earth these splendid architectural remains; in every direction are seen rank vegetation and tottering ruins, and amongst these, where stately courts were once held, and audiences given to ambassadors from all parts of the world, wild animals now roam and make their homes.

The following buildings are well worthy of a lengthened visit and inspection:—

1*st*, the Jumah Musjed, a large rectangular shaped building with pointed gothic arches surmounted by a dome; 2*nd*, the Jaház Mahal or water palace, which to my thinking is most exquisite both in design and situation. It is surrounded by large lakes and noble trees. From its upper terraces there is a magnificent view over the whole plateau. This lovely palace is almost buried in rank jungle, and its lakes are covered with wild fowl. Time, however, has dealt gently with the masonry, and the terraces and walls are still in a fair state of preservation, though on all sides their appearance from the grown up jungle and weedy morrasses and perfect silence is most sad and desolate; 3*rd*, the Hindola Mahal; 4*th*, the Taweli Mahal; 5*th*, the Champá Bouri; 6*th*, the palace of the Sultan Báz Báhádúr and pavilion of Rupmati his Queen, from the terraces of which the views are most lovely, and superior in extent and beauty to any other at Mándo; 7*th*, the marble mousoleum of the Sultan Hosein Shah Goree; 8*th*, the Delhi gate. This was the chief gateway from Mándo towards the north, and of considerable height and depth. The top has nearly all fallen in, but it is still worthy of a visit on account of its beauty of construction. From this gateway the road runs along what was the main street of the town, along which there are many large ruins visible.

Towns.

Mánpúr, in latitude 22° 25′ 52″, longitude 75° 39′ 46″, height above sea level 1,998, population 1,257, was the most important town met with this season. It lies on the high road from Agra to Bombay, 12 miles from Mhow, and 3½ miles from the south edge of the Málwá plateau. It is the principal town of the British pargana of this name, which contains 37 villages in all. The Officiating Bhil Agent who has charge of Mánpúr, as well as the supervision of the various Bhumia territories, has his residence here. There is a court house, school, dispensary, and police station in the town, which has every appearance also of being thriving and flourishing.

Bárwái.

Bárwái, in latitude 22° 15′ 19″, longitude 76° 4′ 57″, height above sea level 629, population 3,796, souls is the capital town of Holkar's pargana of this name in Nimar. There is an extensive trade between this place and Mandlesar, and so soon as the State Railway from Khundwá to Bárwái is opened, as expected in two years' time, this traffic will no doubt considerably increase, especially if a metalled road is made, as His Highness Holkar now proposes, between Bárwái and Mandlesar, Máhesár, and Gujri. Such a road is greatly wanted in order to carry off the produce of the very rich tract of country lying along the Nerbuddá. Cotton, wheat, and opium thrive greatly there, and large quantities would leave the province were this route only opened out.

Mota Mortakka.

Mota Mortakka, in latitude 22° 13′ 17,″ longitude 76° 5′ 22,″ height above the sea level 566, with a population of 244, souls, is a large and thriving place on the banks of the Nerbuddá. This is the chief town in the pargana of the name forming part of British Nimàr. Being at present the terminus of Holkar's State Railway and the site where the bridge for the same is now being built to cross the Nerbuddá, and there being several thousand temporary laborers employed thereat, it has a thriving and busy appearance. There is a school, court house, police station and dispensary here, and the tehsildar of the pergunnah also resides here.

Nalcha.

Nalcha, in latitude 22° 25′ 18,″ longitude 75° 27′ 15,″ height above sea level 1,905, with a population of 1,188, souls is a large village belonging to Dhar, beautifully situated in well-wooded country 24 miles West-South-West of Mhow. The whole of the surrounding neighbourhood is perfect

strewn with architectural remains. There is also good shooting, both big and small, round this place.

The following were the only other places of importance met with :—

Town.	State.	Latitude.	Longitude.	Height above sea, &c.	Population.
		° ′ ″	° ′ ″	feet.	souls.
Bhikangáon ...	Holkar ...	21 52 7	76 0 26	940	183
Cheinpúr ...	Ditto ...	21 42 46	76 2 15	1,030	152
Choli ...	Ditto ...	22 15 0	75 42 45	721	630
Haselpúr ...	Ditto ...	22 29 15	75 40 34	1,900	1,000
Jám ...	Ditto ...	22 21 45	75 47 5	2,180	.....
Lawáni ...	Ditto ...	22 18 47	75 21 42	889	149
Singána ...	Half Dhár ...	22 11 26	75 0 47	569	1,045
Bákaner ...	Scindia ...	22 11 0	75 12 8	485	496
Khal ...	Dhár ...	22 9 25	75 29 40	499	702
Manáwar ...	Ditto ...	22 13 56	75 7 46	659	2,597
Anjer ...	Burwáni ...	22 2 20	75 5 49	550	2,000
Ganwáni ...	Dhár ...	22 20 22	75 2 40	842	713
Khúrampúra ...	Ditto ...	22 1 18	75 23 14	667	227
Tikri	Ditto ...	22 3 42	75 26 35	640	844
Tonki	Ditto ...	22 15 15	75 9 20	703	269
Nimkhera... ...	Bhumia ...	22 26 27	75 14 8	1,464	79
Gújri	Dhár ...	22 19 14	75 32 53	752	.....

Bazars.

Bazars are held weekly at Nálchá, Bargúnda, Tikri, Dawána, Khúrampúrá, Bhikangáon Kanjersiuna, Bamjher, Chirwil, Bákaner, Manáwar, Datwára, Bárwái, Mota Mortaka, Anjer, Singána, Ganwáni, Mánpúr, Gujri, Haselpúr, and Jesarnagar.

Schools.

There are schools at Nálchá, Tikri, Manáwar, Bákaner, Mota Mortaka, Anjer, Mánpúr, Gújri, Surána, Mandwárá, Cheinpúr, Haselpúr, and Jesarnagar.

Police Stations.

Police stations are kept up by Holkar at Koselgarh, Bhikangáon, Cheinpúr, Barwái, Singána, Tonke, Haselpúr, and Jesarnagar, by the Dhár State at Nálchá, Gújri, and Mándo, by Scindia at Bákaner, Manáwar, and Ganwáni, and by the Bhumia chiefs at Rampúr, Dhál, Kankárdá, and Nimkherá.

Inhabitants.

The slopes and plateau of the Vyndhias are entirely peopled by Bhils. Unlike the residents of the plains, they have no regular villages, but live in isolated huts. These were found to be so numerous, that it was impossible to show them all on the field sections. Only therefore the hut or clusters of two or three huts, where the "Tarvi" or head man lived, have been laid down. The reason of their isolating themselves in this way appears to be so as to enable each man to have his patch of cultivation at his own door, instead of having to take himself and his cattle a daily distance to the same, and to prevent quarrels with their neighbours, to which they are very prone when intoxicated, as they often are. These Bhils of the Vyndhias are all cultivators; they also all own cattle, and are far better of both in physique and condition of life than their brethren in the Sátpúras, who go by the same name. They are a contented, happy and humerous race, and work well enough so long as they are sober, but are easily provoked and very troublesome to deal with when at all the worse for liquor, as they constantly are. They get drunk at all their festivals and remain for days in this condition, especially during the "Holi."

They are all armed with bows and arrows, both men, women, and children, and are good shots with these weapons. I used to meet whole strings of them thus armed on bazaar days when they take down jungle produce from the hills to sell or exchange for flour or ghee, and I was much struck with their open, hearty manners and humerous disposition. They take readily to Europeans, especially if they see that the latter care for sport, but it is seldom that any one goes into their country, so difficult is it of access.

Holkar's State Railway.

About 15 miles of this railway, or the portion between Balwárá and 3 miles South-East of Mhow, fall into the area surveyed this season by Mr. Wyatt in plane table 10. The ascent between these two places is 953 feet. The line takes a considerable detour to the North-West 3 miles away from Balwárá, in order to get the gradient of 1 in 100. It then runs parallel to the Mhow and Khandwá road as far as Chorar chouki, where it crosses the Chorar river and runs parallel to it and on its right bank nearly to the foot of the Bagorá Ghát. There are 5 miles then of very heavy tunnelling and other engineering works before the head of the Ghát near Bagorá is reached. Most of the bench marks along this railway have been laid down in the

maps of No. 2 Topographical Party, and the spirit level heights of the same agree well with the trigonometrical ones.

		Feet.	Feet.
Thus No. 16 bench height ...	By spirit level	= 1,111	
	„ trigonometrical value	= 1,135	diff. 24
„ „ 14 „ „ ...	By spirit level	= 1,098	
	„ trigonometrical value	= 1,088	„ 10
Bed of Nerbuddá river at Mortakka	By spirit level	= 507	
	„ trigonometrical value	= 508	„ 1
Bhanbardi B. M.	By spirit level	= 1,278	
	„ trigonometrical value	= 1,271	„ 7

There are many thousand men employed on the making of this line at present, but there is still a very heavy amount of work to be done on it, especially on the Chorar valley and Ghát section, before it can be opened to the public.

Roads.

Portions of the Agra and Bombay trunk road between Mhow and Khúrampúrá by the Gará Ghát Pass down the Vyndhias came into the season's work in plane tables 11 and 16, also a portion of the Indore and Khundwá road between Bárwái and Mortaka and Dhangáon and Dhorwá in plane tables 10 and 1. Also the made, though not metalled, roads between Dhár and Mánpúr, Dhár and Gújri, in plane tables 11 and 12, Mhow and Mandlesar *viá* the Jám Ghát in plane table 11, and a portion of the Rájpúr and Burwáni road between Talwárá and Talund in plane table No. 17.

The following are also good fair-weather roads, quite practicable for country carts:—

In plane table	1	Bárwái	to	Mandlesar.
		Dhorwán	to	Beria.
„	„	2	Khargún	*viâ*	Bhikangáon.
			Chirwil	and	Khundwa.
		Bhikangáon	to	Cheinpúr.
„	„	1	„	to	Sundrel.
„	„	3	Cheinpúr	to	Mitáwál.
			„	to	Bhamnálá.
			„	to	Mahomedpúr.
			„	to	Khargún.
			„	to	Sirsúd.
„	„	11	Gújri	to	Múhesar.
„	„	12	„	Lawáni	to Manáwar.
„	„	„	Múndo	to	Lawáni.
„	„	13	Amjhira	to	Manáwar and thence to Anjer.
„	„	„	„	to	Ganwáni.
„	„	12	Dhár	to	Dharampúri.
„	„	16	Mahesar	to	„
„	„	„	Bakaner	to	„
„	„	„	Tikri	to	Anjer.
„	„	17	Kukse	to	„
„	„	22	Mahomedpúr	to	Pal.

In fact most of the bigger villages or places where the "Kamasdars" reside are joined by rough country roads.

Notes on Mahesar Fort, by F. B. GIRDLESTONE, Esq., *Deputy Superintendent in charge, No. 2 Topographical Survey, Khandesh and Bombay Native States.*

Geographical situation.

This fort is situated in latitude 22° 10′ 14″ North, longitude 75° 37′ 44″ East, at the south-east corner of the city of the name belonging to His Highness Holkar in Nimar, on the left or north bank of the Nerbuddá river, and 766 yards to west of the junction of the Mahesri stream with the same. In a direct line it is 29 miles South-South-West of the British cantonements at Mhow, 27 miles West-South-West of Bárwái, the nearest railway station on the narrow gauge state line from Khundwa to Indore, and 53 miles West-North-West from Khundwa on the Great Indian Peninsula line.

Description of Fort.

2. The fort does not appear to have been built for offensive operations, but was constructed chiefly by Ailiabái, Queen to Kundirao Holkar, more as a residence for herself and courtiers. The foundations were commenced in 1780, and the last stone put to the present walls (which, however, are still incomplete on the southern face) in 1795.

3. As it stands at present, the fort is an irregular figure covering 33 acres of ground and occupies a natural elevated site 106 feet above the bed of the Nerbuddá river. The mark stone cut by No. 2 Topographical Party in the centre of the flat roof of the high water

tower built over what is called the "Gurhi Gateway" is 599 feet above mean sea level, and 146 feet above the base of Banesar temple, which is about the normal level of the water in the Nerbuddá during the cold weather.

Approaches.

4. The approaches to the fort are by two paved and very steep causeways on the north-west and north sides, at the top of which are gateways, inside each of which sentries are placed. Both these approaches into the fort are passable for wheeled traffic. The gateways are surmounted by watch towers which are loopholed for musketry. The passage through the gateway is about 12 feet wide.

Walls.

5. The fort walls occupy a length of exactly 1,500 yards. There is, however, a gap of 300 yards on the southern face still unfinished, which His Highness Holkar, it is said, is intending shortly to build up. The walls follow the shape of the elevated plateau on which they are built. To the north-west and north their summit averages about 40 feet above the level of the surrounding ground, and about 70 feet above that of the main part of the city. To the East they are 131 feet above the bed of the Máhesri stream; and to the South about the same height above that of the Nerbuddá. The actual height of the walls averages about 40 to 50 feet, and their thickness 12 feet.

6. On the north-west side the wall is supported by another solid lower one, of 11¾ feet thickness. This is really a buttress to the upper one. There is an upper parapet to the walls 4¼ feet in height above the flat terrace which is 9 feet in width. This parapet is loopholed for musketry right round the fort. The musketeers would be well sheltered by the 3 feet thickness of the same.

Outer works.

7. There are no outer works, such as moats or ditches, or smaller fortifications of any sort.

Bastions.

8. There are 13 bastions to the fort. On three of these at the north-west, north-east, and south-east corners, there are circular masonry platforms, on which very large guns could be placed. The diameter of these at their base is 49 feet, and at their summits 30 feet. These are the main points of the fort which are intended apparently to be fortified, though there are no pieces of ordnance mounted on them at present, the guns on each of them would command the intervening length of wall or curtain between it and the next platform.

Whether commanded from other positions or not.

9. The position of the fort is well chosen. It commands the whole city, and is not overlooked from any higher site within 1¼ mile distance. The walls are all of very solid masonry, which is probably in as good condition now as ever it was. Both the stone and mortar appear to be of first-rate and durable quality.

10. The nature of the fort defences in the plan point of view is simply to prevent troops scaling the walls, or even approaching them within a distance of 1 to 2 miles, as the heavy ordnance on the 3 gun stands would completely destroy any force making such an attempt. They are not commanded by other works, and there is no ground within a distance of 1¼ miles to the north-west on which artillery could be advantageously placed by an enemy so as to bring its fire to bear against them. Where the gap exists in the walls on the southern side, an entrance could, of course, be easily made at present, and all the buildings within the fort could be easily shelled from rafts placed on the river, or even from batteries planted on the southern shore. There is never less, probably, than 8 feet of water in the river between Mandlesar and Singásád temple during the period from December to June.

Wells and water-supply.

11. There is only one well within the fort. This is situated about 50 yards South-East of the "Garhi" gateway. The water of this is bad and brackish, and on account thereof is not used by the inhabitants. It is 90 feet deep. There is no machinery either for raising water from the Mahesri or Nerbuddá river. There are no public store-house or granaries in the city, but some of the Rajah's dwelling rooms round the Ailiabai palace could easily be made available for this purpose.

Armament.

12. Of ordnance within the fort there are 30 pieces in all, of which nine are iron, about 9 feet in length, and capable of carrying a ball 6 inches in diameter. Seven others of 4 feet in length, also of iron; all these are old, worn and honeycombed. There are also five brass howitzers of 3 inches in diameter at the muzzle, one new brass gun 4¼ inches in diameter at the muzzle, seven small ones 2½ feet in length, and two other very small ones used for firing salutes to the gods when carried about at the various religious festivals. Of these guns 14 are mounted on carriages for field work, and moved by bullocks. All these appear to be in good order and thoroughly serviceable.

Ammunition.

13. Within the fort is a room, 21 feet in length and 33 feet in height, filled with gunpowder, as well as with the materials for making the same, *viz.*, sulphur, saltpetre, and charcoal.

14. The garrison, when the survey was going on, consisted of 135 sepoys, 40 policemen, and 40 sowars with horses; all these were armed with old pattern and very unserviceable looking muskets and swords of sorts.

Garrison.

15. The country round the fort is a mass of intricate ravines from 50 to 120 feet in depth, and extending from the river inland some 500 to 700 yards. To North of this broken ground lies the main part of the city, which contains about 10,090 inhabitants, and extends for about ¾ of a mile to West, North-West, and North, and covering about 450 square acres of ground. Outside the city the country is covered with large topes of mangoe trees, and numerous gardens separated from one another by high and thick hedges. There are three good fair-weather roads leading out to Dhárampúri, Gújri, and Mandlesar, respectively. None of these are bridged.

Description of surrounding country.

16. Within the fort are a mass of buildings. These are principally temples and the residences of the priests employed in service thereat. The place is a perfect labyrinth of narrow streets or gullies, and troops would have much difficulty in getting about them. The whole of the south side of the fort is taken up with the Ailiabai palace and several splendid temples attached thereto. They are very handsome and massive stone buildings, highly sculptured, with fine ghâts extending for several hundred yards along the river bank.

Interior of Fort.

Extract from the Narrative Report of LIEUT. T. H. HOLDICH, R. E., *in charge of No. 3 Topographical Survey, Central Provinces and Vizagapatam Agency.*

Dumagudiam, the point from which the triangulation started, is a very small and insignificant station on the Godavery, called into existence by the Godavery navigation works, and if only these navigation works are carried on to completion, Dumagudiam may yet have some small commercial future before it. At the time I visited it, however, the navigation of the river was suspended, and one of the two Europeans whose fate has deposited them in this locality had been sent elsewhere to hunt for coal. To the survivor (an energetic, hard-working missionary) I was indebted for much interesting information concerning the tribes of the surrounding districts. Starting from Dumagudiam in a northerly direction, I traversed the same route as that taken by Colonel Haig some years ago when looking for a practicable route from the river at this point to Jeypoor. In the immediate neighbourhood of the river (districts already surveyed by the Hydrabad Survey Party) there was considerable attempt at cultivation, with large and flourishing villages; but after passing Bodanalli, we were at once involved in the Bustar jungles. Probably no continuous jungle of the same character and extent exists elsewhere in India As I have already stated, the general level of the country is low, from 200 to 300 feet only above sea level, while huge shapeless masses of hills rise here and there abruptly from the plains to as much as 2,000 feet above the general level below. From the highest of such hills it was, of course, possible to obtain a very wide and extensive view of the districts around, so that not only the area of country already triangulated, but a very considerable stretch of jungle northwards towards the Indrawatti fell under actual observation. The view from any one of these hills was the same as from all the others—one vast unbroken sea of jungle stretching around as far as the eye could reach, with the gigantic forest trees and rank-grass undergrowth dwarfed from the height on which one stood to the appearance of a perfectly level open plain. Hills were scattered about in plenty; but unless high enough to break the horizon line, it was frequently only when they cast long shadows in the evening that they were descernable at all, from the perfect uniformity of the forest-jungle which covered and surrounded them. In the early mornings the grass and trees were usually soaking and dripping with dew, and as the dew gradually evaporated and again condensed into clouds, a huge white mantle was evenly spread over the face of the jungle, and then there appeared, breaking through the mantle, the tops of innumerable little hills that it was perfectly in vain to look for later in the day, when their outlines were hopelessly indistinguishable from the surrounding mass of forest and grass. The long white thread of the Godavery appearing here and there was almost the only break in the scene; at one place only (Jiggergonda) was there cultivation sufficient to be discernable in the jungle from the surrounding hill stations. The route I followed was the only northerly route that can be followed through the jungle. The road was good enough as far north as Chintulnar; it is used by the Banjaris (whom, by the way, I never happened to meet anywhere) and for hauling teak timber to the Godavery. Villages are few and far between, though all that there are are capable of supplying a camp with rice and fowls. There is at times a scarcity of water in the neighbourhood of Yelmagonda; the soil is sandy, and what water is procurable appears to be good. With the exception of Chintulnar and Jiggergonda, the villages which I visited consisted only of one or two huts, and were in some cases completely deserted. A very slight cause is sufficient in these districts to ensure the complete desertion of a village. A visit from a man-eating tiger, or one year's failure of the poor little crop surrounding the few huts, is quite enough, and the village is abandoned to be burnt off the face of the land by the next jungle fire that passes that way. I found it quite impossible to arrive at any sound conclusion as to whether there has been

[Madgul Golgonda and Rampa Talooks.]
Description of the country triangulated.

of late years an increase or a decrease in the population of this jungle. I noticed so frequently (sometimes in the densest part of the forest) unmistakable signs of the recent existence of villages, that it seemed to me at first that there must have been a very considerable exodus from the country, or that the population had in some other way become very rapidly thinned. But this little peculiarity of changing the site of a village on the smallest provocation quite upset any calculations on the subject, and though I still think there has been considerable emigration to the river provinces, I doubt whether there are actually fewer villages in existence than there were ten or twenty years ago. The village huts are very neatly put together with bamboo mat sides and grass thatch, with a good, serviceable split bamboo palisading enclosing each of them as a protection against leopards and tigers. Passing northwards from Chintulnar and following the principal Banjari route towards Jeypoor, a rough but not very steep ghât ascends to the plateau, from which rise the hills near Gogonda H. S., the western and south-western limit of which is the Bailadila range. With the ascent a very pleasant change in temperature is immediately experienced, and the monotonous nature of the jungle scenery is agreeably diversified; but the roads are almost impassable, and in order to move freely it was necessary to have the main camp standing and to work on foot. The Bailadila range rises to 4,000 feet above sea level. The top of the range is above the level of jungle growth. Bare-looking grass covered submits, with an out-crop of loose blocks of conglomerate intensely fatiguing to walk over, are the main features of the hills. There are here and there striking bits of scenery, but the general effect is too monotonous to be pleasing. The vegetation of these hills near the summit of the range differs essentially from the rank growth of bamboos and cane at the foot. The most noticeable trees were those called by the natives Sāz or Sāru (not unlike Mhowa, with white underleaf), the gingeli trees, and a pink flowering shrub, (the leaves of which were eaten by the people) called *gille*. The ascent is steep and difficult. We found water at the summit, but no vestige of human habitation. The objection that the natives show to ascend these hills is doubtless caused by the cold experienced at the top; the guides and coolies collected for work all deserted during the first night passed there. From the Bailadila hills southward and west of the Chintulnar and Jiggergonda route the nature of the forest was precisely that already described. Being untraversed by any main route it was at times exceedingly difficult to move the camp to any point within reach of the hills selected as trigonometrical stations. Now and then it was necessary to abandon even the narrow tracks that lead from village to village, and to push across the jungle from hill to hill. The difficulty of making way through the dense grass in any thing like a direct line, and the intense suffocating heat experienced when buried in the jungle out of reach of the passing wind, made almost any coarse preferable to this: so that frequently two days were sacrificed to a short direct move from one station to another, and moreover it was found that even the villagers of this district were often completely at fault as guides through the everlasting sea of grass which totally obscured the view of even the nearest hills. The utter stillness and want of sound in these jungles is sometimes quite oppressive. Yet this is not at all due to any want of animal life. Tracks of buffalo were frequently observable in the low lands, and bison in the hills about Bailadila. Sambur and smaller kinds of deer exist but not in large numbers. I believe there are no species of antelope in the Bastar jungle at all. Wild pigs are very numerous in the hills and the boars grow to a gigantic size, but the most frequent tracks observable by far are those of tigers and panthers. The dread of tigers is very great among the villagers, and it is impossible here, as in the hills further east, to persuade any one to travel singly along even the most frequented routes. The grass is beaten down as far as possible on either side the main Banjari roads, so as to give a little more chance of observing the enemy in time; but, as a rule, the tracks are the merest footpaths through the grass, hardly distinguishable, and no doubt very dangerous in this particular. I so frequently observed the tracks of tigers (sometimes as many as three distinct animals) over the foot-prints of the lascars and people who had gone on ahead of me in the early morning, as to feel convinced that they were often quite close at hand, although most securely hidden, and so I never attempted to break through the very inconvenient system in these parts of always sending two or three men in company.

Description of the country mapped.

The country brought under topography this season differs most essentially from that triangulated; part of the districts of Golgonda and Rampa under the Narsipatam and Rajamundry Collectorates comprised the whole season's outturn. The parts surveyed consisted entirely of the broken rugged hills which continue the mountain system of the Eastern Ghâts, and, extending across the Godavery river, with a general south-westerly trend, finally merge into the high plateau of the Hydrabad country. The general system is, of course, that of a range of hills running north-east and south-west; but beyond this there is a strange want of that natural arrangement of parallel ridges generally found in other ranges. A look at the completed maps will show flat-topped, irregular-shaped hills, narrow and scarped ridges, and level spaces dotted with isolated peaks, all mixed up in apparent confusion, and the result of this is a most unusual amount of detail among the smaller natural features of the country. It is, as a rule, a densely forest-clad district, the higher peaks only (which rise to about 4,000 feet above sea level) standing out at sufficient altitude to be clear of dense undergrowth, and marking the distant landscape with their square-cut yellow grass covered tops, with an effect that is a good deal more strange than beautiful. The change of climate from the lowlands of the Bustar jungle was most refreshing, and the luxuriant beauty of the villages here and there can be compared to nothing south of the Himalayas. The most marked trees among

the jungle are wild mangoes (whose young leaves in March were of the most brilliant hues), bamboos, palm trees of several varieties, and the graceful tree ferns. These, massed and knotted together with strange creepers and many other wild tropical plants unknown to me, presented effects of scenery pleasant enough to look upon, but most unpleasantly obstructive to the advance of the survey. At one point of the Godavery where the main water-shed of the Eastern Ghâts is broken through by the river which passes by a narrow and almost unfathomable channel called " the gorge," the scenery is so striking as to well merit a visit from all tourists and travellers in this part of India, and it will be easily accessible by means of the shallow steamers that are for the future to navigate the Godavery during those months of the year when there is water sufficient to float them. From this it may be gathered that the country presented unusual natural difficulties to the surveyors ; add to this the difficulty of obtaining supplies, the scarcity of villages, and consequently the daily recurring difficulty of collecting guides and coolies enough to show the way from the villages to the hills and to clear the jungle before the plane table could be fixed in position, and the rather limited outturn of the party is easily accounted for. I have the authority of the oldest surveyors in this party for the statement that it is by far the worst ground that they have as yet encountered. I wish I could say that, once out of these hills, their difficulties will diminish ; but I fear it is rather the other way—all these districts are notoriously malarious. The attempt to establish police stations has almost entirely failed from this cause, and it is only under the pressure of duty that any European official connected with these districts will ever pass into them at all. The Europeans of the party suffered continually and have continued to suffer since leaving the field. There were not many deaths among the natives while actually in the field, but it can hardly be doubted that some of them left the field in a condition that will effectually preclude the possibility of return. All these hills swarm with game, of which bison and tigers are the most prominent species. The damage done by tigers is almost incalculable. Dozens of villages have recently been deserted on their account, and the superstitious dread they inspire is such that all tigers are regarded as deities supposed to have superhuman powers of recognising those who speak lightly of them and of punishing informers. No combined attempt has as yet been made to meet this great evil, but as things stand it almost looks as if the tigers would eventually take possession of some of the best localities altogether. I think there was not a single surveyor who was not more or less obstructed and annoyed by these brutes. Mr. Adams lost one coolie in returning from work, and had a visit paid to this camp by a tiger in the full light of noonday when most well-conducted tigers are supposed to be asleep. Yet the density of the jungle and the nature of the ravines render anything less than a well organised beat a hopeless attempt at dealing with them, and the villagers hereabout are too much panic-stricken to take any share in such beats. One well known old man-eater was pluckily attacked and beaten to death by the villagers of Lamsingi, but I heard of no other such performance. This one was, I think, once well known in that bit of country which Mr. May was compelled to leave unsurveyed last year.

Inhabitants.

The inhabitants of the triangulated part of the Bustar jungle may be broadly classed under one head—Kois. The Koi is an aboriginal tribe of the Dravidian (or Gond) family, somewhat allied to the Telingas of the Godavery districts on the one hand, and to the Gond tribes of the plateau about Jugdulpore (or Bustar) on the other. They imitate the Telingas in their customs in the southern districts, but admit no relationship whatever with the Gonds, though the relationship exists. Very little is known of the aboriginal tribes in the Bustar jungles. As far as my own observations went, I was unable to identify any one man of any other tribe than that of the Kois, although the Gotta or Gottawar tribe and the Maria are stated to be distinct tribes occupying some of those districts through which the season's triangulation extended. Even from such native officials as were deputed by the Bustar Raja to attend my camp could I discover that there was any tribe other than the Kois, from which I infer that the Kois are by far the most numerous, as they certainly consider themselves the most important, tribe in the low districts west of the plateau. The language of all these tribes being very nearly identical, it would be difficult to distinguish them apart ; they all understand Telegu. In the more southern districts included in the Beji, Kotapili and Chintulnar taluks, I observed no stone monuments or anything to denote the burying places of the people; further north in the Chintulnar taluk, immediately the Ghâts were ascended to the plateau, on which stands the Bailadila range, such evidences of burying places were common. Slabs of gneiss eight or ten feet high were placed in upright rows always along the edge of the road as far as I could see, and sometimes at the foot of them would be a smaller slab horizontally supported on four little round boulders. The burning places and burying grounds were side by side, but the burning place was almost invariably overshadowed by the mohwa tree. The fact of the burning and burying grounds being close together would seem to identify the tribe hereabouts as the Marias. It is stated in the ethnological report of the Jubbulpore Exhibition of 1866-67 to be the custom of the Marias to bury their women and children, but to burn their men, binding the corpse upright to the foot of the mohwa tree. It is also more especially their custom to erect the monuments described. Yet the villagers on this plateau answered to the name of Koi just as did the people below, and in more than one instance distinctly refused to admit the name of Gond or Maria. The Kois are a small but well made people, generally dark-colored but not universally so, much given to red and white bead ornaments round their necks, and wearing their hair knotted up behind in a manner suggestive of the chignon. As a rule, they are effeminate in voice and appearance, having little hair

on their faces: but I saw a few instances of very well developed beards. They appear to be generally truthful, honest, and are decidedly cheerful, but have very little idea of doing a hard day's work, and will dismantle a village and depart with it elsewhere, or burn it on very slight provocation. They occupy themselves as little as possible in agriculture, and as much as possible in tending their herds of cattle as a pursuit much more congenial to their disposition. The tribes of the Godavery districts and throughout the Rampa and Galgonda hills are Telingas of two castes, a high caste (called Reddi) and a low one; the latter will eat any sort of flesh, or even carrion. My attention was called to the fact that among the Telingas of the hills there were scarcely any old men. Life seems peculiarly short to these people, and truly their lot is cast in a land as little favorable to longevity as can well be conceived. This is not at all the case among the Kois and Marias. I saw many an ancient specimen of humanity, evidently well tended and cared for, on whom the feebleness of old age had fallen, carried out and propped up against the door of the family, but with just vitality enough to smoke a hookah and blink feebly at the bright sunshine.

Of wandering tribes, the ubiquitous Banjari is, of course, to be found following his trade through all these districts, and to the Banjari the inhabitants may be thankful for the only practicable roads they possess. Other wandering tribes are hardly represented at all in the jungle, though they may be found and studied to great advantage all along the banks of the Godavery.

The Erukalavandlu is a small wandering tribe, of which members are found just on the edge of the Bustar jungle in the neighbourhood of Dumagudiam. They form small encampments in the neighbourhood of a village and remain fixed for some time, employing themselves in mat-making and fortune-telling. The peculiarity of this tribe lies in certain observances at childbirth: the father takes the place of the mother in bed immediately before and after the child is born, and the usual medicines are given to him, instead of to his wife. During the subsequent period of uncleanness he is treated as is the usual custom with Hindu women. Probably no district in India offers such opportunities of becoming acquainted with varieties of the aboriginal tribes of the Gond family as the Telugu speaking districts of the Godavery valley, but a few miles only from the actual banks of the river this mixture of tribes ceases altogether.

Extract from the Narrative Report of CAPTAIN R. V. RIDDELL, R. E., *Deputy Superintendent in charge No. 5 or Bhopal and Malwa Topographical Survey.*

Country triangulated and described by H. Horst, Esq., Assistant Superintendent:—

"The ground triangulated extended over an area of 1873 square miles of hilly country, the greater portion covered with jungle and presenting considerable difficulties to reconnaissance. Several stations of the Gwalior party, *viz.*, Bájna, Shampura, Malpura and Tanod, were conveniently utilised and connected by symmetrical figures with my own work. The computed values of common sides agree most satisfactorily. The cantonment of Augur, occupying a central position in the area under triangulation, and the head-quarters of the Political Agent for Western Malwa, I found most convenient, and duly record my thanks for the valuable assistance rendered me during my operations by Major Martin, the Officiating Agent.

"The Western Malwa Agency includes portions of Gwalior, Holkar, Jhalra-Patan, Alot and Sitamau, an independent sub-division of Gwalior. The principal towns are Augur, the head-quarters of a Subah and Tehsildar; Susner, a tehsil; Nalkhera a tehsil, and Shájapur or Shajehanpur, also the residence of a Subah, all in Gwalior; Gungrar, the residence of a Nazim, a walled city, in a very dilapidated condition, situate on the right bank of the Chota-Kálisind river; and Dug, a Nizamat in Jhalra-Patan; Shajapur on the Agra and Bombay road, contains a dâk bungalow, and post and telegraph offices.

"The country where cultivated is extremely rich and intersected by several large streams, water being invariably found near the surface.

"Opium, found to be the most profitable, is the principal product of cultivation, and, as a natural consequence, the prices of grain of all kinds run high."

Of the country plane-tabled, the greater portion lay in Bhopal territory, the northern sections being, as a rule, open and well cultivated, those to the south hilly and covered with jungle.

Country plane-tabled.

The subjoined statement shows the comparative areas of the various States and the per centage of cultivation to waste land:—

	Total area.	Cultivation.	Percentage.
Bhopal	2042·1	813·2	·39
Gwalior	60·5	26·7	·44
Rajgarh	264·9	124·3	·47
Narsingarh	207·3	130·5	·63
Maksudangarh	61·5	24·7	·40
Tonk	82·0	2·6	.03

Compared with that of last season, 46 per cent., the general proportion of cultivation exhibits a slight decrease, falling to 41 per cent., mainly due to the large tract of hilly country over the Nerbudda valley included in the present year's work.

The total area plane-tabled, amounting to 2,812 square miles, gives an average of upwards of 270 square miles to each of the ten assistants who completed a full season's work. This result may be considered satisfactory, and compares favorably with the outturn of previous years.

Hills.

As in the published sheets of last year the Vyndhia range forms the most prominent feature, entering the season's work about the parallel of 23, and running in a south-westerly direction, with a well defined scarp on the southern side as far as the meridian 77° 45′, immediately to the North of Hoshangabad; at this point the hills immediately overhang the valley of the Nerbudda, the intervening country being very much broken up by small streams running South, and numerous spurs more or less detached from the main range.

The general elevation is about 2,000 feet, and the height of the hills above the bed of the Nerbudda about 1,100 feet.

Beyond Hoshangabad the range again recedes from the river in a westerly direction, minor spurs running north to form the watersheds of the Betwa, Bes, or Huláli, and Parbatti rivers.

On the northern side the fall is comparatively slight, and the general level of the country as far as Bhopal and Sehore is about 1,700 feet.

In the sheets to the north of Bhopal a low range of hills overhanging the city of Nursingurh forms the only prominent feature, but immediately above the parallel 23° 45′ the watershed assumes a more marked appearance, and on both banks of the "Parbatti" the ground is very much broken by irregular groups covered with jungle and rising some 300 or 400 feet above the surrounding country.

Rivers.

The principal rivers met with are the "Nerbudda" forming the boundary of Bhopal and British territory on the south, and the "Parbatti" rising in the Vyndhia range on the north.

Nerbudda River.

The general width of the Nerbudda is about 500 yards, increasing here and there to 800 yards. The river falls about eight feet per mile; the banks, about thirty feet in height, are steep and well defined, and the bed sandy and free from rocks.

It is fordable for the three months preceding the rains near the villages "Bagwára," "Namnagar" "Garjalo," "Ninor" "Pathaora," and "Tigaria," all to the East of Hoshangabad, and crossed during the same distance by nineteen ferries, the principal of which are at "Chichli," "Josipur" and "Hoshangabad."—Its principal tributaries on the south are the "Tāwa" and "Hather," the former joining it about 5½ miles north-east of Hoshangabad, the latter two miles south-east of the large village of Mardánpur.

The streams from the north all rise in the Vyndhia range, and having small drainage areas are comparatively insignificant. The largest of these are the "Dhobi" and "Bhagner." The only considerable rapid is the "Bandraban" near the junction of the "Tāwa"; but two miles east of Mardánpur there is a fall of about seven or eight feet.

Parbatti River.

The "Parbatti" rises in the Vyndhia range near the village of Magarda and enters the season's work near the village of Manakhera about six miles north-west of Sehore. Its general width is about 250 yards, and it is fordable throughout the greater portion of the year. The banks are about twenty feet in height, and the river bed mostly composed of clay, and in places very rocky. The fall is about two feet per mile. The principal feeders are the "Párna" "Patpura" and "Tem" all on the right bank. Other streams of minor importance are the "Sukar" a tributary of the "Newaj" one of the main feeders of the "Chumbal." The "Bae," "Halali" and "Kaliasot," all eventually finding their way into the "Betwa."

Cities

1.—Bhopal.

"Bhopal, the capital and seat of government of the State of the same name, occupies a central position in the season's work.

The following description extracted from Captain Riddell's introduction to the computations of the large scale plan completed during the season 1872-73, may be of interest:—

"The city of Bhopál is overcrowded, at least that portion within the walls, the streets and "lanes of which are mostly narrow. There is no attempt at pavement or Macadam. Yet in "one respect the city of Bhopal has an advantage which I have never seen in any other "Indian city, *viz.* at various places all round the inside of the city wall, and also in some "of the principal streets, excellent water is obtainable to the population by the simple process "of turning a tap. At the southern side of the lake the puffing of an engine may constantly "be heard. This engine is a steam force-pump which forces the water of the lake into a

"reservoir about 150 feet above the surface of the lake; from this reservoir a large pipe conveys "the water into the city; and the height of the reservoir is just sufficiently high to admit "of the water being carried into the upper fort; the level of the water when the reservoir is "full being about ten feet higher than the level of the ground at the gateway of the upper fort.

"The two lakes are divided by a narrow neck of land, partly natural, and partly artificial, "and though I believe communication between the two lakes can be effected, yet for a great "portion of the year there is none, for I found a difference of level of sixteen feet between "the surfaces of the lakes in the month of January, when I made the observations for the "triangulation necessary for the large scale survey. The lower or smaller lake depends for its "existence entirely on a masonry dam at its northern extremity; the ground at the northern "side of this dam must be about thirty feet below the surface of the lake: should the masonry "give way, the water of the lake would collapse and clean a place which is at present an eyesore, "and ought to be a source of disease. Over this dam lies the thoroughfare between the "city and that portion of the suburbs known as Jehangirabad. In Jehangirabad all the troops "are quartered, except the few which guard the fort, and these latter form no part of the "regular troops (if the name may be applied to them.)

The population is about 44,000, but this estimate is probably below the true figure and only includes the permanent inhabitants. A description of the fort of Bhopál accompanied the Narrative Report of last season.

"Nursingurh."

Nursingurh, the capital of the independent district of the same name, is situate on the left bank of the "Parbatti". It is commanded on the western side by a detached group of densely wooded hills rising some 300 feet above it. The population is about 9,000.

The city itself is partly walled, and in the centre there is a large tank with necessary sides filled by a small stream from the adjacent hills. It is approached by roads from "Beaora," "Devipura," and Sajpur, and has five entrances. The distant view from the western side is extremely effective.

The following description of the fort is furnished by Mr. Hamer:—

"The fort of Nursingurh is built on a hill rising to a height of about 300 feet "immediately above the town on the east side. It is about 900 yards in length from North "to south, and 500 yards from east to west at its southern extremity, decreasing to 340 "yards about the centre, and to fifteen yards only at its northern end. The highest part of "the hill is about the centre, shelving down on all sides to the precipice which is continued "all round the hill. There are only two roads leading up to it; the first on the western side "of the hill leading from the town to the palace, a paved road about ten feet wide, but very "steep; practicable for elephants; the second on the northern face of the hill which was "under construction at the time of surveying, will be a much better road, having a gentle "slope from the foot to the highest part of the hill. A low wall about four feet high and "two feet thick is built on the precipice all round the hill. No guns were to be seen on the "walls, though the Raja has nine or ten brass cannon kept in a shed contiguous to his palace.

"Sehore."

Sehore, the residence of the Political Agent and head-quarters of the Bhopál Battalion, is about twenty miles distant from Bhopál. It is approached from the latter place by a metalled road, and another main line of communication enters the city from Indore on the southern side. It is watered by the Siwan, a tributary of the Parbatti, but at this point a comparatively small stream. The population is about 19,000. There is no fort or walled protection of any description, and a large proportion of the buildings is of a temporary character. The triangulation for the large scale plan of the city was completed during the past, and the detail work will be completed during the coming season.

Roads, Passes, &c.

Metalled roads exist between Bhopál and Sehore, and for a comparatively short distance between Sehore and Indore, but the majority of the communications consist of fair cart tracks only, and, as in other parts of Central India, little attention is paid to repairs or the removal of natural obstacles. Numerous tracks cross the Vyndhia range on the south, but few of these are available for carts, and the majority of them are impassable to laden animals. To the east of Hoshangabad the only pass available for camels is opposite the village of Hura, being a continuation of the road crossing the Nerbudda at Garjalo, and eventually reaching Chandpura through the valley of the Jamner.

From Hoshangabad to Bhopál a good road available for wheeled traffic crosses the Nerbudda immediately opposite the village of Josipur by a ferry, and passing up the valley of the "Gadária" a small stream, ascends the ghât by a made pass to Choka; thence through Kaliakeri and Bhojpur, where there is a ford across the "Kalisot" to Bhopál.

Further west there is an alternative route crossing the Vindhias at the Murum Ghât.

It is practicable for carts of all kinds, but no drinkable water is procurable.

The most celebrated pass is the "Delawári," four miles west of the Murum Ghât, in the direct line of communication between Bhopál and the large village of Mardánpur.

At the foot of the ascent there is a spring of good water, and the ghât is one of the best in Bhopál. The fort of Ginorgarh commands the road from the ascent to the village of Kanpura. This pass could be well defended, and is accessible to traffic of every description.

Another good pass is the Kót Ghât, four and a half miles further west. The ascent is about 300 feet, and there is a spring at the foot of the hills, but the water is barely drinkable.

Extract from the Narrative Report of CAPTAIN W. F. BADGLEY, *in charge No. 6 Topographical Survey, Khasia, Garo and Naga Hills.*

Remarks on the country surveyed.

The country surveyed by the party was partly in the Manipur and partly in the Naga Hills District; between these to a certain distance rises a range, the Barrail, averaging from 8,000 to 10,000 feet in height, and giving off on both sides spurs and minor ranges which run in a general N.-N.-E.—S.-S.-W. direction. This large range, the origin of the Gáro, Khasia and North Cáchár Hills, runs from Assálu to south of Kohima on a N.-E. line, and there abruptly end in several precipitous peaks. The watershed, however, of the rivers flowing into Assam and Manipur is continued from it in a S.-E. direction to the Kopamedza range, whence branch two lines of watershed, the Kopamedza having the general N.-N.-E. direction of all the minor ranges forms the watershed between Assamese and Burmese waters, while a range running S.-E. to the hills overlooking Burmah is the watershed between the waters of Burmah and of the Manipur valley. Bounded West and South by these two watersheds and East by high N.-N.-E. ranges, of which Sárámeti, 12,600 feet high, is one of the highest peaks in the Lániere valley, the northern limit of which has yet to be surveyed. Between the spurs from the South of the Barrail and of the watershed to the Kopamedza rise the Bárák which flows past Cáchár and its tributary streams. East of the Kopamedza range to the Shiruifarar peak, the Iril which flows past Imphál, the capital of Manipur, and the Tabalturel drain to the South, the hills of which the Laniere and its branches drain the northern slopes. East of Shiruifarar the waters flowing South are in Burmáh from their source. In the Barrail on the north from the boundary of North Cachar to Kohima, are the source of the Dhansiri River, and between Kohima and the Kopamedza rise the Siju and Zullo, which, joining to form the Doyong, fall into the Dhansiri above Golaghát.

The northern spurs of the middle part of the Barrail end rather abruptly about fifteen miles from the ridge, and between this line, on which the station of Sámáguting, at a height of 2,477 feet is situated, and the Rengma Hills and Golaghát, is a broad, pestiferous forest-covered plain through which wind the Dhansiri and the latter part of the Doyong Rivers. This forest, which has been inhabited populously in places, as at Dimápur, where there are remains of a fortification or palace of about ·15 of a square mile (96 acres) in area, and many fine tanks, is now occupied by a few wretched villages, two riding paths and some police-men, the population in comparison to square miles of area being less than one to one. In striking contrast to this is the populousness of the Naga Hills, especially to the East of Samaguting. From one point sixty villages, some of them of more than 600 houses, could be seen, and the population roughly calculated amounts to more than ninety to the square mile, and the people seem to be on the increase, notwithstanding their quarrels and blood feuds.

Having explained our plans to the leader of the expedition, and succeeded in inducing him to aid the survey of the Doyong to the Lániere exploration, which was all he at first contemplated, on the 1st of January the camps of the Political Agents of the Nága Hills and of Manipur with Captain Badgley and Lieutenant Woodthorpe marched from Kohima. Our route lay northward along the spur, which running N.-N.-E. from Jápro peak at the east end of the Barrail range, ends in the hill called "Woka" by the Lota Nágás who live on it, and "Thebzothin" by the Angámies. The Doyong flows on the eastern side of this ridge, and circling round its northern end cuts it off from the hills further north. On the 2nd we set up a new mark at Nidzokru H. S., and on the 3rd camped at Themokadima. We had left the Angámies, had passed through two half Sema villages, and were now in the Rengma country.

Our next day's march was to have been to the next Rengma village, Tesephima, but in the morning various rumours came in; at first our men sent on in front had been killed, but finally that the Tesephimas would not either let us into or pass their village, their message being bombastically worded to the effect that as neither man nor tiger had ever been allowed to pass, neither should we. But little was thought of this, however, and we started to try to induce them to receive us, taking sixty men as a precautionary measure, and as the sight of them might induce them to admit us more readily and cheerfully. More than a mile from the village we found the path and jungle thickly set with those little bamboo lancet like darts called "panjics," the Native Officer of Police getting one through the leg, and by the time we had reached the village, though we crawled along most slowly and cautiously, four men had been lamed by them.

Tesephima is finely situated for defence on a height at the junction of three ridges. The hill is precipitous on one side, steep on all, and approached on our side by a narrow rocky neck

above which rose the steep ascent to the village with the precipice on our right. At the neck they had made a breast-work of earth and stone, where, with guns or even arrows, they might have given us more than we would have cared for, but they did not attempt to defend it, perhaps as a stratagem to induce us to rush on too boldly and fall into their trap of a flank attack, repulsed by which they might hope to have us at a disadvantage among the "panjies,"—which, and the ground in front of it were studded with. They retired steadily with a chorus of two deep sounding notes which had quite a grand organ-like thrill very different from the cackling jackall-like war cry of the Angámies.

What happened was very exciting while it was going on, however much we might pity the unfortunate people after it was over, and there is this to say that they brought it entirely on themselves, rejecting every overture for peace or conference, and leaving us no choice but to attack them. Halting at the breast-work for a minute, interpreters were put forward to try to induce them to come to terms, but they were answered with the war-cry alone, and we advanced up the slope crowned by the village which was protected by zig-zag approaches, stone-walls, hedges and clumps of bamboo. They probably had not expected us to be so quick, for we were in their lines before the flanking party showed, which thus became a rear attack; and now, if they had only stood, or if both had rushed in, they might have done something and we something worth writing about; but our guns frightened them. They gave way at once, without, I was going to say, throwing a single spear, for, though I am told spears and stones flew about promiscuously, I saw none myself, and we never stopped till we were in the village. Here perhaps a little recovered from their fright, they made several attempts to advance, but always to be driven off with loss, and at last gave it up, so that at about 3 in the afternoon finding nothing to do, we returned to camp. Before we left, Lieutenant Woodthorpe, who had been out surveying, joined us sorry to have missed the affair, bringing with him fortunately his cold breakfast, which we were glad to help him to dispose of, the excitement having had a good effect on our appetites. Dr. Brown had meanwhile kept the camp at Themokadima; no attack was made on it, the two villages being at war, though both Rengma. Many of the Themokadimans, indeed, went with us (perhaps to take advantage of either event) and looted and set fire to Tesephima, burning down a third of the place. Twenty-two of the poor wretches were killed, and two or three died afterwards; our loss was four men lamed by panjies.

Halting on the 5th to give them time to come to terms, we marched again against them on the 6th. They now occupied a hill two miles from their village. We held a parley with them; women with bared breasts and the green bough of truce acting as heralds on both sides. They declared they would resist, but whether it was a mere demonstration, or that they lost heart at the sight of the red coats of Dr. Brown's escort, of whom he brought ten with us on this occasion, or from whatever cause, we reached the village without meeting any opposition, excepting from "panjies" by which again two men were wounded. Near the village we were met by messengers of peace, which, after the payment of a fine, was concluded in the village and we marched back again.

The next day we encamped at Tesephima, on the 8th at the Lota village of Phurma, and on the 11th at Woka, halting on the 10th at Nongsee Close to Woka; to the east rises the Woka hill, 6,500 feet in height and about 1,500 above the village. Here we cleared the hill top and put up a signal for a station, but without being able to make use of it, for the rain came down, or clouds hid the view, till we at last gave it up, and on the 14th marched west towards the villages, also Lotas, on the opposite side of the Doyong. They were a sullen lot at Woka, the most vile of all the Nágas we saw; they would neither fight nor act peaceably, nor sell us food, though the money would have been a benefit to them, as they knew its value and could use it in trading with the plains.

Camping on the 14th on the Doyong, 15th at Morákcho, 16th on the Doyong where it turns west to leave the hills, and 17th at Phurma, we completed a circuit to the west which brought us back through Tesephima to Themokadima on the 18th. In this short time most of the houses at Tesephima had been rebuilt, and we found the inhabitants quite friendly and seemingly taking what had happened to them quite as a matter of course. On the 19th Dr. Brown with his escort, &c., and the sick men marched for Kohima. Some difficulty had been found at times in feeding so large a camp; any question as to the direction of the outfall of the Doyong having been settled, there was no occasion for him to accompany us on the round we proposed to make westward across the Doyong, up its eastern side and across westward again to Kohima.

On the 20th we marched through Tesephima again to Kotsobagwema, on the 21st to Kite, 22nd across the Doyong to Goshitomi, and 23rd to Káken-agámi. At Kite, which, with Sámpui and Roki close to it, are Sema-Nága, villagers turned out to oppose us panjying the path, but a crowd of Rengmas, who had followed us from Themokadima, hoping for a quarrel that they might pick up some plunder, as they had done at Tesephima, having been driven back, and the Semas having been assured that we were friends, they pulled out the panjies and treated us well. Here we were again in danger, not of a quarrel, indeed, but of leaving a bad impression from some of the interpreters and followers doing a little private pillage, but they were discovered, the plunder returned, and themselves made examples of.

The Doyong where we crossed it, east of these villages, is deep enough for canoes, but whether navigable from below I cannot say. Where we saw it on the opposite west side of the Woka ridge there was ample depth for boats of some size, but we heard that there was a ridge of rocks or some such barrier which prevented boats of any burthen from going far: where this was, I am sorry to say we did not ascertain. The Nágas do not use boats. On lines of traffic where the rivers are too deep to be forded in the rains, they have cane suspension bridges, similar to those built by other hill-people in India.

Above Káken-agámi, on the Kopamedza range, we proposed to build a survey station, and on the 24th the morning was fine, but when we reached the hill it had begun to cloud over for rain, and we had barely time to sketch a few points when everything was hidden in mist. It was particularly disappointing, as all we should have seen was new to us, and the way up had been so very bad, part of it through a newly felled forest where we had to climb and creep and play the tight-rope dancer over the fallen trees. Káken-agámi was too small to keep us supplied with rice, and bad weather promising, we had to move on, and on the 25th we marched to Nokami, and 26th to Imphema, having rain on both days.

The next morning Lieutenant Woodthorpe and myself made an excursion to Terocheswemi on the Kopamedza ridge, where we had a good view and added a good deal to our work. Halfway up we passed through Ketsáma where they treated us very civilly. So they did on our return, presenting each of us with a spear and rice beer, and offering to put us up if we would but stay, but after we had left the village and were passing below it, two spears were thrown from the jungle, from one of which a policeman had a very narrow escape; it shaved past the back of his neck. While enquiring about this and picking up the spears, some Nagas belonging to another village, who had come with us, told me that they had seen the men who threw them running away, and that they recognised them as belonging to another third village which was found afterwards to be untrue, for the men were truly Ketsáma men, as that village acknowledged next day, begging forgiveness and offering to turn the men out. These men were Angámies, all the other villages we had seen on this bank of the Doyong having been Sema, except Terocheswemi, which was half Ángámi.

On the 28th, passing through Ungoma, the last of the Sema village in this direction, we encamped below Khesoma, and on the 29th, passing through Chájabamá on the Kopamedza range, camped at Rongazuma. I have called this range the Kopamedza, having no other name for it; it is the continuation of that range northward, and is the watershed between the Doyong and Laniere rivers. We halted at Rongazuma to the 5th February, clearing the hill Nummu, where we built a station. It fortunately cleared on the 5th, (having been raining the whole week previous), and though at one time it looked threatening and we had a sprinkle of snow, we finished our work, both sketching and triangulation, satisfactorily. The next day we encamped on the Siju below Sakábama, and on the 7th I went towards the trigonometrical station of Japoo, Lieutenant Woodthorpe having gone on the 6th towards Nidzokru.

The weather in Japoo was severe for my followers. Our camp was in the snow, which we found deeper and deeper the higher we went. We encamped at the last water and on the morning we tried the ascent and struggled on for three hours over a distance of about a mile, often waist deep in the soft snow, and when within two hundred yards of the summit found our way barred by an ice-covered precipice which was quite impracticable to laden men. Though in thin clothes and wet through, I felt that delicious tingling warmth that exercise in winter weather at home gives one, but my unfortunate carriers thought they were done for and talked of dying. As nothing could have been seen, clouds coming on, we gave it up, and slipping and tumbling hurried back to camp as quickly as we could, and reached it in less than a third of the time it had taken to go up. On the 10th I marched into Kohima, and on the 15th we started on our Laniere exploration.

Camping on the 15th on the Siju, on the 16th at Cháduma, and on the 17th at Tákubáma, we marched on the 18th to Razami, crossing the ridge and taking the Kopamedza station *en route*. It was a very heavy march, the snow, which I judge from the circumstance to be unusual on that range, having heaped the ground with boughs and creepers broken from the trees and beaten the bushes down so as quite to close the path in places and obliging us to cut our way through with knives and spear heads. On the 19th we marched to Thetcholumi, and 21st Kezabámi, (halting at each place a day), on the 23rd to Losemi, 24th Lozaphehome, and 25th Jessami, all Ángámi Nága villages.

On starting on our next march we found the path thickly panjied almost to the camp; those who did it must have come within spear throwing distance of our sentries; they were known to be men from Primi, a village two marches to the north-east, by some seeds of a millet scattered in the way, with which grain they make their liquor in distinction from the other Nagas, who use rice. We encamped at Melomi, all the men of which place were drawn up in their high street to receive us, and not one of them with a stitch on below their waist. They do not, I should say, always go about quite so freely, on ordinary occasions probably wearing their clothes draped round them as do the Lushais, Tankhul Nágas and others who wear no waist cloth, but on this occasion their sheets were tied across their chests in the fashion in which all Nágas tie them when expecting fighting. The sight was very extraordinary certainly, and very much inclined one to cachination. On the 27th we marched on to Primi. It was men from this village who had obstructed our advance from Jessami. From the spur opposite the

village we saw them assembled to oppose us, but after some parley they broke up and we encamped unmolested. These men wear a small apron, and, like the Semas and Lotas, tattoo their breasts. On the 28th we encamped at Thetchunása, and on the 1st March at Thetchumi.

Here we found ourselves beyond interpretation. At the last village we had managed in a way by translation from Primi to Melomi, to Ángámi, to Assamese, to English, and *vice versâ*, to understand and express a little, but here signs were our only, fortunately we did not want much, and such signs as pointing to one's mouth and stomach are not easily misunderstood. Fortunately also we had no need to go further, as what we had especially come to see was before us. The map shows what we discovered—that the Lániere instead of flowing through the large valley to the north, as we thought, was met by a stream from that valley, and that both turning at right-angles escaped through the high ranges to the east, about fifteen miles south of the Sarameti peak. The height of the rivers near their junction we made out by barometer to be about 2,000 feet above sea-level. The conjoined rivers agree perfectly with a branch of the Kyendwen of the old maps.

From this point we began our return journey, not because there was nothing more to be done, or that we would not have gone on if we could, but we had no interpreter, and the people had no rice to give us; they lived themselves on (*iobs tears—coix lachryma*); so having accomplished one of the principal objects of the survey, we turned back. Dr. Brown, with his escort, and the Munipuris, left on the 2nd to march direct to Manipur. On the 3rd we started and camping again at Primi and Melomi, on the 5th and 6th we stayed at Kotisimi, 7th at Sowhemi, 8th at Kitsophemi, and 9th at Chipokitámi, all Ángámi villages, except Sowhemi, which was of naked Nagas and was built in the valley on the river bank, not on the hills as is the general custom. We were now returning by a more direct route than that we had come by, but had turned northward at Kitsophimi into a valley drained by a tributary of the Lániere, the Tizi, at the head of which we heard that there lived a tribe of Nágas in ten villages, all contrary to the democratic usage of the other Nágas, owning allegiance to one Chief. There were two paths, it was said, to these villages, but that on the west bank particularly bad; it must have been bad indeed, if it was worse than that we found on the other side; however, we at last reached the first of these villages called, as we afterwards learned from the name of its head man, Cherhi or Cherhena, and by the Ángámies, Mezamibásáma. It is the only one of the ten villages on the east bank. What followed I cannot account for, except on the supposition that expecting us to go by the west bank they had collected in force at the first village on that side, and that the jungle had hidden our movements, for, on coming up to the village, though some asked us to come up, others gave war cries. We reached the glacis, which was thick with panjies, and saw some two dozen men moving about inside, some seeming to wish to parley, others yelling, two unlucky spears, a stick and a feeble arrow flew over and then we fired upon them.

We found one—one of the headman's sons—dead when we got inside, a fine young fellow shot through the brain; what other casualties there were, if any, I do not know, but fourteen of our party stuck themselves with panjies, including Captain Butler and Lieutenant Ridgeway; their shoes were soaked with wading, and the sharp bamboo slips went through and through them. The only person otherwise wounded was my jemader of khalassies, who made himself too prominent and got a sharp crack on the shin from the stick.

On the hill, which opposite to us divided the two streams which form the Tizi, we saw a crowd of armed men, and prepared ourselves for an attack by occupying the upper end of the village, and pulling down the middle part, across which we threw a stockade. We supplied ourselves with rice from their granaries which our coolies husked and sifted. A careful watch was kept for two nights. On the third day peace was concluded, and Lieutenant Woodthorpe and myself crossed to Rehipumi, where we saw the blind Chief Rehipu who rules the clan,—a fine old man who must have had great strength when young. He had a curious manner of not raising his eyelids and often of not turning his head when speaking to or hearing any one speak, so I could not form an idea of how he lost his sight, probably by accident, not through age.

On the 13th we returned to Chipo-Kitámi, having decided that in our somewhat disabled state (five of the fourteen lamed had to be carried), it would be as well to leave further exploration of these unknown valleys and tribes till next year. On the 15th we marched to Ságájuma, where we halted one day, and after starting on the 18th had to return to give them a lesson.

They were a very strong village and used to lording it, having, I think I heard, sixteen other villages dependent on them. They would not give us coolies for our sick, and when we returned and occupied the village, both spears and shield were out, but it passed off and they were more obliging next day. From this we made four marches to Sámáguting, which we reached on the 22nd.

Leaving Sámáguting on the 26th and passing through the Terai (which is passable at this time of year) by Dimapur, Mohangdijua and Bokulia Ghât, I entered the hills again at Panimohur and reached Shillong *viâ* Jawai on the 7th of April. Lieutenant Woodthorpe, going by steamer from Nigriting to Gowhatty, arrived at Shillong on the 12th. Lieutenant Woodthorpe plane-tabled on the $\frac{1}{4}$ inch scale about 1,150 square miles; Captain Badgley on

the ¼ inch scale about 2,250 square miles. They observed at three stations, the triangulation amounting to 800 square miles. It was an easy country to survey, and had not political reasons and the requirements of the large scale survey obliged us to halt and make short marches, more could have been done on the small scale.

The Naga Hills survey expedition this year was a most interesting one—not from any particular beauty of the country which, except in a few places, gave a tame view of long ridges unbroken by peaks and unenlivened by a single waterfall: nor from the climate—we had rain for a third of the time—but from the people, who, though they might generally be classed as vile, viler, vilest, were so new to us and so varied, one section from another, that one could not fail to be interested.

I will say nothing about the dress, &c., of the tribes, but add merely a few words with particular reference to one section of the tribes we visited. There is just one point, however, on which I would remark before doing so, which is, that I did not notice that any of the Nágas, either at Tesephima or Cherhe, the two places where they opposed us, wore "war-paint," some wore feathers, and some wooden tails ornamented with red and black hair, but I saw nothing approaching the custom of the American Indians, nor even so much color as is used by Hindoos. The only occasion on which we saw anything at all of the sort was at Lukámi. I think it was where the villagers had apparently been celebrating what might be called a "joom" burning festival (before the rains they burn the forest previously felled on land to be brought under cultivation; such fields are "jooms"), and some of them had their faces blackened with charcoal, and all were more than ordinarily dirty.

The frontier tribes I have seen appear divisible into three lots—Lushais, Kukies, Manipuris and Khásias,—Mikirs, Angámies, Tankuls, Semas and Rengmas,—Lotahs and naked Nagas. The first are light-skinned, short, with well-shaped broad heads, prominent foreheads, moderately thick lips, and moderately flat noses, wear all their hair (except the hindooized Manipuris), use (now discarding their spears for guns) a short chopping knife and a short thrusting spear or sword, and a small shield, cultivate by jooming. The second are light-skinned, tall, and the most handsome of the three, have well-shaped heads, often acquiline noses and thin lips, shave the head more or less, use no other weapons than the long spear and large shield, cultivate by terracing or jooming. The third are dark-skinned, short, have conically shaped heads, flat noses, thick lips, shave the head except a patch at the top, use the thrusting spear, an axe or heavy chopper, bows and arrows. The Lotahs use the same shaped shield as the second, but smaller, the others perhaps none (this is conjecture: we saw none among the naked Nagas.) The first and second are the stronger races; where the blood mixed in them with the Tartar comes from, I cannot say, and will only venture to hint at Mahya. They appear to be ousting the others for the special benefit of the country as regards the Angamies on account of their civilised method of cultivation. As regards the third, the resemblance to the Tartar races is much less marked; the people whom they most reminded me of (especially the naked Nagas, who are perhaps the least mixed in breed) are the Kols of Central India. Their dark skin, heads shaven except the tuft, the conical shape, their noses and lips, the use of the axe and bow, their carelessness about clothing, all agree, and in no single instance did I see anything like the light skin, long face, acquiline nose, thin lips and pointed chin which is found among the better conditioned individuals of the Tartar tribes of the frontier.

Of the marriage ceremonies, modes of disposing of the dead and new born, and those many customs whose differences help the classification of races, I am grieved to say, that trusting that it would be done by others who had less to do than I, I have not learnt so much as to warrant my writing of them, even had not continued indisposition in this damp climate unfitted me for making an amusing report, and I beg you will excuse me if I finish off here with a few general remarks. As regards what every one could see of the general condition of the Nagas, they were well housed, clothed according to their wants, well fed and seemingly content, healthy, free from small-pox and skin diseases, deformities (except goitre among the Rengmas and Semas) and dwarfs.

From the facts that the hilly country stretches so far south from the Nága hills, and that the north is open to winds crossing the broad, damp valley of the Bramaputra, I should say that the summer rains are less and the winter rains more than in other parts of Assam. We had much rain during the season, and the weather was at times disagreeably raw and cold, perhaps exceptionally so. The recorded temperature was as follows :—

	Mean maximum.	Mean minimum.	Highest maximum.	Lowest minimum.
January	66°	44°	79°	37°
February	67°	44°	84°	36°
March	81°	49°	88°	42°

The minimum was observed daily, the maximum whenever opportunity offered. The heights of places of observation were between 3,000 and 6,000 feet, their differences seeming to have little effect on the temperature. On Jápvo, at about 9,500 feet, the minimum was 31, maximum 40 on the 8th and 9th February.

The rocks are sandstone and shale, which turns to a good slate in the hills to the eastward, where it is used for roofing. The summits of the ranges bounding the Laniere valley to the east are, I fancy, granite, one, an immense thimble-shaped rock so peculiar as to have a name, Kezatulazo, even among the Nagas on the Doyong, and some other points having very much the appearance of peaks of that stone. There is not much game in the country, I fancy; the population is too thick, and pot hunting too prevalent. On one of the few occasions on which I could leave the beaten track, I saw a couple of deer and fell into two artfully covered pit-falls, saving myself fortunately from going to the bottom, but hanging helplessly dangling up to my shoulders until dragged out each time. One can never have a good opinion of a people whose only idea of sport is in the use of such villainous contrivances, and who are so lurking and treacherous that any one of them would feel unsafe a mile from his village and would panji the road behind him on his return. On Japvo I saw some large apes tailless, of the size and appearance of apes from the Cape; they escaped by running, not by climbing the trees.

Extract from the Narrative Report of CAPTAIN GEORGE STRAHAN, R. E., *Deputy Superintendent in charge No. 7, or Rajputana Topographical Survey.*

Rajpootana.

The country through which my triangulation passed is uninteresting in the extreme; it consists for the most part of a plain diversified here and there with groups of sand-hills, some of them rising 80 or 100 feet above the general level. Rocky hills are so few and far between as to afford but little convenience for observing stations. Considerable difficulty was experienced in obtaining supplies, especially grass, and the water is brackish and only found at great depths. I measured one well over 400 feet deep. In many places several villages have to depend for their water supply on one well common to them all. Bajra appears to be the only crop grown. I was surprised to find that a system of telegraphy by the use of looking-glasses flashed in the sun was in use across this desert country from Ajmere to Bikaner. It is used by the opium merchants at the latter place. The system only supplies means for telegraphing whether the opium is selling at cheap, moderate, or high rates in Calcutta. Three places about 150 or 200 yards apart are selected at each telegraph station, and the person receiving the flash at the next station knows by observing at which of these three points the sender flashes, whether the rate is low, moderate, or high. The information is, of course, conveyed as far as Ajmere by electric telegraph. I saw the system in operation, but it did not appear to be very successful in consequence of the carelessness of the signallers whose duty it was to watch for the flash from the preceding station.

The general level of these plains appears to be about 900 feet above the sea. There is no appearance of rivers or watercourses of any kind, the small annual rainfall being almost immediately absorbed by the sand, which appears to be of immense depth. The sand hills do not shift their position to any great extent according to the statement of the inhabitants, and I hope that some of the principal stations which I had to build there at considerable expense may prove tolerably permanent. Marching over such a country is very fatiguing from the depth of the sand, and from its being extensively undermined by rats through the roof of whose burrows nearly every foot-step breaks. There are but few wild animals in this district, ravine deer, a very few nilgai and hyenas being all that I saw. The plane-tabling will no doubt make very rapid progress over such ground as this.

Description of the Ranpur Temple by MR. W. MCNAIR.

Ranpur temple is situated amongst a mass of hills of the Aravalli Range, in latitude 25°-6′-50″, longitude 73°-30′-49″ midway between the villages of Sadri and Bhanpur, with which it is connected by a road running parallel to a water-course for a mile and a half beyond the temple in a westerly direction as far as Malgarh, thence the road turns abruptly south and follows a ravine which takes its rise from the top of the hills 2,000 feet above Malgarh. A description of this pass is given by Captain Strahan in his Report on the Bhanpur Pass.

This temple derives its name from the ancient city of Ranpur, or Ranakpur, which existed during the fifteenth century, and is said to have contained a hundred thousand houses. Ruins are still visible in different directions round the temple even as far as Malgarh hill, on which stands the ruin of a fort supposed to have formed the western defence of the town.

The temple was built by Dhunna "Set" in the Hindoo year 1,496, corresponding to A. D. 1439, during the reign of Roma, son of Koja, who was descended from the famous Bapa. This hero was chosen by the Chiefs of Rajputana to lead their forces against Mahomed Kassim, the first Mahomedan invader of India. Kassim had in 714 conquered Sind, compelling the inhabitants to embrace the Moslem faith. After this he marched into Rajputana, but was met by Bapa and completely routed. Bapa on his return founded the Udepur monarchy, and from him the present Ranas claim their descent.

The temple buildings cover a rectangular piece of ground measuring 260 feet by 244 feet. It is enclosed by an outer wall having 86 cells, each of which contains an idol built against its internal face. In front of the cells and extending into the inner court is a verandah. In the centre of the inner court and parallel with the outer wall is a colonnade supporting a roof

and having at its four corners minarets, each of which contains an idol. This colonnade, or open verandah, surrounds an open space in the middle of the entire enclosure, in the centre of which is built the principal shrine. The pillars, 420 in number, which form the colonnades are richly sculptured with figures of Hindoo divinities. The principal idol, a drawing of which is given, is colossal, represented in a sitting posture, and is carved from a block of granite. Each of the 86 smaller idols is a model of it.

The temple is of sandstone, which must have been brought from the quarries of Narlai, 13 miles away. It stands on a raised foundation about 12 feet high. The view of the interior from the entrance porch is very magnificent and imposing. The long aisles and sculptured minarets lend an air of grandeur, which is heightened by the massive nature of the structure, and render probable the native statement that its constructien cost 75 lakhs of rupees.

It is devoted to the Jain or Jaina system of worship, which is midway between Brahminism and Buddhism. Springing from the latter sect, it partakes more largely of its rites. They acknowledge the whole of the Hindoo gods, but consider their own saints or Jirthan Karas as superior to all, and to these they pay all worship and obedience. The Jirthan Karas are those hermits who by their ascetic practices have gained the heaven of both Jain and Buddhists, that is "Nirvana" or annihilation, a state of profound abstraction in which they are freed from all cares, sufferings, joys or sorrows. They pay great attention to the Vedas, the sacred Hindoo books, but, unlike the Brahmins, do not consider them sacred. They carry their regard for animal life to an absurd pitch, beyond even Buddhists. Their priests, or Jatis, dare not drink water at night lest they should swallow insects, and even in day light strain it through cloth before drinking; they carry a brush and before sitting, sweep the spot for fear of crushing any living thing. Their sacred language is Pali, closely allied to Sanskrit; they have a numerous literature and were the real refiners of the Tamil language.

This system originated about 600 A. D. and declined A. D. 1200. Jains still abound in Guzerat and Kanara; they are an opulent class, generally bankers. The Jain temples are generally very large and handsome, often flat roofed, with courts and colonnades but sometimes, like Hindoo temples, circular and surrounded by statues of Jirthankaras. Besides images they have marble altars, figures of saints in relief, and foot prints of holy men. The noblest specimens of Jain temples are the white marble remains on Mount Aboo; there are Jain caves at Ellora, Nassik and elsewhere. Near Chingraipatam in Mysore is an immense statue of a Jirthan Kara cut out of a rock and nearly sixty feet high. Their Jirthan Karas number 24 and are said to have lived fabulous ages; but the last and most celebrated who lived the age of an ordinary man was Parasnath, whose abode is on a hill of the same name in Bengal. The Jains, also called Sheawaks, are scattered about the West Coast and number probably 5,000,000. They were much persecuted in Madura in the extreme South, thus their leaders impaled and their race nearly rooted out about the eleventh century.

The temple is still considered of some importance. Pilgrims assemble from Guzerat, Bombay, Bhopal, and the North-West Provinces during the months of March and September, when a fair is held which lasts only for a day, owing to the bad reputation the pass has for murder and dacoities.

I was encamped within a few yards of the temple when the fair was held in March last.

For some days previous, travellers had come into Sadri, which is the nearest village on the Marwar side, and halted till the day of the fair. The Bheels on the contrary who have little or nothing to lose and are in fact the ones that commit, in company with the Menas, all the depredations in these passes, bring loads of bamboos the evening previous which are readily bought by the people of Marwar the following day.

From an early hour on this day till sunset the pass, which is about nine miles long, is strictly guarded by sepoys and sowars, sent by the Rajahs of Udepur and Jodhpur, as the pass runs through both States; on ordinary occasions the pass is considered open twice in the week, Sunday and Thursday, when all travellers are escorted through. On each side of the road for about 300 yards from the temple-steps temporary shops are set up merely by sticking into the ground a couple of bamboos six or eight feet apart with a sheet thrown over. The articles displayed consist principally of ornaments of the roughest workmanship, such as steel rings, earrings, noserings and bangles, also glass beads and looking glasses; these latter are much sought after. Some wooden toys are also shown, and, notwithstanding the exorbitant prices asked, are readily bought by the Bheel women and Banias' wives. Amongst the edibles, the dried pumpkin commands a large sale, and is taken into Marwar by the cart load, being a vegetable much sought after.

The pilgrims do their poojah first and spend the rest of the day bartering with the different shop-keepers. In the afternoon I went into the temple and was surprised at seeing, in front of the principal shrine, the pile of pice heaped up, amongst which glittered some silver coins. From enquiries made I was given to understand that yearly from six to eight thousand rupees are collected; half this sum is yearly spent in repairs and in supporting the guardians of the temple who live in the serai that adjoins the temple, the remainder is lodged in the hands of the daroga of Sadri. The number of pilgrims on this occasion exceeded ten thousand. The following is a translation of the inscription engraved on the wall of the central shrine:

In the year 1496 of the Samvat era, amongst the Meywar Rajahs are (1st) Bapa, (2nd) Goil Rajah, (3rd) Bhogsel, (4th) Kalbhoj, (5th) Bhartari Bhut, (6th) Maik, (7th) Sing, (8th) Khoomar Raja, who bestowed much alms, (9th) Mandlat, (10) Narban, (11th) Sakti Koomar, (12th) Sochi Baran, (13th) Kirthi Baran, (14th) Jog Raj, (15th) Bairatthi, (16th) Bansipal, (17th) Harri Sing, (18th) Bersing (19th) Arra Sing, (20th) Chorsing, (21st) Bikram Sing, (22nd) Arrising, (23rd) Khemsing, (24th) Samat Sing, (25th) Komar Sing, (26th) Mathan Sing, (27th) Punna Sing, (28th) Chez Sing, (29th) Tej Sing, (30th) Samar Sing, who had no sons, (31st) Chun Sing, (32nd) Fee Sing, (33rd) Begmag Sing, (34th) Ajjee Sing, his brothers Arre Sing, Sunier Sing, Hammat Sing, Lakshaora Sing, Mokal Sing, who bestowed much in charity. Khoja Rana laid out several gardens and built many houses; he conquered the land of Nagpur from king Narain Mandal Puri, as well as fought against several powerful Rajahs and destroyed his enemies.

In the reign of Romar Rana, Dharma Set was born; he made many pilgrimages and repaired dilapidated dwellings; his elder brother's name was Rathna, who had four sons, Lakha, Sajha, Sona and Salaj; these were by his chief wife; by his second wife he had Jhaja, Jhawar and Bardman. This Dhunna "Set" built three "Loks" in Ranpurnagar, also four of the temple doors, and gave his name to them, his grandson invited a Gúrú, and with the assistance of Sripugjuggat Chander Suri and Dewant Suri (the Gúrús adopted children) and several pilgrims performed their purifications here in the Hindoo year 1496.

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

Statement showing the nature of the work performed, and the progress made from 1st January to 31st December 1874.

Maps, &c.	Scale. Miles. Inches.	Progress and Remarks.
India—Standard in 6 sheets ...	32=1	New materials from the several surveys in progress inserted, waiting further survey.
India—No. 3, reduced from above standard, 4 sheets ...	64=1	Engraving; fresh additions made on dry proofs from recent surveys, Sumatra compiled and new names written.
India—for a general map of the world	10=1	Sheet 7, between parallels 25° and 30° and meridians 74° and 78°; sheet 19 between parallels 20° and 25°, and meridians 90° and 94°, suspended.
India—6 sheets	32=1	A reproduction of the standard map divided into 6 uniform sheets, blue prints taken to be re drawn with a view to speedy publication, sheets 1 and 5 out-lined, sheet 4 (Bengal) out-lined and written, nearly completed.
Bengal—Standard in 4 sheets ...	16=1	Proofs examined and corrected. Original sheets brought up to date from recent surveys.
Bengal—Eastern Frontier of 3 sheets	4=1	Originals being completed from recent surveys to date. In progress.
Bengal—Western, in 10 sheets ...	8=1	The following sheets compiled and drawn complete with hills. Sheet 14, Midnapore, Balasore, Singhbhoom, and part of the Orissa Tributary States. Sheet 15, Cuttack and Pooree Districts. Sheet 13, parts of Hazareebagh, Manbhoom, Lohardugga, Sonthal Pergunnahs, and Beerbhoom. Sheet 11, part of Nepal. Sheet 17, parts of Sarun and Shahabad. Sheet 18 } Part of Lohardugga and the Gurjat Sheet 19 } States of Chang Bhokar, Korea, Sirguja, Oodeypore, Jashpore, Gangpore and Bonai. Sheet 20, part of the Orissa Tributary States. These sheets complete the series.
Oudh—Outline map ...	16=1	Fresh additions made on dry proofs and all necessary names written; engraving.
Sindh—The Province of ...	16=1	Compiled and drawn complete with hills, &c.; engraving.
Assam—In 8 sheets, Provinces under the Chief Commissioner ...	8=1	Compilation of sheets 4 and 5 embracing parts of Goalpara, Kamrup, Nowgong, the Garo, Khasia, Jaintyah and Naga Hills, with Sylhet, in progress from latest surveys.
Assam—Northern Frontier of ...	8=1	Compiled and drawn from the latest surveys and the best materials for use of the Duffla Expedition.
Bhootan—New Map of ...	8=1	Compiled and drawn from the best available information with hills.
Punjab—Outline Map ...	32=1	Fresh additions compiled of countries on north-west frontier, for a new edition.
DIVISIONAL MAPS.		
Dacca Division	16=1	Drawn for the "Imperial Gazetteer" of Bengal.
Cooch Behar Division Patna Division ...	8=1	Skeleton maps on vellum cloth to illustrate the famine relief operations, &c.
Bengal and Behar	64=1	2 copies } To shew extent of jute cultivation and
Do.	32=1	2 copies } manufacture.
DISTRICT MAPS.		
Lohardugga ... Shahabad ... Monghyr	4=1	Tracings on vellum cloth for reproduction, prepared in skeleton form to illustrate the famine relief operations and other projects.

Statement showing the nature of the work performed and the progress made from 1st January to 31st December 1874—continued.

Maps, &c.	Scale.	Progress and Remarks.
DISTRICT MAPS—*continued.*		
Bhaugulpoor ...		
Purneah ...		
Midnapoor ...		
Burdwan ...		
Julpaigoree ...		
Sonthal Purgunnas ...		
Chumparun ...	4 – 1	Tracings on vellum cloth for reproduction, prepared in skeleton form to illustrate the famine relief operations and other projects.
Sarun		
Tirhoot		
Bancoorah ...		
Singhbhoom ...		
Rajshahi ...		
Gaya		
Cooch Behar ...		Compiled from Revenue Survey sheets.
Chindwara District	4=1	Reduced from the Revenue Survey sheets and drawn complete with hills.
Hazara District	4=1	Ditto ditto ditto.
Hazara, vernacular map ...	4=1	Drawn for use of the native officials under the Deputy Commissioner of Hazara by special request, in outline.
Darjeeling District	4=1	Reduced from sheets of the Revenue Survey, drawn complete with hills and the Native State of Sikkim also added from best available sources.
Garo Hills District	2=1	Compiled and drawn complete with hills from the latest Topographical Survey.
Nowgong District	4=1	Reduced from sheets of the Revenue Survey, outlines in progress.
Baitool District ...		
Sibsagar District ...	4=1	Reduced from sheets of the Revenue Survey, outlines in progress.
Lakhimpur District ...		
Raipur District ...		
Karauli Native State ...	4=1	Drawn for the Rajputana Gazetteer.

Sheets of the Atlas of India, engraving in India.

Maps, &c.	Progress and Remarks.
Sheet 34, quarters, N. W. and S. W.	Parts of Jeypur, Udeypoor and Bundi Native States and Ajmere, additional material to date from recent surveys compiled and drawn in outline. In progress.
„ 49, full plate	Rajputana State Railway inserted on a dry proof.
„ 52, N. W., N. E., S. W., S. E.	Parts of Malwa and Gwalior, Tonk and Jhalra Patan Native States, N. E. and S. E., compiled and drawn with hills, N. W. and S. W. in progress.
„ 53, quarter, N. E. ...	Part of Bhopal compiled and drawn to date in outline. In progress.
„ 67, full plate	Part of Oudh compiled and drawn to complete plate.
„ 72, quarter, N. W. ...	Part of Chindwarra District compiled and drawn in outline. In progress.
„ 93 „ N. E., S. W. ...	Parts of Jeypore, Bustar and Godavery Talooks (Vizagapatam Agency), N. E., hills, drawn on a dry proof; S. W., additions made to date in outline. In progress.
„ 105 „ S. W. ...	Parts of Belaspur and Sumbulpur Districts and Gurjat States, Chota Nagpur Division, compiled and drawn in outline. In progress.
„ 106, full plate	A dry print proof of this plate, under correction on the north-west for the Native State of Raigarh from the sheets of the Chota Nagpore Division Survey.
„ 107, and 108 full plates ...	Jeypoor, Kalahandy, Panchpetta, &c., of the Vizagapatam Agency, hills drawn, to complete.
„ 113, full plate	Hazareebagh compiled and drawn in outline on a dry proof to complete plate. In progress.

Sheets of the Atlas of India, engraving in India—continued.

Maps, &c.	Progress and Remarks.
Sheet 115 and 116, full plates ...	Orissa new canals and roads, inserted on dry proofs to bring up to date.
,, 119, full plate	Part of the Garo Hills, compiled and drawn in outline from recent surveys to complete plate. In progress.
,, 124, quarters, N.E., S. E., S. W.	Parts of Goalpara, Kamroop, Durrung and Nowgong, additions of new material to complete plates under compilation. In progress.
,, 125, quarters, N.E., S. E., N. W.	Parts of the Garo, Khasia, and Jaintiah Hills, additions to complete plates compiled and drawn in outline. In progress.
,, 130, quarter, S. W. ...	Part of the Naga Hills, additions from recent surveys under compilation. In progress.
,, 131, quarter, N. W., S. W. ...	Part of the Naga Hills and Manipur, additions from recent surveys under compilation. In progress.

Sheets of the Atlas of India, engraving in England.

Sheet 8, quarter S. E. ...	Part of Sindh, proof corrected and returned to England.
,, 50, full plate	Parts of Jeypore, Ulwar, &c., proof corrected, completed with hills, &c., and returned to England.
,, 69, quarter S. E.	Part of Bundelkund, proof corrected and returned to England.
,, 70 ,, N. E.	Part of Bundelkund, proof corrected and returned to England.
,, 71 ,, N. W., S. W. ...	Parts of Bhopal, Hoshungabad, Chindwara, &c., Chindwara portion compiled and drawn complete with hills, proofs corrected and returned to England.
,, 89, full plate	Part of Rewah, &c., proof corrected, additions made and returned to England.
,, 90, quarter N.E., S.E. and N.W.	Parts of Belaspur District, Rewah and Gurjat States of Chota Nagpur Division, S. E., proof corrected, N. W., compiled and drawn with hills to date and sent to England, S. E., additions to complete this plate under compilation, N. E., drawn in outline only.
,, 91 ,, N. E., S. E. ...	Parts of Belaspur and Raipur, additions to complete plates and under compilation. In progress, nearly ready.
,, 92 ,, S. E.	Parts of Jeypur and Bustar, proof corrected and returned to England.
,, 104, full plate	Parts of Hazaribagh, Lohardaga, &c., proof corrected and returned to England and hills drawn complete.
,, 105, quarter N. W. ...	Part of Gurjat States of Chota Nagpore Division, proof corrected and returned to England.
,, 118, full plate	Part of Bhootan and the Western Dooars, proof corrected and returned complete to England with additional hills drawn.
,, 126, quarters N.W., N.E., S.W., S.E.	Eastern Districts of Bengal with Hill Tipperah and Lushai Hills, &c., proofs corrected, additions compiled, and drawn complete with hills and returned to England.
,, 127 ,, N.W., S.W., N.E., S.E.	Eastern Districts of Bengal, proofs corrected, additions compiled and drawn complete with hills and returned to England.
,, 128 ,, N. E.	Part of Chittagong and Akyab, dry proof corrected and returned to England.

Standard sheets of the Topographical Survey, re-drawn for Photozincography.

Maps &c.	Scale.	Progress and Remarks.
Chota Nagpore Division Survey.		
Sheets, 9, 10, 11, 12, 13, 14, 16, 21, 22 & 23	1=1	Projected and re-drawn from the original 6" sections.
Sheets 5, 15, 17, 20 and 2 ...	1=1	Projected and in progress in various stages.
Ganjam and Orissa Survey.		
Sheets, old series, 9, 49, 59, 70 and 72.	1=1	Projected and re-drawn from the original 6" sections.
,, 12, 13, 14, 15 and 15A. ...	2=1	Ditto ditto ditto.

Standard Sheets of the Topographical Survey re-drawn for Photozincography—continued.

Maps, &c.	Scale.	Progress and Remarks.
Ganjam and Orissa Survey—could.		
Sheet 7, 11, 20, 21, 38, 47, 49, 60, 61	1=1	Projected and in progress in various stages.
85 and 87		
„ 26, 27, 28 and 29 ...	2=1	Ditto. ditto ditto.
North-East Division Central Provinces Sheet 11	1=1	Projected and re-drawn.
Miscellaneous Maps, &c.		
India Sketch Map	32=1	Showing financial circles and Customs line to 1874, prepared for the Financial Department.
Hill Tipperah	12=1	

Index to the Atlas of India. A new one prepared for general use.

„ to the surveys of India, to accompany Surveyor General's Report for 1873-74.

„ to the one inch sheets of the survey of India, 32 miles=1 inch, 3 copies.

„ Garo and Khasia Hills Survey, 16 miles=1 inch, prepared on vellum cloth for reduction to half scale, by photography.

Corrections and additions to Topographical Survey sheets, 1 mile=1 inch, and 2 miles=1 inch; 51 sheets examined and corrected.

Corrections and additions to engraved, lithographed and photozincographed maps, various { railways, boundaries, territorial names heading, and footnotes and titles, &c., inserted, examined and corrected in 2,120 sheets.

Lithographed and photozincographed maps and plans colored 18,590 sheets.

Atlas sheets and engraved maps colored 5,902 „

Proofs examined of Atlas sheets, maps, charts and plans 1,162 „

Surveyor General's Office, Calcutta,
1st *January* 1875.

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

Annual Progress Report, Engraving Branch, Surveyor General's Office.

No. of Atlas sheets.	*Atlas Sheets finished and ready for publication.*	When finished.
2 S. E.	Completed and ready for publication.	August.
9 N. W.	Ditto ditto ditto.	April.
9 N. E.	Ditto as far as drawing or survey is done, about three-fourths of the sheet still blank.	October.
53 S. W.	Ditto as far as drawing or survey is done.	December.
72 S. E.	Ditto ditto ditto. A very small portion remains blank in the N. W. corner.	Ditto.
124 S. E.	Ditto as far as drawing ditto.	July.
131 N. W.	Ditto ditto ditto.	October.
7 Plates.		
	Sheets of the Indian Atlas that have been in hand for additions, repairs and alterations.	
17	Additions, finished.	
26	Hill work, repaired.	
29	Additions, finished.	
30	Ditto and corrections, finished.	
31	Ditto ditto ditto.	
42	Hills repaired, ditto.	
44	Additions, ditto.	
47	Ditto ditto.	
48	Ditto ditto.	
49	Ditto Railways, ditto.	
57	Ditto ditto.	
62	Ditto ditto.	
63	Ditto Border recut, ditto.	
64	Ditto ditto.	
74	Ditto ditto.	
75	Writing recut, ditto.	
76	Additions, ditto.	
77	Ditto ditto.	
78	Hills repaired, ditto.	
106	Writing recut, ditto.	
113	Writing recut, ditto.	
114	Additions, ditto.	
121	Ditto.	
	Quarter Sheets.	
1 S. E.	Additions, finished.	
2 S. W.	Ditto ditto.	
3 N. E.	Ditto ditto.	
3 S. E.	Ditto ditto.	
51 N. E.	Ditto ditto.	
51 S. E.	Ditto ditto.	
51 S. W.	Ditto ditto.	
87 N. W.	Ditto ditto.	
87 S. W.	Ditto ditto.	
105 N. E.	Ditto ditto.	
125 N. E.	Ditto ditto.	
34 Plates.		
	Miscellaneous maps and other work finished, and additions and corrections made.	
1	Map of Oudh, scale 16 miles = 1 inch.	
2	Small map of Bengal.	
3	Ditto Burdwan Division.	
4	Ditto Presidency ditto.	
5	Ditto Dacca ditto.	
6	Map of the Punjab, additions.	
7	Ditto North-West Quadrilateral, additions.	
8	Index Chart to the G. T. Survey of India, additions.	

Double Elephant or full size plates.

No. of Atlas sheets.		When finished.
	Miscellaneous maps and other work finished, and additions and corrections made,—Continued.	
9	Map of India, No. 1, additions.	
10	Ditto No. 2, ditto.	
11	Plate of instruments used in the G. T. Survey.	New plate.
12	Theodolite plate 4, additions.	
13	Ditto ditto 5 ditto.	
14	Signal apparatus plate 10, additions.	
15	Topographical items ditto.	
16	Plan and section illustrative of the towers.	New plate.
17	Colonel Everest's plan of towers, additions.	
18	New plate of imprints with month and date.	
19	Map Heading for Revenue Survey.	
5	Five scales engraved for the M. I. D.	
Plates 24	*Atlas sheets in hand up to December* 1874.	
2 N. E.	Outline and writing done, hills in progress.	
34 S. E.	Ditto ditto ditto.	
52 S. E.	Ditto done, writing in progress.	
52 N. E.	Ditto ditto done, hills in progress.	
53 N. E.	Ditto ditto ditto.	
D. E. 55	Writing being re-cut.	
„ 58	Repairing hills.	
„ 59	Writing being re-cut.	
„ 60	Hill work being re-etched.	
„ 61	Writing being re-cut.	
„ 67	Outline of new survey done, writing in progress.	
72 N. W.	Outline done, writing in progress.	
72 N. E.	Outline and writing done, hills in progress.	
D. E. 73	Additions and corrections in progress.	
„ 75	Writing being re-cut.	
„ 88	New survey, heavy sheet, writing in progress.	
93 N. E.	Outline and writing done, hills just commenced.	
93 S. W.	Ditto done as far as drawing, writing in progress.	
93 S. E.	Ditto ditto ditto.	
D. E. 103	Writing being re-cut.	
105 S. W.	Outline done, writing just commenced.	
D. E. 107	Additions done, hills in progress.	
„ 108	Ditto outline done, writing just commenced.	
„ 111	Writing being re-cut.	
„ 112	Ditto ditto.	
„ 113	Large portion being cleaned off the plate for new survey.	
„ 119	Outline of new survey done, writing just commenced.	
„ 124 S. W.	Ditto done, writing in progress.	
„ 125 N. W.	New survey outline and writing done, hills in progress.	
33 Plates of Atlas sheets in hand.		
	Engraving the borders of four quarter sheets, and two projected *viz:* Atlas sheets 130 S. E. and 130 S. W.	
	Miscellaneous maps and other plates in hand up to December 1874.	
1	No. 3 Map of India in four sheets, outline done and writing well advanced.	
2	Map of Sindh, just commenced.	
3	Plan of Calcutta, additions nearly done.	
4	Large Tint being ruled.	
5	New imprints nearly done.	
6	Old ditto alterations in progress.	
6 plates in hand.		

Copper-plate printing branch, number of impressions taken.

Transfers	... ..	662
Proofs	... ...	1,206
Impressions	... ...	10,529
	Total ...	12,397

12,397 Impressions of transfers, Atlas sheets and other maps likewise of miscellaneous work.
104 Plates have been in progress during the year 1874.

SURVEYOR GENERAL'S OFFICE, CALCUTTA,
1st *January* 1875.

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

APPENDIX D.

Dr. *Abstract Cash Accounts from 1st January to 31st December 1874* *Cr.*

Items.	Amount.			Total amount.		
TO MAP SALE ACCOUNT.	Rs.	A.	P.	Rs.	A.	P.
Amount received from sundries	849	2	6			
Sales by Punjab Printing Company	395	0	0			
„ by Curator of Government Books, N. W. Provinces ...	218	8	4			
„ by Thacker, Spink and Co.	3,132	10	6			
„ by Curator of Government Books, C. Provinces	16	0	0			
„ by Mrs. E. Williams	411	0	0			
„ by Superintending Engineer, Bombay	17	8	0			
				5,039	13	4
TO REFUND ACCOUNT.						
Amount received from Mr. J. H. O'Brien, Probationary Assistant Surveyor, in part refund of his pay and allowances for not having served three years as stated in agreement signed by him at the time of admission.	285	0	0	285	0	0
TOTAL ...	...	...	...	5,324	13	4

Items.	Amount.			Total amount.		
BY TRANSFER ACCOUNT.	Rs.	A.	P.	Rs.	A.	P.
Amount paid to Bank of Bengal, No. 59, dated 7th January 1874 ...	407	4	0			
Ditto ditto No. 201, dated 2nd February 1874, and No. 383, dated 26th February 1874 ...	442	8	0			
Ditto ditto No. 625, dated 30th March 1874 ...	236	0	4			
Ditto ditto No. 640, dated 1st April 1874, and No. 854, dated 30th April 1874	3,172	10	6			
Ditto ditto No. 1040, dated 28th May 1874 ...	17	8	0			
Ditto ditto No. 1178, dated 29th June 1874 ...	16	0	0			
Ditto ditto No. 1404, dated 15th August 1874 ...	285	0	0			
Ditto ditto No. 1648, dated 23rd September 1874, and No. 1674, dated 28th September 1874.	429	0	0			
Ditto ditto No. 1724, dated 8th October 1874 ...	193	12	0			
Ditto ditto No. 1994, dated 27th November 1874 ...	14	4	0			
Ditto ditto No. 2251, dated 30th December 1874 ...	93	6	6			
Ditto credited to Government of Bombay, as per Superintending Engineer, Bombay, No. 1182, dated 29th May 1874.	17	8	0			
				5,324	13	4
TOTAL ...	...	...	...	5,324	13	4

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

Memorandum showing the total amount recoverable from the Map Sale Agents for 1874.

Punjab Printing Company	Rs	168	4	0	Curator of Government Book Depot, Central Provinces ...	Rs.	320	8	0
Curator of Government Books, North-Western Provinces ...	„	114	0	0	Messrs. Cotton and Morris, Simla	„	50	14	0
Messrs. Thacker, Spink & Co.	„	3,230	1	0					
Messrs. Thacker, Vining & Co., Bombay	„	200	7	0		TOTAL Rs.	4,084	2	0

Report by CAPTAIN J. WATERHOUSE, *Assistant Surveyor General, in charge Photographic Branch, dated the 1st January* 1875.

1. AMOUNT OF WORK.—The amount of work performed between the 1st January and the 31st December may be briefly stated as follows :—

1,280 original maps and other subjects have been received, 812 transfers have been made to zinc or stone, 1,53,242 complete photozincographed copies of maps, &c., struck off, besides 1,324 silver prints, and 1,495 photocollotypes.

2. PROGRESS.—The difference between the amount of work turned out in the year under notice and in the previous year is shown in the table below, from which it will be seen that, although the number of original maps received is less than in the previous year and the numbers of negatives and transfers are only very slightly less, there has been an enormous increase in the out-turn of printed sheets, estimated both by the number of pulls, or actual work done, and by the number of complete copies. This is attributable to the large demand for maps of the districts invaded by famine in the early part of the year, and to meet this demand, an extra press was set up and the ordinary establishment made to work extra time, the result being that between the months of January and July upwards of 27,800 sheets of famine maps were struck off in this office alone, of which number, 12,400 were done in the month of March. The number of silver prints is less than last year, but this process is now comparatively unimportant and but little used.

3. The photocollotype work has not progressed so satisfactorily as I could have wished, but this may be accounted for partly by a change in the establishment working this process and a consequent loss of time in learning the details as modified for use in this country, and partly by the great difficulties and uncertainties met with in working the gelatine films in this unfavorable climate :

SUBJECTS.	1873.	1874.	DIFFERENCE.	Difference in decimal square feet.
Originals	1,611	1,280	— 331	
Negatives	1,969 *5110·72 d. s. f.**	1,933 *5203·36 d. s. f.**	— 36	*+ 9,264 d. s. f.**
Silver prints	2,010 *3553·84 d. s. f.*	1,324 *1610 06 d. s. f.*	— 686	*— 194,378, d. s. f*
Phototransfer prints ...	1,949 *5157·88 d. s. f.*	1,926 *5276·21 d. s. f.*	— 23	*+ 118·33 d. s. f.*
Photocollotypes	3,000	1,495 *2668·55 d. s. f.*	— 1,505	
Transfers to zinc	829	812	— 17	
Number of pulls	1,1.1876	1,57,600	+ 45,724	
Ditto of complete copies ...	1,05,753	1.53,242	+ 47,489	

* Decimal square feet of 100 square inches.

4. EXPENSES OF WORKING.—The approximate expense of working the office during the year, including the Superintendent's salary, has been Rs. 61,176-14-1.

5. The approximate sum to credit of the department is Rs. 87,826-11-6, showing a nominal profit of Rs. 26,649-13-5.

6. PERSONNEL.—I have much pleasure in reporting on the continued good conduct and steady attention to their duties of my European Assistants, Messrs. J. Mackenzie, B. Mackenzie, J. Watson, and Sergeant Harrold. Corporal Marshall, R. E., arrived from Chatham on the 20th March, and took charge of the collotype printing ; and though he has not made the progress that was expected from his training in England has worked very hard to adapt the English methods for use in this climate and has produced some very fair results, and it is hoped that with further experience he will do better.

Syud Ishmael and the other Native assistants have also worked satisfactorily.

7. PROCESSES.—There have been no changes of importance in any of the processes used. A method of preparing the phototransfers by Captain Abney's papyrotype process was tried, but was not successful for want of the proper transfer paper and appliances. A supply of paper has just been received from England, and the experiments will be resumed immediately.

8. By this process the phototransfers are prepared by inking in a print on paper prepared with gelatine, chrome alum and bichromate of potash, and on which the gelatine being consequently insoluble serves both as a protection for the fine lines and to prevent the transfer print slipping and the ink spreading during the process of transfer to zinc, thus the work is sharper and the fine lines are better preserved than in the ordinary process, where the superfluous ink is washed away with the unaltered gelatine and the fine lines are liable to be lost.

9. PHOTOCOLLOTYPE PROCESS.—On the arrival of Corporal Marshall a great many experiments were tried to work the collotype process in the manner practised successfully by Captain Abney at Chatham, but it was found that these methods could not be used with advantage in this climate, and after several trials the following formula was adopted as giving the best results :—

Gelatine	1½ ounce.
Glycerine	1½ dram.
Albumen	1 ounce.
Bichromate of potash	40 grains.
Chrome alum	7 grains.
Water	12 ounces.

In other respects the working of the process is much the same as described in previous reports. The principal work done by this process during the year has been a series of plates of illustrations of the sculptures in the caves of Cuttack reproduced direct from the casts made by Mr. H. H. Locke for Babu Rajendralala Mitra's work on the antiquities of Orissa. The series, though not so perfect as could be wished, admirably show the superiority of the process and its immense superiority over lithography for such work.

10. EXPERIMENTAL WORK.—Much of the limited spare time the charge of two offices leaves me available during the year has been devoted to drawing out plans of the new buildings for the Survey offices, and in preparations for the transit of Venus, and consequently I have not been able to do all I should have liked in advancing the special work of the office. I have continued my observations on the solubility of chrome gelatine tissues and on the effect of the addition of organic acids to a mixture of gelatine and bichromate of potash in connection with the collotype and the ordinary phototransfer processes, and it is probable that when I find leisure to go more closely into the subject, that useful results may be obtained. Several foreign systems of collotype printing have been experimented upon, particularly those in which the sensitive surface is spread over *metal* plates, and which would possess many advantages over the usual methods with glass plates, but the pressure of current work and constant interruptions caused by other demands upon my time and attention render it difficult to carry such experiments to a practically successful issue.

11. THE TRANSIT OF VENUS.—Though this great event of the year does not come within the scope of the ordinary work of the Department, this office has taken an important part in the observations of it by means of photography. In August I was appointed to the charge of the photographic observations under Colonel Tennant, and from that time till the beginning of October, when I left Calcutta to join Colonel Tennant, at Roorkee, the whole of my spare time was taken up in experimenting on various dry processes with a view to find one suitable for use for taking the solar photographs with the photoheliograph. A summary of the results of these experiments and a full account of the operations are given in the accompanying memorandum, and it will be sufficient to say that 107 photographs on 6-inch plates were taken at intervals of two minutes during the progress of the transit, besides five circular plates of the three last contacts and two intersections taken in the Janssen apparatus. Each of these circular plates comprises 60 separate pictures taken at intervals of about 1·21 minutes.

12. Thirty-nine photographs of transit were also taken in Calcutta, under the superintendence of Mr. J. O. N. James, Assistant Surveyor General, with a rough photoheliograph I had made up for the dry plate trials. These photographs, though smaller and not so perfect as the ones taken with the finer instrument at Roorkee, and of no strictly scientific value, may be useful as a complete series showing the phases of the whole transit, and for comparison with others taken in different places.

13. HAND-BOOK OF TOPOGRAPHICAL DRAWING FOR INDIA.—The want of good specimens of writing, printing and topographical drawing suitable for the maps of the Indian surveys under the new system of drawing in pen and ink for reproduction by photography has long been felt, and I have therefore endeavoured to supply the want by collecting a series of the most suitable alphabets either hand-drawn, engraved, or from ordinary type and specimens of drawing selected from maps of the Revenue and Topographical Surveys that were considered to be most suitable in style and execution for successful reproduction by photozincography. The earlier publication of this collection was delayed by the demands of current work on the presses, but the first part containing the specimens of cartographic writing and printing has been issued, and the plates of the second part containing specimens of drawing will be proceeded with immediately so that it may be ready before the end of the year.

Abstract of work performed in the Photographic Branch of the Surveyor General's Office from 1st January to 31st December 1874.

Maps photographed.	Number of sections or sheets.	Number of negatives or plates.	PRINTS. Collo-types.	Silver	Transfer.	Transfers to zinc or stone.	Number of pulls.	Number of complete copies.	REMARKS.
Topographical Maps ...	140	223	...	222	204	...	21,565	21,760	
Revenue Survey Maps	689	1,003	...	16	1,057	...	46,676	39,908	11,995 Anastatic.
District Maps ...	25	84	...	...	93	...	14,810	10,470	470 ditto.
General „ ...	23	97	...	32	111	...	8,930	5,874	
City and Cantonment Plans	69	80	...	...	83	...	14,418	5,040	
Miscellaneous Maps ...	334	446	1,495	1,054	378	...	50,070	70,190	2,250 Anastatic. 346 Zincograph.
Zincographic and Anastatic Transfers ...	...	...	...	...	...	812	...	...	
Proofs	...	...	...	...	...	...	1,131	...	
TOTAL ...	1,280	1,933	1,495	1,324	1,926	812	1,57,600	1,53,242	

Statement showing cost of working the Photographic Branch of the Surveyor General's Office from 1st January to 31st December 1874.

DR.	Number of complete copies.	Rs. A. P.	DR.	Rs. A. P.
Topographical Survey Maps	21,760	21,237 14 7	Superintendent's salary from 1st January to 31st December 1874.	10,809 4 6
Revenue Survey Maps ...	27,913	34,455 8 4		
District Maps ...	10,000	6,479 15 2	Sanctioned establishments and house-rent from 1st January to 31st December 1874.	24,382 1 9
General „	5,874	5,400 3 4		
City and Cantonment Plans	5,040	8,205 0 0	Contingencies, inclusive of chemicals received from the Government Medical Store Department on emergent indents, and stores from England (as far as invoices have been received)	12,327 4 11
Miscellaneous Maps ...	67,594	2,667 7 9		
Anastatic „ ...	14,715	7,242 6 0		
Zincographed „ ...	346	11 1 0		
Silver prints	1,324	1,145 13 4	Cost of paper	13,658 2 11
Photocollotype ...	1,495	981 6 0	Balance in favor of the Department	26,649 13 5
TOTAL ...	1,56,061	87,826 11 6	TOTAL ...	87,826 11 6.

J. WATERHOUSE, *Captain,*
Asst. Surveyor General,
In charge Photographic Branch,

Calcutta, 1st January 1875.

Memorandum on the Photographic Operations connected with the Observation of the Transit of Venus at Roorkee, December 8th (9th Civil) 1874.

Personnel.

The operations were under the charge of Captain J. Waterhouse, Assistant Surveyor General, assisted by Sergeant J. Harrold, R. E., a photographer from the Surveyor General's Office, Calcutta ; and Lance-Corporal George and Private Fox of Her Majesty's 55th Regiment, who had been trained in the ordinary photographic manipulations by Colonel Tennant. Three native khalassies were also entertained for cleaning the rooms and apparatus and other miscellaneous duties.

Equipment.

The instrument used on this occasion for taking the solar photographs was an equatorial photoheliograph by Dallmeyer, exactly similar to those furnished to the English observing parties, and therefore requiring no special description. The necessary equipment of chemicals and apparatus was supplied partly by the stores sent specially from England, and also in great part from the Surveyor General's Office, Photographic Branch, and my own private apparatus ; for the wet-plate chemicals, supplied from England in the first instance, were lost on the voyage, and the second supply came too late. The other chemicals and appliances sent from home were principally meant for dry-plate work, but, as will be seen, this process was abandoned. A great many appliances, such as shelves, extra plate boxes, a drying box for dry-plates, plate-racks, &c., &c., had to be made up on the spot at the Canal Foundry, the Sapper and Miner Workshops, and by native carpenters under my own immediate supervision.

General arrangement.

The general arrangement of the Photographic rooms in the Observatory was very convenient and efficient. As will be seen from the accompanying plan, the dark-room was about 10′ × 10′ and was entered by a double door leading out of the general entrance to the Observatory. On the right hand, in front of the window, was the developing table with an ample supply of water at hand contained in two tanks, one inside and the other outside the room. On a shelf close by were placed all the chemicals used in developing. On the left was a table for the sensitising baths, and shelves conveniently placed for the collodion and plate boxes. Directly in front of the entrance-door a second set of double doors, with a passage between them, opened into the Instrument room, in which was the Photoheliograph. In order to obviate the necessity for constantly opening these doors for the passage of the dark-slides to and fro during the operations, a box opening at both ends and large enough to hold a dark-slide was let into the panelling of each of the doors, and in this manner the dark-slides were passed backwards and forwards between the dark-room and Photoheliograph without any risk of letting in light. The Janssen slide had, of course, to be carried through from the dark-room to the instrument, but the double doors enabled this to be done very conveniently without interrupting the work in the dark-room.

There being only a single dark-room in the Observatory, it was undesirable to use it in any way as a store or laboratory, and nothing was kept in it beyond the chemicals and appliances actually in use. A dark-room for the preparation of dry-plates, testing baths, &c., was fitted up in a bungalow immediately opposite the Observatory, and here also all preparation of chemicals, cleaning of plates were carried on, and the spare stores kept.

The Photoheliograph stood on an isolated brick pillar in the centre of a circular room 12 feet in diameter, fitted with a revolving dome similar to the other domes. On the wall to the left hand was placed the electric clock-dial worked by a current from the standard clock. The wires connecting the recording tappet-key and Janssen slide with the chronograph were taken through the passage, down the wall and then, passing under the floor, up the pillar of the instrument and fastened in connectors fixed on a shelf near the top of it. Separate pairs of wires for the Janssen slide and for the tappet-key were fixed in the connectors, the ends of the Janssen wires being left loose, so that they could be attached to the slide when in use. The tappet-key was fitted with a pair of scissors, according to a plan devised by Colonel Tennant, so that the act of cutting the thread to set loose the exposing shutter completed the circuit, and thus each exposure was instantaneously recorded on the Chronograph.

Process employed.

It had originally been intended to use the dry-plate process on account of the great convenience it presented in allowing the operations of preparing and developing to be performed at leisure, free from hurry and excitement, as well as for the ease of working the large number of plates required with a minimum establishment.

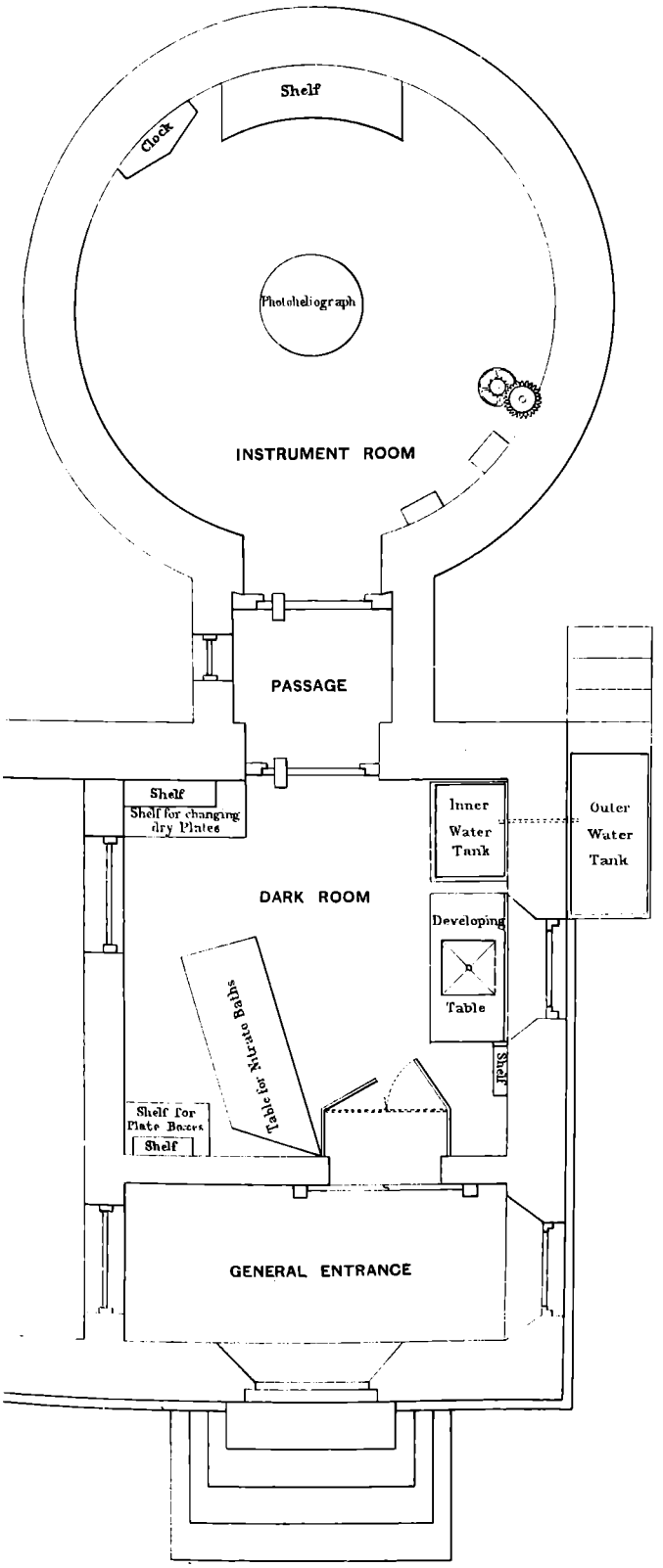
I had never had much experience of dry-plate working, but in view to using the process for the Transit photographs, I made trials of different processes in Calcutta, almost daily, from about the middle of August till the beginning of October, when I left Calcutta to join Colonel Tennant. I found that the beer-albumen process, recommended by Captain Abney and adopted by the English expeditions, was not in many respects so good as other processes, particularly in a great want of sensitiveness. I also found from trials with a rough photoheliograph, made up for the purpose, that the sun-pictures required special conditions, so that a dry process which would answer very well for views, would not answer with the sun, and vice

PLAN OF PHOTOGRAPHIC ROOMS

ROORKEE OBSERVATORY

as arranged for observing the Transit of Venus

Scale $\frac{1}{4}$ *Inch* = 1 *Foot.*



rerså; and I could not decide upon any process as giving really satisfactory results with the sun, but hoped that with the proper chemicals and improved appliances to obtain better results at Roorkee. It may, however, be mentioned that most promising results had been obtained from plates prepared with laudanum, either alone, as a dilute solution containing from 30 to 120 minims to an ounce of water, or with the addition of gum arabic or gum tragacanth. I was led to use the laudanum from a statement of Prof. Vogel, that plates prepared with morphia were more sensitive to the comparatively nonactinic rays from the outer part of the solar disc; and though I did not remark any particular superiority in this respect, the laudanum plates were found more sensitive than most of the others tried.

After my arrival at Roorkee, I again tried Abney's process with the chemicals sent out by him, as well as a very good beer-albumen process recommended by Mr. Davies of Edinburgh, which was found better than Abney's in point of sensitiveness, and also the gum-gallic and laudanum processes, which my previous experience in Calcutta led me to believe likely to give good results, but all attempts failed owing to the plates being covered with spots, the cause of which could not be traced, and which resisted all endeavours and careful precautions to avoid them, and were the more perplexing because I had experienced nothing of the kind in Calcutta, though working with no special precautions. Besides the tendency to spots, none of the plates prepared by the beer-albumen, laudanum, gum-gallic and other processes gave quite satisfactory pictures of the sun, but the best results were obtained from a modification of the coffee process recommended by M. de Constant of Lausanne, albumen being substituted for gum to avoid all tendency to blistering. This process was exceedingly simple, and the plates prepared by it were found fairly sensitive and perfectly free from blurring. The plates having received a coating of albumen as a substratum were coated with collodion and sensitised by a somewhat prolonged immersion in a 40-grain silver-bath, then washed in four changes of distilled water, and finally immersed in a sensitising solution, or so called preservative, composed of

Dried Albumen	30 grains	or	1 part.
Sugar	180 „	„	6 parts.
Coffee infusion, made by boiling 1 ounce of coffee, in 12 ounces of distilled water	10 ounces	„	160 „
Water	10 „	„	160 „

and then drained and dried without heat.

I may note that the highly bromised collodion recommended by Captain Abney for solar pictures was found very valuable in giving an intense picture with considerable sensitiveness, but owing to the short time between receiving the materials from England and their being used, this collodion had scarcely time enough to ripen properly, and so could not have a fair trial. It was, however, used on the day of the Transit with the above preservative for one of the Janssen and four of the 6-inch plates, and, with the exception of the spots, gave very excellent pictures, fairly sharp and dense, quite free from blurring, and indeed, in some respects, much better than many of the wet plates.

Owing to the difficulty experienced in obtaining satisfactory results with the dry plates, it was resolved to adopt the wet process, and the dry-plate trials and drills were discontinued about three weeks before the Transit. Although the dry-plate process would have been undoubtedly more convenient in some respects, and one was naturally reluctant to give it up after all the trouble taken to perfect a good working method, the change to wet had many advantages in avoiding the very tedious operations of preparing and developing the plates, which alone would have taken up about two days before and after the Transit, and more particularly in enabling the state of the working to be seen throughout its progress, and any defects remedied immediately. Further, the manipulations of the wet process were familiar to all my assistants, and by a division of labour they were able to carry on the work with ease and without the slightest confusion.

The details of the wet process worked on this occasion do not require any special notice beyond a mere outline of the operations.

Preparation of the Plates.

The plates having been numbered on the back with a diamond, were cleaned and then coated with an albumen substratum composed of the white of one egg to a wine-bottle of water. The object of the substratum was to secure the holding of the collodion film to the glass.

Collodion.

The collodion used was a preparation made by Colonel Tennant containing a full proportion of pyroxyline and iodising salts, being composed of

Iodide of Cadmium	40 grs.	or	1 part.
Iodide of Ammonium	40 „	„	1 „
Bromide of Cadmium	40 „	„	1 „
Pyroxyline	160 „	„	4 parts.
Ether	10 oz.	„	120 „
Alcohol	10 „	„	120 „

and giving a denser film and a more intense picture than most of the commercial samples. A few of the plates were taken with a mixture of equal parts of Rouch's and Thomas' collodions, which also worked well.

Nitrate Bath.

The weather being cold, and also to secure as much density as possible without intensifying, the nitrate bath was used rather strong, being 45 grains to the ounce of water. Four baths were provided for the 6-inch plates, and one large one for the Janssen plates. A spare large bath and two small ones were kept in reserve in case of accidents.

Developer.

The developer was a tolerably strong iron developer containing sugar. It was composed of

Protosulphate of Iron	5	parts.
Sugar	5	"
Glacial Acetic Acid	4	"
Spirits of Wine	3	"
Water	100	"

Fixing.

The plates were fixed with the ordinary fixing solution of cyanide of potassium.

The plates were not varnished, as it was considered undesirable to varnish plates intended for future measurement, and also to obviate any chance of the varnished film cracking when removed to England. On this account the plates have not been printed from, as Sir George Airy has directed in his instructions to the English observing parties. Such prints would be of little use except to give a general idea of the results, and of no use at all for measurements, owing to the distortions caused by unequal shrinkage of the paper; but it is proposed to make copies of the negatives on glass, in a copying camera, before shipping them off to England.

Preliminary preparations.

I joined Colonel Tennant at Roorkee on the 13th October, and immediately commenced the necessary preparations. First of all the dark-rooms had to be fitted up with double doors and shelves, water supply arranged, chemicals and apparatus to be unpacked and conveniently stored away. I had also to study the different adjustments of the photoheliograph and acquaint myself with the nature and extent of the work before me, so as to be able to form a plan for carrying it out efficiently. One of the first things to be done was the selection of the glass to be used for the transit plates, so as to avoid as far as possible the use of flawed glasses. The whole stock was carefully gone over before any of the plates were given out for use, and about 200 of the best were selected and put aside.

About the 21st October, arrangements were sufficiently advanced to begin the training of the assistants, and preliminary drills were started with a view to ascertaining the most convenient mode of working, supposing dry plates to be used. In these drills sensitive dry plates were not used, only plain glasses; but every twelfth plate was prepared by the wet process and developed. In subsequent drills, however, every fifth plate was prepared wet and developed in order to see if all adjustments were correct; and this system would have been followed throughout had the dry plates been used as originally proposed.

The dry-plate trials began on the 28th October, as soon as the arrangements of the dark-rooms were sufficiently advanced to admit of it, and were continued till about the 17th November, when it was considered advisable to try the wet process owing to the spotty and unsatisfactory results given by the dry plates. After a few trials it was found that with four baths there was no difficulty whatever in keeping up a constant supply of plates at intervals of two minutes, and the advantages of working the wet-plate system became so manifest, that it was definitely decided to adopt it. The dry-plate trials and drills were therefore discontinued, and the wet-plate drills regularly practised daily, as circumstances permitted, either in the early morning or after breakfast, sometimes twice on the same day, but always as far as possible between the hours of 7 and 12, during which the transit would take place. In these drills most attention was given to practising the amounting of the Janssen slide by signal, and again unmounting it and resuming the ordinary plates in the interval.

On the 28th November, being all fairly well practised, and the preliminary programme of operations drawn up, the first full rehearsal was gone through with fair success, and several points were noticed as requiring modification and practised in succeeding drills.

On the 2nd December, a second full rehearsal was gone through very successfully, and after a few more drills a final rehearsal took place on the 6th, when every thing worked quite satisfactorily, 120 six-inch and 6 Janssen plates being taken in the course of the time it was estimated the transit would occupy.

The preparations for the transit itself had already been commenced about the 2nd, and glasses were cleaned, baths prepared and tested, and adjustments of the instruments looked to. Unfortunately, the weather for a few days before the transit was cloudy and hazy, and most unfavourable for trials of chemicals, and some difficulty was experienced on this score. About a dozen six-inch and four Janssen plates were prepared by the coffee-albumen process to be used in case of necessity, and all necessary preparations were finally completed by the afternoon of the day before the transit.

During the progress of the drills and other preparations, a great deal of time and anxious care had to be devoted to the cleaning and focal adjustment of the instruments, and particularly to the Janssen slide, which for a long time worked unsatisfactorily, and even up till the last gave cause for anxiety.

In the first place, the Janssen plates were found to be fogged and so indistinct as to be almost useless. This was due partly to the reflection of light from the polished surface of the wood-work of the slide itself, and the brass-work of the revolving disc carrying the exposing aperture, and partly to the red glass of the revolving disc being pervious to chemical rays. The first was partially obviated by thoroughly dead-blacking these and all other surfaces capable of reflecting light on to the sensitive plate, and the second by substituting a thick piece of dark ruby glass for the thin and light coloured piece originally supplied. Even with these precautions a little white light found its way on to the plate between the revolving disc and the wood-work of the slide, which were at a greater distance apart than appeared necessary, though the entrance of light might have been easily obviated by fitting the revolving disc with a flange running in a groove cut in the wood-work of the slide.

A greater difficulty connected with the working of the Janssen was the fact of the front surface of the revolving plate-holder rubbing against the wooden shutter of the slide; and this was removed by scraping the wood-work. The catches holding the ring of the plate-holder in its place were also found to rub against the spindle of the winch. Partly owing to the strain caused by this friction, the clock-work was liable to get out of order and required frequent looking after and repair.

The hanging counterpoise at the object-glass end of the telescope was found to swing and induce a tremor in the instrument, spoiling the definition of the pictures; it was therefore replaced with a rough, but efficient, substitute in the shape of a canvas bag, the ends of which were filled with shot. This was merely hung over the end of the telescope at the proper balancing point and kept the tube perfectly steady.

Towards the end all these difficulties were surmounted, and on the day of the Transit the Janssen slide worked very satisfactorily.

The programme of operations, as revised after the last rehearsal, was as follows:—

Programme of the Photographic Observations, Transit of Venus, at Roorkee, December 8th (9th Civil) 1874.

Process.

1. As the dry-plates have not been found to give satisfactory results, and there is no difficulty in working the ordinary wet-plate process, the latter will be adopted. It will, however, be desirable to have a small supply of dry-plates prepared in reserve in case of accidents, and also to be used, if necessary, at times when the supply of wet-plates cannot readily be kept up.

2. It has been ascertained that with four silver baths a constant supply of wet-plates at intervals of two minutes can be maintained. Arrangements must, therefore, be made for having four baths in good order, for the six-inch plates, and a large bath for the Janssen plates. At least two baths, one large and one small, must be kept in reserve in case of one of the other baths getting out of order, or becoming temporarily unfit for use. A sufficient supply of clear collodion must also be prepared so as to allow of every plate being coated with fresh collodion, the same collodion not being used twice—about two pints will be sufficient; 150 ounces of developer and a sufficient quantity of cyanide solution for fixing will also be prepared. The plates will not be intensified, but the greatest degree of intensity possible should be obtained from the first development.

3. Some days before the Transit, 120 six-inch glasses will be selected from those set by as the best, and will be numbered with a diamond in one corner, consecutively from 1 to 120. A reserve of 30 or 40 plates will also be selected and marked with a cross in one corner. The whole of these plates as well as a dozen circular Janssen plates will be carefully cleaned and then albumenised on the unmarked side.

4. The plates thus numbered and albumenised will be arranged in order in five boxes, holding two dozen each, with the marked corners running along the upper left-hand side of the boxes. Each box will be legibly marked with a distinguishing letter and the numbers of the plates contained in it, thus $\frac{A}{1\text{-}24}$. A sixth box, containing marked plates, will be kept in reserve to be used if required, and any plates so used must be numbered at the time with their proper number in order of sequence.

5. The utmost care must be taken that the proper order of sequence of the plates is preserved throughout the operations, but if, by accident, a plate should be left out, or any alteration in sequence occur, a note must be made of it at once and given to the Officer in charge, who will duly record it. Should any of the plates originally numbered be broken during any of the operations, or put aside from any other cause, their places must be filled up from the marked plates, and they must be numbered in their proper order of sequence.

6. During the operations it may be advisable to expose dry plates, particularly before and after the interval of relaxation about mid-transit, or to quickly supply the place of a spoiled wet-plate. In order to secure the proper sequence of these plates they should, if possible, be numbered in their proper order, following the numbers of the wet plates immediately preceding them, the corresponding cleaned and numbered plates being passed over. When dry plates are used, the Officer in charge must always be informed, so that he may change the aperture of the exposing shutter.

7. When developed, the plates must be placed in the draining racks in the order in which they were taken, and carefully placed aside till after the Transit.

Distribution of duties.

8. The distribution of duties will be as follows:—

Captain Waterhouse will remain at the Photoheliograph, expose the plates and record the time at which each is taken, carefully noting any variation in the intervals or other noteworthy circumstances. In case of the exposing shutter sticking so that the plate is not exposed at the time recorded by the Chronograph, he will record the time at which the signal was made, and cross it out with a remark "slide stuck," and at once proceed to attach another loop and record the time when the plate was actually exposed. At every sixth plate he will replace the cross-wires by the reticule. He will be responsible that all the adjustments of the instrument are in good order the day before the Transit. He will be assisted by a native khalassie to hand the plates in and out, turn the dome, &c.

9. Sergeant Harrold will develope the plates and exercise a general supervision in the dark room. He will take special care that the plates are ranged in their proper order of sequence as developed, and will note in writing any variations. Should any change in the exposures, or in the adjustment of the pictures on the plates, be necessary, he will at once inform the Officer in charge.

10. Corporal George will coat the plates with collodion and put them in the baths. He will be responsible that the plates are taken up in proper order, as arranged in the boxes, and will at once report any change. Should it be necessary to pass over any of the marked and numbered plates, he will see that the plates substituted for them are properly numbered in order, as described in paragraph 5. In coating the plates with collodion he will observe to keep the numbered corner of the plate downwards and at the upper right-hand corner, pouring off the collodion at the lower right-hand corner, so that when the plate is placed in the slide, the number may be on the back, or uncoated side, of the plate, at the *upper* left-hand corner of the slide, and the thick collodion corner at the *lower* left-hand corner, thus furnishing a ready means of ascertaining the proper position of the sun's image on the plates.

11. Private Fox will take the plates out of the baths, place them in the dark-slides, in the manner described in the last paragraph, and pass them into the dome. He will also carry the Janssen slide into the dome, place on and take off the No. 1 counterpoise and carry the Janssen plate back again for development. Should there be any delay in a wet-plate being ready at the proper time, he will keep a dry-plate in readiness and send it in, notifying the change; and this he should do at all changes from wet to dry, or *vice versâ*.

12. One khalassie will remain in the dark-room to assist in handing the dark-slide backwards and forwards, and will put on the No. 2 counterpoise when the Janssen slide is used. A second khalassie will remain in the space between the double-doors and pass the dark-slides in and out through the boxes in the doors. The third khalassie will remain in the dome to hand the plates to the officer in charge, turn the dome, &c.

13. The dome will be opened at 6 A. M. by the orderly of the week, who will uncover the instrument and have all in readiness for commencing work at about ½ to 7.

14. The officer in charge will see that everything is ready for work and verify the adjustments of the Photoheliograph and the electrical communications with the Chronograph, which should all have been carefully examined and adjusted two or three days before the Transit. He will also compare the time of the electric clock-dial in the dome with the standard clock, and also with the chronometer, in case of the clock breaking down.

15. The following routine of taking the photographs will be strictly observed, whatever the state of the weather, but the officer in charge will exercise his discretion in regulating the intervals between the exposures, in the case of the weather being cloudy, so as to avail himself of a passing gleam of clear sunshine.

16. It has been computed that the first contact will take place about 12h. 10m. 47s. (sidereal time) or 7h. 13m. 7s. (mean time.) The order for commencing the preparation of the plates will be given about 11h. 55m., and the work of the day will commence with the exposure of a Janssen plate for trial of the apparatus, after which four of the six-inch plates will be exposed at intervals of two minutes. About the time of bisection, at 12h. 24m., a second Janssen will be exposed, to be followed, as before, by 4 six-inch plates, and a third Janssen plate will be prepared in readiness for the first internal contact at Ingress, about 12h. 30m., for which a signal will be given by Colonel Tennant; and after this the regular work of photographing the Transit, at intervals of two minutes, on the six-inch plates will be carried on uninterruptedly, with the exception of the intervals to be noted hereafter; every sixth plate

being taken with the reticule instead of the cross-wires, until a few minutes before the second internal contact at Egress, about 16h. 38m., when the Janssen slide will again be mounted in readiness, and await the signal for exposure to be given by Colonel Tennant. Janssen plates will also be taken about the times of bisection and last contact at Egress, and during the intervals between the exposures of these plates, 4 six-inch plates will be taken as at Ingress. It must be borne in mind that the photographing of the internal contact at Egress with the Janssen apparatus is all-important, and ample time must be allowed to make sure of everything being in readiness to expose the plate at the moment the signal is given.

17. At 14h. a signal will be given by the officer in charge for a break of 15 minutes in the observations. All wet-plates then under preparation will be exposed, and dry-plates will be sent in until all the wet-plates have been developed and everything is ready for opening out the doors. In like manner, after the break, dry-plates will be sent in until the wet-plates are ready.

18. After the Transit the officer in charge will examine and verify the sequence of the plates in the racks, and have them carefully dried and then replaced in proper order in the plate-boxes.

Operations of the 8th (9th Civil.)

The operations during the Transit were carried out in accordance with the foregoing programme with the exception that, instead of 4 six-inch plates being taken between the Janssen's, only two were taken, in order to obviate all risk of being too late. There was also an error of sequence, the plates marked Nos. 86 and 87 having been taken after Nos. 88 and 89. This was detected in going over the plates, after the Transit, from the position of the plates in the drying racks, and, when confirmed by measurement, duly recorded.

Results.

The total number of six-inch plates recorded is 109, but of these, two (Nos. 103 and 104) failed totally, and Nos. 1 and 2, taken at the very commencement of the Transit, are so faint as to be nearly useless; they have, however, been put up with the rest, making in all 107 photographs.

Many of the photographs show very marked irradiation round the planet, and in some few cases there is an appearance resembling streamers issuing from different parts about its limb. In plate No. 105, taken about the time of bisection at Egress, the whole disc of the planet is just visible with a very faint trace of a bright boundary, but it is remarkable that in the Janssen plate No. 4, taken just before this plate, the disc of the planet is not *distinctly* visible in any of the pictures, and is, perhaps, only doubtfully so in one or two of them. With a few exceptions, at every sixth plate the reticule was substituted for the cross wires.

General Remarks.

I have but little to add in the way of general remarks. The arrangements of the rooms and programme of operations proved efficient and left little to be desired.

Of the Photoheliograph I can say little. It was no doubt an excellent and carefully finished instrument, but I think that for continuous work extending over some hours, during which the adjustments were constantly being disturbed by the insertion and withdrawal of the dark-slides, it should have been more firmly mounted in consideration of its great length than it was. The dark-slides were found to be very stiff and did not appear to have been originally made of the same size as the focussing screen, which fitted perfectly, and consequently they required considerable filing down to make them fit, at the risk of losing sharp definitions.

I think the pattern of dark-slides adopted for the equatorial camera used at Dodabetta for the Total Eclipse of 1871 was far preferable and much more convenient for easy insertion and withdrawal of the slides through a long series of observations.

I have already noted some of the defects of the Janssen slide, the want of blackening of the polished surfaces, the friction between the revolving disc and the case, and the consequent irregularity of the clock-work; but these defects can easily be avoided in future. The idea is admirable, and, as far as I can judge from results, well adapted for the object in view, but should such a slide be used at the next Transit, it would, I think, be desirable that arrangements should be made for the automatic movement to be continued or distributed at intervals over a much longer period—I should say for at least three or four minutes, perhaps even five—so that all the phenomena attending the contact may be fully observed and recorded. The mounting of the slide necessitates the alteration of the adjustments of the telescope for taking the six-inch plates, thus stopping such observations for some time before and after the critical period, and it is therefore desirable that each operation with the Janssen slide should extend over as long a period as possible. If it were feasible to construct the slide so that the plates could be easily changed, it would be better still; and in that case three or four plates might be taken in quick succession during five or six minutes about the time of contact, but to do this, an arrangement would be required by which the revolving disc could be at once brought into the proper position for exposing the successive plates, instead of having (as in the present slide,) to be reversed through *an entire revolution*, which alone takes nearly half a minute.

J. WATERHOUSE, *Captain*,
Assistant Surveyor General,
In charge Photographic Observations.

Roorkee, 18*th December* 1874.

Report by CAPTAIN J. WATERHOUSE, *Assistant Surveyor General, in charge Lithographic Branch.*

1. The amount of work turned out during the year, as compared with the previous year, is shown in the table below :—

	1873.	1874.
New drawings executed on transfer paper	274	271
Do. do. do. on stone	25	37
Color stones prepared	139	142
Subjects printed	481	602
Complete copies	1,59,652	2,14,153
Pulls	2,38,712	2,77,501
Sheets of forms, &c., for type	594	2,100
Complete copies	2,75,334	1,95,876
Pulls	3,80,693	3,28,583

2. The cost of the establishment and contingencies has amounted to Rs. 40,617-9-0, or Rs. 43-12-8 more than last year.

3. The color printing of the engraved sheets of the Atlas of India and other departmental and extra-departmental maps and publications has continued to make good progress during the year, and the new preliminary map of the Bombay Presidency, two geological maps of the Trans-Indus Salt Region, and the province of Pegu, and a map showing the distribution of the forests in British Burmah, all of large size, are excellent specimens of work.

4. During the year, Mr. Fraser Crawford's method of drawing lithographic transfers over photographic prints made with gelatine and bichromate of potash, alluded to in my report of the Photographic Branch for last year, has been largely used, and is found very valuable in making copies or reductions of subjects unsuited for photozincography. Some experiments have also been made with a method of making transfers of shaded chalk drawings on the grained transfer paper prepared by Messrs. Maclure and Macdonald, and I am much indebted to Major Godwin-Austen, who has used the paper with great success, for a supply of it and information regarding its use.

5. I have again the pleasure of reporting on the continued good conduct and devotion to their duties shown by Messrs. Jevezy, Niven and Lepage, and by the native assistants and draftsmen.

J. WATERHOUSE, *Captain,*
Assistant Surveyor General,
In charge Lithographic Branch.

Abstracts of the Drawings executed in the Surveyor General's Office, Lithographic Branch, from 1st January to 31st December 1874.

Scale.	New Maps, &c., the lithographic drawings of which were completed during the present year.	Size.	No. of Sheets.	Remarks.
	GENERAL MAPS.			
8 miles = 1 inch	Western Bengal, Sheets Nos. 11, 12, 13, 15, 16 and 17.	Imperial ...	6	
128 „ = 1 „	Index to the Sheets of the Atlas of India, squares drawn only.	Ditto ...	1	
8 „ = 1 „	Preliminary Map of Bhootan	Double Elephant ...	1	
	DISTRICTS.			
4 miles = 1 inch	District Darjeeling	Double Elephant ...	1	
„ = „	„ Bhundarah (a portion drawn) second edition.	Antiquarian ...	1	
8 „ = 1 „	Skeleton Map of Bhaugulpoor Division ...	Double Royal ...	1	
4 „ = 1 „	„ „ of District Rungpoor ...	Atlas ...	1	
4 „ = 1 „	„ „ „ Dinagepore ...	Ditto ...	1	
4 „ = 1 „	„ „ „ Bograh ...	Super Royal ...	1	
4 „ = 1 „	„ „ „ Moorshedabad ..	Atlas ...	1	
4 „ = 1 „	„ „ „ Pubna	Super Royal ...	1	
4 „ = 1 „	„ „ „ Maldah ...	Imperial ...	1	By plate transfer from engraved plates on the Atlas of India.
4 „ = 1 „	District 24-Purgunnahs { Corrections, boundaries, margin lines drawn. }	Atlas ...	1	
4 „ = 1 „	„ Jessore Ditto	Antiquarian ...	1	
4 „ = 1 „	„ Nuddeah Ditto	Atlas ...	1	
4 „ = 1 „	„ Pubna Ditto	Super Royal ...	1	
4 „ = 1 „	„ Bograh Ditto	Ditto ...	1	
4 „ = 1 „	„ Rajshahye Ditto	Imperial ...	1	

Abstracts of the Drawings executed in the Surveyor General's Office, Lithographic Branch, from 1st January to 31st December 1874—(continued).

Scale.	New Maps, &c., the lithographic drawings of which were completed during the present year.	Size.	No. of Sheets.	Remarks.
	Revenue Survey Maps.			
1 mile = 1 inch	Oudh, Sheet No. 38, Districts Gondah and Bharaich.	Super Royal ...	2	
1 „ = 1 „	District Bijnour, Sheet No. 4	Double Royal ...	1	
1 „ = 1 „	„ Chanda, „ „ 7	Ditto ...	1	
1 „ = 1 „	„ Loburdugga, Sheets Nos. 11, 14, & 15	Ditto ...	3	
1 „ = 1 „	„ Bareilly, Sheet No. 2 (re-drawn)	Ditto ...	1	
1 „ = 1 „	„ „ Sheets Nos. 5, 6, 8, & 9 ...	Ditto ...	4	
1 „ = 1 „	„ Moorshedabad, Sheets Nos. 1, 2, 3, 4, 6, 7, 9 & 11.	Ditto ...	8	
1 „ = 1 „	„ Bhaugulpoor, Sheets Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 & 16.	Ditto ...	16	
1 „ = 1 „	„ Nowgong, Sheets Nos. 1, 2, 3, 4, 8, 11 & 13.	Ditto ...	7	
	Plan of Cantonment and Civil Station.			
10 inches = 1 mile	Plan of Civil Station and City of Dumoh ...	Imperial ...	1	
	Barrack Plans.			
	Plan of Asseergurh Fort	Double Royal ...	4	
			71	
	Geological Maps.			
4 miles = 1 inch	Geological Maps of Indian Atlas, Quarter Sheets Nos. 76 S. W. and 77 N. W., Geological lines, &c., drawn.	½ Sheet Atlas ...	2	
4 „ = 1 „	„ „ of Rajmahal Hills, correction, border lines, &c., drawn.	...	1	
	„ „ of Dumbal Hills, correction, border lines, &c., drawn.	...	1	
			4	
			75	
	Miscellaneous Drawings.			
	Public Works Department plans ...		1	
Various scales	Bengal Government maps and plans ...	Various sizes ...	20	
„ „	Foreign Department maps and plans ...	ditto ...	13	
„ „	Archæological Survey plans and drawings ...	ditto ...	40	
„ „	Telegraph Department diagrams, &c. ...	ditto ...	30	
„ „	Department of Revenue, Agriculture and Commerce maps, plans, &c.	ditto ...	14	
„ „	Miscellaneous maps and plans, &c., &c. ...	ditto ...	115	
			308	
			No. of tint stones prepared	
	Coloring.			
32 miles = 1 inch	Sketch Map of the Provinces comprising the Lieutenant-Governorship of Bengal,	Double Elephant ...	3	
„ „	Preliminary Map of Bombay Presidency ...	ditto ...	2	
„ „	Ditto ditto plate transferred	ditto ...	3	
128 „ „	Sketch Map of India, Sheets Nos. 1 to 6 ...	ditto ..	19	
„ „	India showing the progress of the Survey of India.	Imperial ...	5	
„ „	Index to the sheets of the Atlas of India for 1874.	ditto ...	1	
8 „ „	Map of Western Bengal, Sheets Nos. 11 and 12	ditto ...	4	
4 „ „	Map of Indian Atlas, Quarter Sheets Nos. 3 N.E., 34 N.E., 51 S.E., 72 S.E., and 93 N.E.	½ Sheet Atlas ...	12	
„ „	District Dumoh ...	Imperial ...	1	
„ „	Ditto Nuddeah ...	Atlas ...	1	
„ „	Ditto Jessore ...	Antiquarian ..	1	
„ „	Ditto Rajshahye ...	Imperial ...	1	
„ „	Ditto Bograh ...	Super Royal ...	1	
„ „	Ditto 24-Pergunnahs ...	Atlas ...	1	
1 „ „	Ditto Pubna ...	Super Royal ...	1	
„ „	Oudh Revenue Survey, Sheets Nos. 23, 24 and 38	ditto ...	6	Line of levels.
„ „	District Bijnour, Sheets No. 5 ...	Double Royal ...	1	Line of levels.
„ „	Ditto Bareilly, Sheets Nos. 1, 7 and 10 ...	ditto ...	3	Line of levels.
32 „ „	2 Specimen sheets of Cadastral Survey ...	Imperial ...	4	
	Sketch Map of the Provinces comprising the Lieutenant-Governorship of Bengal, illustrating the Report on the cultivation of Jute in 1874.	Double Elephant ...	2	

Abstracts of the Drawings executed in the Surveyor General's Office, Lithographic Branch, from 1st January to 31st December 1874—(concluded).

Scale.	New Maps, &c., the lithographic drawings of which were completed during the present year.	Size.	No. of Sheets.	Remarks.
22 miles=1 inch ...	Sketch Map of India, sheets Nos. 1 to 6, showing financial circles..	ditto ...	6	
16 „ „	The Presidency Division, comprising the 24-Pergunnahs, Nuddea, and Jessore.	½ Sheet Imperial ...	1	
„ „	Map of Burdwan Division, comprising the Districts of Burdwan, Beerbhoom, Bankura, &c.	Imperial ...	1	
64 „ „	The Provinces of Bengal, Behar, and Orissa under the jurisdiction of Lieutenant-Governor of Bengal with Provinces of Assam under Chief Commissioner.	Super Royal ...	2	
8 „ „	Map of Nuddea Division ...	Atlas ...	1	
120 „ „	Map of India to illustrate the Annual Report of the Sanitary Commissioner for 1874.	Imperial ...	1	
16 „ „	Forest Map of British Burma ...	ditto ...	1	
8 „ „	Sketch Map of the Islands in the Bay of Bengal.	Super Royal ...	2	
128 miles=1 inch ...	Map of India, shewing arsenals, magazines, depôts, &c.	Imperial ...	2	
10 „ =1 „ ...	Sketch of Chota Nagpore to accompany the annual return and the Report of the Ranchee circle of Vaccination.	Imperial ...	2	
8 „ =1 „ ...	Sketch map of Dacca and Fureedpore districts, shewing the Vaccination operations in 1872-73 and 1873-74.	Super Royal ...	2	
8 „ =1 „ ...	Sketch map of the Metropolitan Vaccine Circle shewing the operations of 1873-74.	Atlas ...	2	
	Map shewing the existing circles of Vaccination in their relation to the Metropolitan circles.	½ Sheet Super Royal	3	
64 „ =1 „ ...	Map of Bengal, shewing the tracts affected by the famine of 1874.	Super Royal ...	1	
8 „ =1 „ ...	Settlement map of district Bahraich, Nos. 1 & 2	Atlas ...	5	
4 „ =1 „ ...	Map of Bamun Pokri plantation reserve ...	½ Sheet Super Royal	1	
	Rain map of India		2	
	Chart of rainfall in 1873		1	
	Weather chart for April 1873		1	
	„ „ for June „		1	
	„ „ for August „		1	
	Wreck chart of the coast of India ...		1	
	Nine military maps for Colonel Paget's work		9	
	Plan of Berhampore drainage scheme ...		1	
	Chart of the Chittagong river		1	
	Small plan of Calcutta		1	
	Map of Afghanistan, shewing salt range ...		1	
	View of salt valley at Bahadur Kheyl ...		1	
	Drawing of antiquities of Orissa, Plate No. 33			
	„ of „ of „ „ No. 55			
	plan of Cuttack		1	
			128	
	Coloring Geological Survey Maps.			
½ inch=1 mile ...	Geological map of Trans-Indus salt region ...	Double Royal ...	4	1 color remaining.
8 mile=1 inch ...	„ Pegu province, British Burmah.	Double Elephant ...	6	
256 „ =1 „ ...	Map of India, shewing present state of progress of the geological survey for 1874.	Foolscap ...	3	
	View of salt valley at Bahadur Kheyl ...	½ Sheet do. ...	1	
			14	
			142	

ABSTRACT.

	Sheets.
General and District maps	... 23
Revenue Survey maps	... 43
Plan of cantonment and civil station	... 1
Barrack plans for Secretary of State	... 4
Geological maps, lines, &c., drawn	... 4
Miscellaneous drawings	... 233
Color stones prepared	... 142
Total of Sheets	... 450

Abstract of printing executed at the Surveyor General's Office, Lithographic Branch, during the year 1874.

Subjects.	No. of Sheets.	No. of Copies.	No. of Pulls.
Lithographic Branch.			
District and general maps	56	17,679	28,967
Revenue Survey sheet maps, 1 mile=1 inch	59	13,745	19,656
Cantonment plans	2	570	570
Block plan of barracks for Secretary of State	26	1,380	2,392
Reprints of old maps	77	13,210	18,820
Miscellaneous maps	70	24,550	43,706
Do. plans, sketches, &c.	305	1,38,902	1,47,795
Tints printed on geological maps and plans	7	4,117	15,595
TOTAL ...	602	2,14,153	2,77,501
Type Department.			
Departmental orders, &c	14	2,647	2,897
Memoranda and forms for use of the Department	501	1,24,621	1,87,302
Forms of Topographical and Revenue Surveys	85	62,608	1,32,384
Transfers of headings, foot-notes, references, &c., to published maps	1,500	6,000	6,000
TOTAL ...	2,100	1,95,876	3,28,583

Statement of cost of Lithographic Branch, Surveyor General's Office.

	Rs.	A.	P.
Permanent establishment	34,946	13	1
Contingent expenses	3,841	1	11
Extra contingencies	1,829	10	0
	40,617	9	0

J. WATERHOUSE, *Captain*,
Assistant Surveyor General,
In charge Lithographic Branch.

SURVEYOR GENERAL'S OFFICE,
LITHOGRAPHIC BRANCH;
Calcutta, 1st January 1875.

No. 332.

Extract from the Proceedings of the Government of India in the Department of Revenue, Agriculture, and Commerce, dated Simla, the 14th May 1875.

SURVEYS.

READ—

Letter from the Surveyor General No. 118A, dated 15th January (received on the 26th April 1875) submitting his annual general report on the operations of the Topographical Surveys of India and of his head-quarter offices for 1873-74.

OBSERVATIONS.

Seven parties were employed as in the previous year, and the field of operations was the same, the work being advanced in compact blocks in continuation of that already completed. The following table shews the results of the season's survey as compared with that of the previous year :—

	Final topography.	Triangulation in advance.	Cost.
	Square miles.	Square miles.	Rs.
Season 1872-73	25,327	18,930	4,49,896
„ 1873-74	24,103	19,623	4,25,041

The outturn of work is nearly the same, there being a small decrease in the area of final topography and a slight increase in the area triangulated in advance. The mileage rate was a little lower than in the previous year, being Rs. 17-10-0 against Rs. 17-12-0, and the total outlay shews a decrease of Rs. 24,855.

2. The decrease in the area finally surveyed is due to a smaller outturn in the area accomplished by No. 6 party, employed on the exploration of the Eastern Frontier in the Naga Hills and the Manipur State. Great difficulties have to be encountered in this survey, and when allowance is made for these, the outturn of both years has been satisfactory.

3. There has been a large increase in the number of points fixed and heights determined trigonometrically, as shown below :—

	No. of points fixed.	Heights determined.
1872-73 ...	1,885	1,365
1873-74 ...	2,276	1,965

4. The progress made in the drawing, geographical, compiling and engraving branches, under the efficient supervision of Mr. James, is satisfactory.

5. The work in the photographic and lithographic branches under the charge of Captain Waterhouse has largely increased and has, as usual, been successfully performed.

6. It is to be regretted that the photo-collotype process has not been found sufficiently successful for the reproduction of maps, and it is hoped that the experiments which are being made to utilise the process for other purposes will succeed.

7. The results of the season, on the whole, are very satisfactory, and the Governor General in Council considers that great credit is due to Colonel Thuillier and all the officers referred to in paragraph 58.

ORDER.—Ordered that a copy of the above Resolution be forwarded to the Surveyor General of India for information,

(True Extract.)

Secretary to the Government of India.

Bxd.—F. J. B.

1875.

DEPARTMENT OF REVENUE, AGRICULTURE, AND COMMERCE

SURVEYS.

RESOLUTION.

No. 38.

Dated Simla, the 14*th May* 1875.

Diary No. 255.

SUBJECT.

REVIEW of the Annual General Report on the operations of the Topographical Surveys of India and of the Head-quarter offices of the Surveyor General of India for 1873-74.

GENERAL REPORT

ON THE

Topographical Surveys of India,

AND OF THE

SURVEYOR GENERAL'S DEPARTMENT,

FOR SEASON

1874-75.

BY

COLONEL H. L. THUILLIER, C.S.I., F.R.S., &c.,
SURVEYOR GENERAL OF INDIA.

SUBMITTED TO THE GOVERNMENT OF INDIA, DEPARTMENT OF REVENUE, AGRICULTURE, AND COMMERCE.

CALCUTTA:
OFFICE OF SUPERINTENDENT OF GOVERNMENT PRINTING.
1876.